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THE PRACTICAL ENGINEER
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TRADE UNIONISM AND TRADE RESTRAINT.

"TRADE UNIONS," said a High Court Judge in a recent case, "are a necessity of the times." But though one may and does, with that Judge, thoroughly believe in the value and appreciate the good work of trade unions, it is well for all concerned to constantly remember that trade unionism must necessarily act in restraint of trade rather than in its furtherance.

In our last issue, and also that of June 10th, we dealt with some personal and particular aspects of the ever-constant question of the relations between employers and employed. Our desire now is to look at it from the more general and national point of view indicated by our opening paragraph.

We say that trade unionism acts in restraint of trade. Within certain limits we make no complaint of this. On the contrary, we believe it to be a necessary service to the Commonwealth. Restraint in all things is at times a most urgent requirement. The brake mechanism of a railway or any other vehicle can hinder and prevent, but never help the progress of that vehicle. Only a mentally-deficient person would use that as an argument against brakes. It is the business of such things to restrain. All that we have to do is to see that the restraint is only applied just when and where it is necessary, and not otherwise.

When a capitalist thinks wholly and solely of dividends (as he very often does), a manufacturer of low costs of production, and the merchant of discounts off list prices, the artisan and the labouring man are likely to be brought up against conditions such that common humanity calls aloud for restraint. Such restraint should be and is applied by trade unions to the advantage, not merely of their members, but ultimately of the entire community.

But it is to the capitalists, the manufacturer, and the merchant that the community looks for the discharge of the function of the furtherance of trade. In other words, it is their business to get work for the artisan and the labouring man. To enable them to discharge that function efficiently, it is absolutely necessary that they shall possess themselves with the best equipment, both in methods and means or appliances, that science and invention can provide. To satisfactorily discharge such a function is at all times a difficult matter, and there is no doubt whatever that the difficulty has been frequently increased, unfairly increased, by the action of trade unions.

We can readily imagine the feelings of the driver and fireman of an express train, doing their level best to make up a little lost time on a fine stretch of straight clear road, if the guard, on suddenly waking up from a little nap, should jump to the conclusion that the locomotive was running away, and forthwith apply the brakes! Similar feelings are all too frequently experienced by the employer of labour who sees the opportunity of securing a contract that will keep his people in full work for a long period absolutely lost because of the ill-timed and unfair interference of a trade union in a situation it entirely fails to understand or appreciate. Is it any wonder that bitterness is engendered and hard things said?

Everyone knows that a trade union benefits the incompetent and indifferent workers in that union a great deal more than it benefits the skilled and reliable. Indeed, a trade union is, amongst other things, an organisation whereby the idle man is enabled to shift the burden of his maintenance on to the industrious and competent man. Every manufacturer has got men in his employment that are "not worth their salt,' and never will be. Those men would no doubt receive "short shrift" in many cases, and be promptly "fired," but for the fact that such a proceeding would bring trouble with the trade union to which they belong, for if they are thrown out of work the union will have to keep them; hence the threatened strike is not quite so insane a proceeding, looked at purely from the union's point of view, as it might at first sight appear.

We refer to these problems, not because we have any patent solution to offer, for we have nothing of the kind. The solution is not, we believe, beyond "the wit of man," but it will not come until we all of us acquire the habit of trying to understand the other man's position, and to appreciate that he, like ourselves, has his difficulties.

Machinery Imports into Japan.—According to the report published in the Board of Trade Journal, the imports of machinery into Japan in 1909 were £1,426,100 (or 40 per cent) less than the amount for the preceding year. This report includes a table containing the amounts expended on the various classes and grades of machinery, which shows that not only was the decrease common to nearly all the items, but the shares of all the participating countries were reduced, the United Kingdom, as a matter of fact, suffering less in proportion than her nearest competitors; the reduction in her share was £661,400, or 32 per cent, while in the case of the United States of America and Germany it was £533,700, or 58 per cent, and £200,600, or 44 per cent, respectively. The reasons for this decline are not far to seek. The Government's policy of cutting down expenditure wherever possible had a serious effect on business in machinery, but a still more potent factor was the stagnation in the industrial world. During the boom years of 1906 and 1907 many orders for machinery were placed which were only executed in 1908, but after the slump very little new business was put through, and the results are now seen in the small total for the year, a total which would have been even smaller had it not been for the extensive importations of machinery by the Japan Steel Foundry at Muroran, which amounted to nearly £380,000, or 18 per cent of the whole purchases of machinery by the country. It should, however, be remembered that sugar machinery for Formosa, the orders for which have been very large, do not come into the Japan Customs Returns.

Clyde Engineers' Wages.—A local conference for which members of the Amalgamated Society of Engineers in the Clyde district applied recently under the terms of the working agreement with the Federation of Engineering Employers was held on the 21st June, in Glasgow, to consider the request of the men for an advance of wages of ¼d. per hour, or 1s. per week, on time rates, five per cent on piece rates, which they had asked to take effect on June 15. The employers declined the demand on the ground that the conditions of trade did not justify it. The wages were reduced at the beginning of last year, 12 months after a reduction had been made in other trades. The proceedings at the conference were private, and at the close it was officially intimated that the employers had made an offer of an advance of ¼d. per hour, or 1s. per week, according to the practice in the different shops, to take effect in the first week in October, and that this offer was to be put before the men for consideration. If the men are not satisfied with the offer, they may appeal to a central conference, consisting of their own executive council and the executive board of the Engineering Employers' Federation.

Concrete Piles.—In the region of engineering as applied to docks and harbour works, many noticable changes have taken place during the last decade, not only in the methods of construction and the machinery and plant generally, but also in the material used for certain specific purposes. The old days of wooden piles for foundation and other uses seem to be giving place to an era of concrete. The latter is being very extensively used now for sub-aqueous purposes of every description, including bridge caissons, sea walls, dock culverts, and piles, etc. In connection with the last-named, it is claimed by those who favour the use of concrete that piling of this material, especially when reinforced with steel, is more durable than timber; in fact, almost indestructible under ordinary conditions of use. There appears, however, to be an element of dubiety as to whether, under certain circumstances, the steel would be free from a corrosive tendency, due to the action of the water and other causes. If this point of doubt could be set at rest, and proof given from actual experiments, then unquestionably concrete in a reinforced form would be more largely used for pile foundations under water, even though the initial cost exceeded that of timber, on account of the liability of the latter to attack from insect life, and the consequent deterioration and resultant shortening of the life of this form of material.

Internal Combustion Engines for Marine Purposes.—The Committee of Lloyd's Register of British and Foreign Shipping have adopted and issued rules for internal combustion engines for marine purposes. These rules are the same as those relating to steam engines, so far as regards the testing of material used in construction and the fitting of sea connections, discharge pipes, shafting, stern tubes, and propellers. For the design construction of the engines themselves, however, the rules have been specially drawn up, and are very detailed. They are in five sections—General, Construction, Rules for Determining Sizes of Shafts, Fuel Tanks and Connections, and also Periodical Surveys—and they are altogether 30 in number.

The Horse Power of Motor Cars.—The Lords Commissioners of the Treasury have issued provisional regulations with regard to the horse power of motors cars, which on account of urgency are to come into immediate operation. They provide that the horse power of any car deriving its motive power wholly from a steam, internal-combustion, or other engine worked by a cylinder or cylinders shall be taken to be: (*a*) In the case of a single-cylinder engine the horse power attributable to the cylinder of the engine; (*b*) in the case of an engine having two or more cylinders, the sum of the horse powers attributable to the separate cylinders. Amongst other rules it is set forth that "any motor car deriving its motive power or any part of its motive power otherwise than from an engine worked by a cylinder or cylinders shall be deemed to be a horse power exceeding 12, but not exceeding 15, provided that where the motive power is derived in part from an engine worked by the cylinder or cylinders, the horse power of the car shall not be deemed to be less than the horse power attributable to the cylinder or cylinders of such engine." In measuring cylinders and calculating horse power, fractions of an inch and fractions of a unit of horse power are to be taken into account.

TURBINE LOCOMOTIVES.—An electro-mechanical locomotive is being constructed at the works of the North British Locomotive Company at Glasgow, in accordance with the designs of Messrs. Reid and Ramsay, and tests will shortly be carried out. A single horizontal turbine of the Curtis type is employed to drive a direct-current series dynamo, from which power is taken to four or more series-wound motors coupled to the driving axles through gearing in oil boxes. The steam, after passing through the turbine, enters a jet or ejector condenser, where it is condensed and mixes with the condensing water. The whole is then pumped by means of turbine or reciprocating pumps through the cooling apparatus mounted on the front of the engine, so as to obtain the full blast of the air when the train is in motion. Cooling may also be facilitated by a turbine-driven fan, forcing the air over the water, the same or another fan being used to cause a draught in the boiler furnace. The water, after being cooled, drops by gravity into a supply tank, and part is pumped back into the boiler through a feed heater, and part used for condensing purposes again, the supply tank being of sufficient capacity to carry the water required for the boiler, and to make up any losses in the condensing water.

WE give below some interesting figures showing a comparison based on the published returns of the iron and steel output of the United States. It will be noted that the pig-iron industry has steadily grown since the year 1890, with a slight exception in 1908. The greater part of this metal is converted into steel, hence the remarkable increase in its yearly production. The following show some of the movements of three classes of metal—the output for the years named being in tons as below for the the United States.

Year.	Pig.	Bessemer.	Open-hearth.
1890	9,200,000	3,600,000	513,000
1905	22,900,000	10,900,000	8,900,000
1906	25,300,000	12,200,000	10,900,000
1908	15,900,000	6,116,000	7,800,000
1909	25,700,000	9,300,000	14,000,000

These figures show strikingly the rapid growth of the iron production in the United States, with the remarkable fall that followed the financial collapse of 1907-8. They show, too, that the production of Bessemer iron rose with some rapidity in the earlier of the years given, but that it fell also, and has not entirely recovered yet; and it is also shown that the output of open-hearth steel, which was very small in the early years, was checked in the time of financial adversity, but has now reached its highest total, and in the two last years has risen above the output of Bessemer steel. It is probable that this is due in some degree to the use of open-hearth steel for railway purposes, and also to some enlarged use in the building of steamers for use on the great lakes of America. In any case, these figures that we have quoted form one of the romances of metallurgy, showing, as they do, the growth of great industries in America in a ratio that is without a compeer in the history of the iron trade of the world.

THE PRINCIPLES OF IRONFOUNDING.

By PROF. A. HUMBOLDT SEXTON, F.C.S., F.I.C.

(*Continued from page 741.*)

AIR FURNACES.

WHILST for general foundry work the cupola is now almost universally used as best meeting the needs of the founder, there are cases in which, for various reasons, some other form of furnace is desirable, and it is then replaced by either the air furnace or the crucible furnace, whichever is best suited for the required conditions.

CHARACTER OF AN AIR FURNACE.

In the air or reverberatory furnace, the material being melted is not in contact with the fuel, but is contained on a separate hearth, and is heated partly by the flames and products of combustion and partly by radiation from the roof and other parts of the furnace, which become intensely hot. In nearly all air furnaces the roof is sloped downwards so as to direct the flame downwards on to the surface of the charge being melted.

The principle of the furnace will always be the same, but in general there will be two types, depending on whether solid fuel or gas is the fuel used. Up to the present air furnaces for foundry use have been mainly fired with solid fuel, but in some cases gas-fired furnaces have been used with great success.

SOLID FUEL FURNACES

A reverberatory furnace for burning solid fuel always consists of two chambers—a fireplace on which the fuel is burned and a hearth on which the charge is melted—these being separated by a ridge of brickwork or firebrick.

The lower part of the furnace may be built solid, but it is more usually carried on an arch of brick. Above the level of the bottom of the hearth the side walls are carried up to the required height, and over these is thrown the roof in the form of a shallow arch. The form of the roof causes a great outward thrust on the side walls, so that these are always held in place by vertical "stays," the space between them being preferably filled in with iron plates united by ties passing across the top of the furnace. These ties are usually about 1 in. iron or steel rod, and they must always be provided at the one end with some screw or wedge arrangement, by which they can be tightened or slackened as occasion may arise, because as the roof gets hot it expands, and it can only do so either by forcing out the walls a little or lifting the crown of the arch and thus causing cracks; so to prevent cracking of the roof the walls are allowed to move a little outward by slackening the ties. When the furnace is allowed to cool, the arch contracts, and the ties are tightened up; but as it is almost impossible to tighten sufficiently to bring the walls back into their normal position, the walls of a furnace that has been long in use often have a decided slope outwards, which, though very unsightly, does not interfere with the working of the furnace.

The walls must be built of, or lined with, very refractory firebricks. The older furnaces often have only a lining; in modern furnaces it has become customary to build the side walls entirely of refractory bricks; the roof is usually of "silica brick," or some equally refractory material which does not sensibly soften at the temperature attained. The relative size, measured as superficial area of the hearth and fireplace, is a matter of great importance. Speaking generally, the higher the temperature to be attained, the larger must the fireplace be in proportion. In furnaces for melting cast iron, the ratio of fireplace area to hearth area is about 1 to 2·5, varying between 1 : 2 in very small furnaces to 1 : 3 in very large ones. As a rule, the smaller the furnace the larger must be the hearth proportion, as the heat losses are proportionately greater. The feeding door will almost always be placed at the side of the fireplace, and, in order that the fuel may be evenly distributed, the fireplace should not be more than 6 ft. wide. The depth of the fireplace below the firebridge will depend on the character of the coal being burned, but the fireplace should be so deep that it is possible to work with a fairly thick layer of fuel, and thus to provide an atmosphere which is not too oxidising. A good depth is about 1 ft. 6 in., although in large furnaces it may be greater, and, where a non-caking coal is used, it may be necessary to burn on a layer of clinker, in which case the hearth will be much deeper.

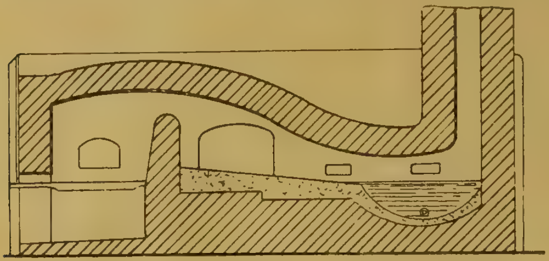
FIG. 71.—Scottish Air Furnace for Three-ton Casts.

The hearth on which the charge is to be melted is, of course, of very great importance. Its size and form will depend on so many conditions that it is only possible to indicate very generally how it may be arrived at.

The hearth will always slope towards one point, where the tap hole will be placed, so that the liquid metal can be completely run out, and this, as a rule, will be at the end farthest from the firebridge, though it is better to have it at the firebridge end, as there the heat will be greatest, and it is always necessary to keep the metal well melted. In some furnaces the well is a distinct basin-like depression, in others the slope of the hearth is made nearly uniform towards the lowest point. The door for charging the pig will be near the highest part of the hearth, and therefore at the opposite end from the tap hole. When the tap hole is at the end furthest from the firebridge the charging door will be near the firebridge and on the side of the furnace, or, when the tap hole is near the firebridge, the charging door will be near the other end, or built into the end wall, if, as is often the case, the flue is taken off at the side of the furnace. In general, it is probably better to take the flue off direct at the end of the furnace, and provide the charging doors in the sides.

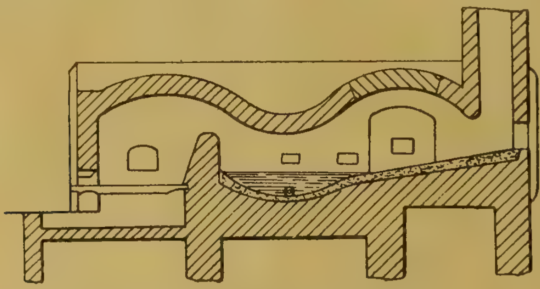
FIG. 72.—Five-ton English Air Furnace.

The size of the charging doors will vary with the nature of the material to be charged; for pig iron charged in the usual way on a "peeler," then 2 ft. by 1 ft. 6 in. is quite large enough, but where large scrap is to be used they will have to be much larger, and in some cases where exceptionally large scrap is dealt with the roof is carried on iron plates, so that it can be lifted off usually in sections and the charge let in from above, and it may sometimes be necessary to raise the level of the roof at the charging end to accommodate it. The door opening will, of course, be protected by a casting, and it will be closed by a door which consists of an iron frame filled with slabs of firebrick.

The size of the hearth will depend on the amount of metal to be melted, and on the conditions of melting. If a large amount of oxidation is desired, a thin layer of metal will be used, and the hearth will be larger in proportion. On the other hand, if but little oxidation is required, the hearth may be smaller and the charge much deeper. With very large furnaces the question of obtaining sufficient heat over the entire area has to be taken into account, and a furnace more than 16 ft. long is very rarely advisable, except in the case of gas furnaces, which are heated alternately at the two ends. For ordinary work an average depth of about 1 ft. 6 in. is convenient, and if it be assumed that the hearth is built on a uniform slope, this will mean that the depth of the tapping end will be 3 ft. It may be assumed quite nearly enough for our purpose here that a cubic foot of iron weighs 4 cwt.; then, if we assume an average depth of 1 ft. 6 in., each square foot of hearth will contain 6 cwt., or, roughly, we need 3·3 square feet per ton. In the American furnaces, of which drawings are given, the areas are respectively 4 and 6 square feet per ton of capacity, which would give a very much less depth of metal and, therefore, a larger surface exposed to oxidation.

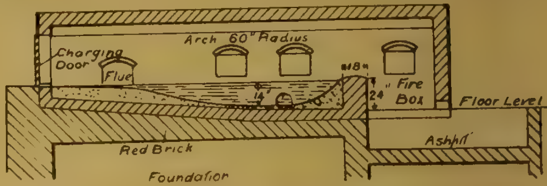

FIG. 73.—Ten-ton Air Furnace. Hearth, 110 sq. ft.; firebox, 25 sq. ft.

The form of the hearth in plan is of but little importance. The simplest is the rectangular, and this is, as a rule, quite satisfactory, although the corners may very well be rounded off, especially at the firebridge end, if the hearth is wider than the firebridge. The hearth is best made with a gentle uniform slope towards the tap hole. The masonry of the furnace bottom is built roughly to the required form, and on this is made the actual furnace bottom of refractory sand. The bottom is put in in layers, each layer being heated until it frits, exactly as in the putting in of the working hearth of a steel furnace. Basic materials, such as burnt dolomite, set in tar exactly like that used in basic open-hearth furnaces, are now coming into use, and have some advantages over the silica sand if kept quite dry.

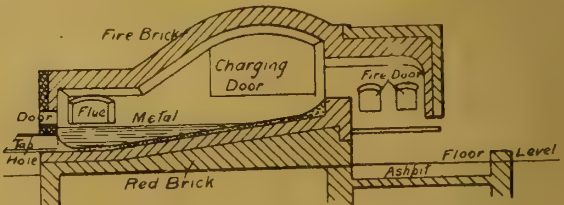

FIG. 74.—Fifteen-ton Camel-back Air Furnace.

The roof of the furnace may vary very much in form. The very name reverberatory furnace indicates that the roof is so shaped as to reflect or reverberate the flame downwards, and in the older type of furnaces—those known in the United States as English furnaces—this was always the case, the roof being depressed till it was at its lowest over the well, and when the well was at the firebridge end it was often raised again so as to give space for charging, as shown in the sketches figs. 71 and 72.

More recent study of the phenomena of combustion and of heating by radiation has shown that this idea is largely mistaken, that the dipped roof does not add to the efficiency of the furnace, and is rapidly destroyed.

In modern furnaces the roof is usually horizontal, as in fig. 73, which shows a modern American 10-ton furnace. Sometimes the roof is even arched, as in the American camel-back furnace, fig. 74. Both these illustrations are from a paper read by Mr. R. H. West before the American Foundrymen's Association in 1906.

Use of the Air Furnace.

The one great advantage of the air furnace is that large charges can be melted at once, and that the whole of the charge is of the same quality, a condition which is not at all easily obtained in the cupola, and, with care, the metal can be maintained in its molten condition with very little change for a considerable time.

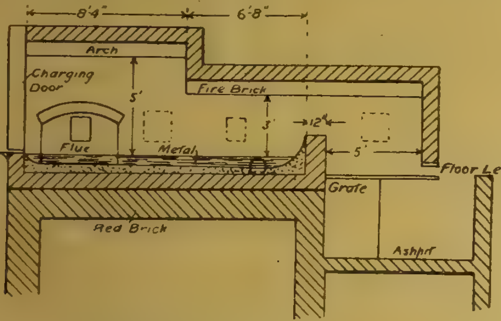

Fig. 75.—Twenty-five Ton Pittsburg Furnace. Hearth area, 87 sq. ft.; fire-place, 30 sq. ft.

As the iron is not in contact with the fuel, there is very much less likelihood of sulphur being taken up as the amount of silicon is reduced.

The chemical changes which take place in the air furnace are mainly due to oxidation, and are much more extensive than in the case of the cupola. The pig iron is charged into the furnace in a solid condition, and is surrounded by a hot oxidising atmosphere, so that a considerable quantity of oxide of iron is formed. When the charge is melted this reacts on the silicon contained in the iron, and oxidises it to silica, which at once forms a silicate of iron slag. The silicon is therefore much more rapidly removed than in cupola melting, where the removal is only about ·2 per cent for each melting. As there is no excess of carbon, the carbon may also be removed to some extent, but the removal of the carbon will not be serious till nearly all the silicon is gone. The phosphorus will not be removed at all under ordinary conditions, but will rather seem to increase, because whilst the quantity of phosphorus remains the same, some silicon and iron are lost by oxidation, so that it is distributed through a smaller quantity of metal. If the furnace be basic lined, no doubt the phosphorus would be reduced, but, as far as the writer knows, basic-lined furnaces have only been used for melting pig iron on an experimental scale.

A consideration of these conditions will indicate the circumstances under which the use of a reverberatory furnace may be advantageous: (1) Irons are now often obtained far too high in silicon for foundry use; this can be reduced by repeated melting, or mixtures may be made with white scrap or irons low in silicon. As such irons can often be obtained cheaply, it may be profitable to melt them in an air furnace, and thus reduce the silicon.

(2) Where irons low both in silicon and in sulphur are required, as for white iron to be annealed for malleable castings, the air furnace is convenient, as there is far less chance of the iron containing sulphur than if it is made white in the cupola. For special chilled castings, in cases where sulphur is objectionable, the air furnace is also very advantageous, but for common chilled castings a little sulphur is not objectionable, as it helps to augment the chill, and in such a case cupola or blast furnace iron low in silicon is used.

Working the Air Furnace.

The furnace may be charged hot or cold. Where the working is continuous it will, of course, always be hot before the charge is put in. Where it is intermittent the charge is often introduced whilst the furnace is cold. As far as fuel consumption goes, there is little to choose between the two methods, but oxidation is likely to be less, on account of quicker melting, when the furnace is hot before the charge is put in. The pigs are put in on a "peeler," and are stacked on the upper part of the hearth.

Starting with a hot furnace, the charge will be melted down in from two to four hours, according to circumstances, and a bath of molten metal will accumulate in the well, covered with a layer of slag. As oxidation will have gone on during melting, the silicon will be much reduced, and the character of the iron will be very different from that which was charged. The charge is well mixed, a sample is taken, cast into an ingot, and broken, so that the quality may be judged. There are, of course, three possible conditions: (1) The metal may be in the required condition, in which case it is used as quickly as possible, or, if it has to be left in the furnace, the flame is kept as reducing as possible, so that no further oxidation should go on.

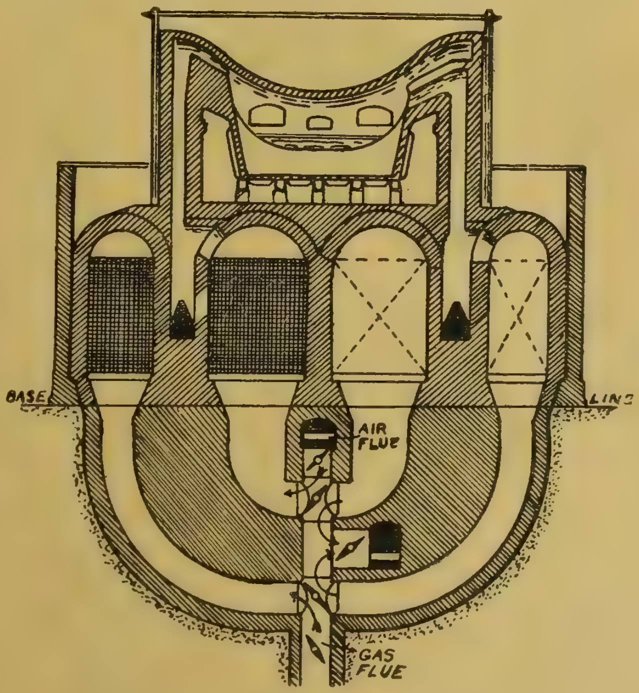

Fig. 76.—Section of Siemens Steel Melting Furnace, with Valves.

(2) The iron may be too grey; that is, it may still contain too much silicon. The oxidation is then continued, the slag being well stirred into the charge from time to time till the iron comes to the required condition.

(3) The iron may be too white, the oxidation having gone too far. In this case the charge is brought back by the addition of highly siliceous grey iron till the required

quality is reached. As soon as the charge is out, the bottom is examined, repaired where necessary, and made ready for another charge.

It must be borne in mind that if the tapping is slow, changes will continue to take place, and samples must be taken from time to time.

FUEL, ETC.

The fuel used for the air furnace is, of course, coal, not coke, and preferably a coal that burns with a long flame. The furnace should be so arranged that by adjustment of the air supply an oxidising or a reducing flame can be given. This is not easy with the ordinary shallow fireplace, and therefore it is often better to make the fireplace so deep that it becomes almost a gas producer, and thus also allows the use of dross and fuel cheaper than that which can be satisfactorily used on an ordinary fire hearth. A reverberatory furnace is never economical; combustion is much more complete on the hearth than it is in the cupola, so that the amount of heat evolved is greater, but the losses of heat are also far greater, so that the efficiency is much less than that of the cupola. The fuel consumption varies with the nature of the coal, the construction of the furnace, and the care of working, and will usually be about one ton per ton of iron melted, though it may be as low as ¾ ton, or, in some cases, even higher than a ton. One ton may be taken as a fair average for small furnaces, but the larger the charge melted, the smaller will be the consumption of fuel per ton, and in the large Pittsburg air furnace, shown in fig. 75, as much as three tons of iron has been melted per ton of coal.

GAS-FIRED FURNACES.

The passage from coal to gas-fired furnaces is a short step, since by making the fireplace larger it becomes a gas producer. It is always, however, better to use a separate gas producer, so that the gas and air can be heated before mixing for combustion. The gas used is always producer gas made by passing air and steam through hot coke, the hot gas then formed distilling the gas from the coal with which the producer is charged. The gas therefore consists of a mixture of coal gas, carbon-monoxide, carbon-dioxide, hydrogen, and nitrogen; it contains, roughly, about 40 per cent. of its volume of combustible gases, and has a low calorific power, so that if burnt cold the temperature produced is too low for use. It is therefore always heated before burning, and to allow of this the Siemens regenerative furnace is used.*

In the ordinary type of Siemens furnace, four firebrick chambers are built under the furnace, and so arranged that they can be connected with the furnace at alternate ends by ports, with the gas producers and air supply, or with chimney. In the illustration, fig. 76, the air and gas pass separately into the two left-hand chambers, then to the furnace, where they burn, and the products of combustion pass away through the right-hand chambers to the chimney. The checker work of firebrick in the right-hand chambers thus becomes very hot. After a time the valves are reversed, the air and gas are passed through the right-hand hot chambers, thus becoming heated before ignition and producing a high temperature; the very hot products of combustion then pass through the left-hand chambers and heat them. After a time the current is again reversed, and so on. The heating chambers soon become full red hot, and thus the air and gas are red hot before they burn, and a very high temperature is obtained.

In the new form Siemens furnace, which is coming largely into use, not so much for melting as for reheating furnaces, there are but two regenerative chambers, viz., those for the air. The products of combustion are divided; one part passes through one of the air chambers and heats it, the other passes into the gas producer, and there, mixing with air, helps to produce more carbon monoxide. The gas thus enters the furnace direct from the producer at a very high temperature, and is burnt by the hot air. All the intake and outlet ports are on one side of the furnace. Gas furnaces are not suitable for working occasional charges, but where continuous work is required they have great advantages. Owing to the high temperature, the metal is quickly melted down, and the fuel consumption is less than with solid fuel furnaces.

At present gas furnaces have only been used in the manufacture of large chilled rolls, or where chromium or vanadium is being added to the metal in quantity. The furnaces may be of any size from one ton upwards, but from 2 to 5 tons is the most convenient size. For steel melting they are built up to 200 tons capacity.

Oil-fired furnaces have also been suggested, and several types are at present on the market.

(To be continued.)

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* The student who is interested in the use of gas-fuel furnaces will find full particulars of gas producers in the Author's "Fuel," or "Producer Gas."

TRADE NOTES.

TENDERS for the ships of the new Canadian navy will be called for next September. The Candian Admiralty is sending out plans and forms of specification upon which the tenders will be based. There is considerable shipbuilding and dock-building activity in preparation at every Canadian port of any consequence.

A NEW ferro-concrete bridge is being constructed across the Stour, near Long Melford, by **Messrs. Holloway Brothers Ltd.,** of London. The structure will consist of three spans of 31 ft., the ends being supported upon four rows of ferro-concrete piles. The piles are 16 in. square by 35 ft. long, and the two end rows are placed about 9 ft. from the abutment walls. Arched main beams 3 ft. deep at the haunches and 1¼ ft. in the centre by 9 in. wide are supported directly upon the piles, and cross beams 9 ft. 9 in. long by 5 in. wide and 12 in. deep are placed at 5 ft. intervals. The bridge, which is to cost £1,100, will provide a 20 ft. roadway between kerbs and a footpath 2 ft. 6 in. wide at each side. The footpath is supported by corbels placed at every 10 ft., with an overhang of 18 in. The ferro-concrete decking will be 5½ in. deep under the roadway and 4 in. under the footpaths.

The Palmer Shipbuilding and Iron Co. have just arranged contracts for two new steamers. One of the vessels is a liner for the British India Steam Navigation Co., and the other is a cargo steamer for an Austrian company. The news of the placing of these new orders will be received with satisfaction by the workmen and residents of Jarrow generally. At the present time two vessels are in course of construction in the yard, and a large number of men are employed on the battleship Hercules, which was launched last month.

IT will interest sanitary engineers and others to hear that a demonstration was recently given at the offices of **Messrs. Sibley and Co.,** 171, Queen Victoria Street, London, of Newland's patent double-flushing cistern or water waste preventer. It is claimed that the new appliance is superior to the single-flush system at present in vogue. It is obvious that any improvements in this direction cannot fail to be of value and utility from a sanitary point of view.

OF the five steamers recently ordered on behalf of the Atlantica Co. two are to be built by Messrs. Raylton Dixon and Co. Ltd., Middlesbrough, and two by Messrs. Richardson, Duck, and Co., Stockton. The fifth is understood to be the steamer "for Austrian owners," already mentioned as having been placed with Palmers Co., Jarrow.

NOTICE OF MEETING, &c.

July 9th.—THE NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS. Excursion to Blyth.

1400-H.P. TANDEM COCKERILL GAS ENGINE.

The object of the present article is to describe, with the aid of the illustration, an engine recently designed and constructed by the Cockerill Co.

The bedplate, comprising the pedestals of the main shaft and the crosshead guides, is continued rearwards by two hollow cast-iron longitudinal frames, between which are placed the cylinders, and which serve as guides for the piston rod. The cylinders are only fastened to the frames at one end, so as to allow for expansion and contraction

The cylinders are interchangeable and symmetrical, which arrangement favours the resistance of the metal to normal or accidental tensile strains. The cylinders are jacketed for circulation of the cooling water, and the jackets are provided with man-holes to permit of inspection and cleaning. The cylinder covers are also water jacketed, and are secured to the cylinder by bolts passing through the water jacket of the same.

The pistons, fitted with cast-iron Ramsbottom rings, are made of two hollow parts bolted together, each of which bears against a shoulder forged on the piston rod, which is of steel and hollow for water circulation, the hollow of the piston being in communication with the hollow of the rod.

The weight of the piston is carried entirely by its rod, so that there is no friction between it and the inside of the cylinder, except that due to the spring of the packing rings. Before being mounted, the piston rods are slightly bowed upwards, so that, instead of bending downwards with their own weight and that of their rods, they become straight. The forged-steel connecting rod, of marine-engine type, is forked at the crosshead end. The throws or cheeks of the steel crankshaft are cast with their counterweight, the crankpin being of forged steel.

The shaft is carried by three pedestals—one on each side of the crank and one outside the flywheel—and kept cool by water circulation and provided with lubricating rings. The flywheel boss and rim are cast, the latter with teeth inside for turning, but the arms are of forged steel carefully fitted.

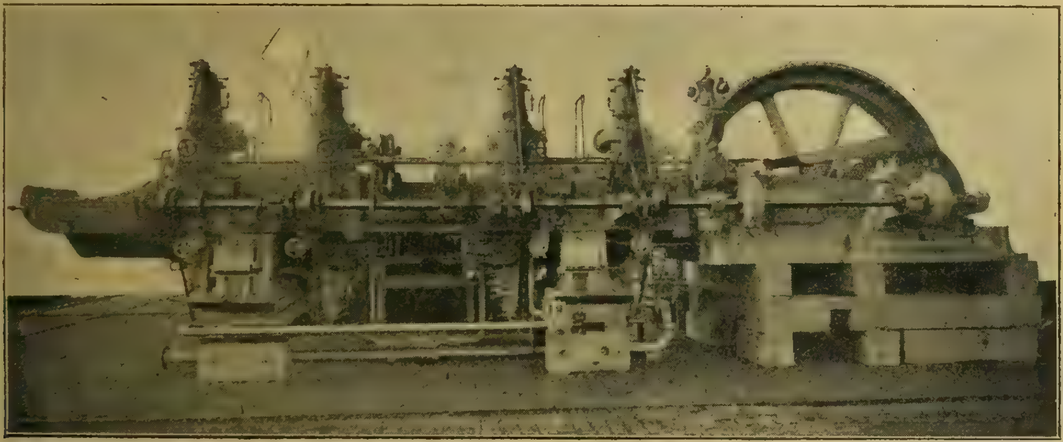
The half-speed shaft actuating the valve gear is parallel with the centre line of the cylinder, and is driven from the main shaft by mitre gear. The distribution is by variable gas admission and constant compression, which affords the advantage of equally balancing the inertia of the masses in motion for all loads. The admission of gas is controlled by the governor.

The engine is double-acting, the distribution being effected at each of the cylinder ends by an emission valve at the lower and by three admission valves at the upper portion in the same vertical plane. The first valve admits air, the second gas, and the third a mixture of the two. This last-named valve is fast on the same spindle as the air admission, the former being a simple disc, and the latter a cylindrical slide valve that closes the circular ports admitting air to the cylinder, and opens them directly the mixture valve descends, so as to permit its introduction.

The descent of the spindle common to these two valves compresses a strong spring that tends to raise them, and this spindle passes with easy friction through that of the gas valve. The latter only descends so as to admit gas at a given point in the piston stroke, determined by the governor. Before this point air alone enters the cylinder, first filling the space traversed by the piston, after which air and gas enter simultaneously and, intimately mingled in proper proportion, completely fill the cylinder, the compression being thus kept constant. The emission valve and its spindle are made hollow for water circulation.

The distribution shaft carries a cam which acts successively on rollers at the ends of two bars that actuate the valve levers. The gas and air mixture valve and that for exhaust open at invariable moments of the stroke with a certain lead; and the opening is maintained during a certain fraction of the admission stroke—an arrangement which energetically scavenges the explosion chamber, and especially the parts near the igniter.

The gas admission valve opens so much later as the power to be given out is less, its opening being determined by the governor. When set free, it opens owing to the action of gravity and the diminished pressure of the admission. At the end of the admission stroke both these valves are brought back to their seats by springs.


1,400-H.P. TANDEM COCKERILL GAS ENGINE.

The ignition, which may be advanced or retarded according to the engine's working, is effected by high-tension electric spark with fixed candles.

The lubrication is effected automatically, almost entirely by mineral oil, which, in the case of the cylinders, the piston rods, and the exhaust valve spindles, is forced in by a small pump. The crankpin is drilled with a hole for permitting oil to arrive by centrifugal force at the connecting rod crosshead. The other end of the rod is lubricated by "lickers," and the rubbing surfaces of the crosshead guides move in oil baths communicating with a container in the bedplate.

Starting is effected by compressed air, furnished by a small compressor and stored in a receiver communicating with the starting valve, which is operated by a cam on the distribution shaft. By shifting a roller on this cam the valve's motion is interrupted directly the first explosion takes place.

The dimensions of the engine are: Length, 56 ft.; width, 20 ft.; diameter of cylinders, 3 ft. 3⅜ in., while the stroke is 3 ft. 8 in., and the normal speed 100 revolutions per minute.

The engine has been subjected to a series of exhaustive trials, under various conditions of load, gas richness, and mixture with air. At about normal speed with a mean pressure of 59 lbs. per square inch, the indicated horse power was 1,463·68, E.H.P. 1,332. The efficiency was 91, the gas consumption 84 cubic feet per indicated horse power per hour, and the indicated thermal yield 28·52.

BOILER EXPLOSIONS.

ABSTRACTS FROM RECENT BOARD OF TRADE REPORTS.

Explosion from a Main Steam Pipe Junction Piece.

Report of Preliminary Inquiry No. 1,916.—This explosion occurred on board the steamship Waimate, a single-screw steamer trading between London and New Zealand, and owned by the New Zealand Shipping Company Ltd., 138, Leadenhall Street, London. The junction piece was a brass casting, and connected the main steam pipes on the three main boilers with the main steam pipe to the propelling engines. The average thickness of metal in it was ⅞ in. The propelling engines were stopped, and while some repairs were being made to them, the main stop valves on the boilers were closed. When the boiler stop valves were again opened, steam was observed to be escaping from a crack, about 7 in. long circumferentially, on the under side of the junction piece and near to the flange by which it was jointed to the centre boiler stop valve. The explosion was due to the movement of the main steam pipe, caused by the violent racing of the engines during heavy weather between the 9th and 14th August, 1909. No one was injured by the explosion.

Explosion from a Kier.

Report of Preliminary Inquiry No. 1,917.—The kier on which this enquiry was held is the property of Messrs. Lindsay, Thompson and Co. Ltd., Prospect Linen Thread Mills, Belfast. The kier was a cylindrical vessel with a conical bottom, and it was provided with a dished wrought-iron cover. The shell was made of cast iron; it was 5 ft. 9 in. in diameter, 6 ft. in height, and varied from ¾ in. to $^{15}/_{16}$ in. in thickness. The upper edge was formed with a flange 3⅝ in. wide and 1 in. thick. To this flange a cast-iron stiffening ring, 3⅝ in. wide. and 1½ in. thick, was secured by means of a number of screwed pins, ⅝ in. in diameter. The bottom was stiffened by four external ribs, ⅞ in. thick. The cover was of wrought iron, ¼ in. in thickness, and was dished about 8½ in. deep. It was made of one central piece and eight segments, riveted together with rivets ⅜ in. in diameter, pitched from 1⅝ in. to 1¾ in. apart. A ring, 3½ in. wide and ⅝ in. thick, was riveted to the cover to form a flange. The cover was hinged to the shell, and was secured in its working position by ten hinged bolts, 1 in. in diameter. Inside the kier a perforated grid was fitted about 7 in. from the bottom, and a vomiting pipe, 4½ in. in diameter, was fitted in the centre. Various valves were fitted. The explosion was a violent one. The cover of the kier was forced from its fastenings, and the contents of the kier were discharged through the roof, lifting the slates and breaking the rafters. The cover swung back on its hinge and struck the wall at the side, thus breaking the safety valves and bending the cover. A number of the holding-down lugs on the cover were bent downwards from the horizontal; the one almost directly opposite the hinge was so much bent that a piece of wire, ¼ in. in diameter, had been placed under one side of the washer to keep the bolt square in position. Under working conditions this packing piece had probably loosened and worked out, thus relieving the bolt of its load and suddenly throwing an additional stress upon the adjacent bolts and lugs. Owing to the defective condition of these, they were unable to retain the cover in position, and it was therefore forced from its fastenings. No person was injured.

Explosions from Heating Tubes in a Baker's Oven.

Report of Preliminary Inquiry No. 1,918.—This inquiry was held upon an oven at the steam bakery of Messrs. William Miller Ltd., Kent Street, Portsmouth. The oven was of the "double deck" type. Length, 10 ft. 9 in.; breadth, 5 ft. 6 in.; height, 7 ft. 3 in. It had two baking compartments, heated by a number of steam tubes. The body of the oven consisted of an external and an internal sheet-steel casing, having spaces between the casings filled with slag wool. The furnace was constructed of brick. The tubes, 61 in number, were arranged in three rows of 19, 21, and 21 in the upper, middle, and lower rows respectively, rising 6 in. longitudinally towards the front ends. They were of wrought iron, butt welded, each said to contain about one-third to half a pint of water, and were 9 ft. 6 in. in length, and 1$^{5}/_{16}$ in. in diameter externally. There were two types of tube in the oven, viz., those originally fitted, which were plugged and welded at the ends, and ¾ in. in bore; and those which have been renewed, which were cup welded at the ends, and ⅞ in. in bore. The front ends rested on bearer bars, and the tubes extended the full length of the baking compartments, through the steel casing and brick work, to the back of the furnace, the lower row forming the fire-grate. Two thermometers, graduated at 600 deg. Fah., were provided for indicating the heat of the baking compartments, but the tubes were all self-contained, without any means of ascertaining or regulating their internal pressure. One or more tubes in the middle row failed at about 1 a.m. on the 16th December last. The noise caused by the explosion or explosions was slight. At intervals up to 6 a.m. several other slight explosions were heard. Owing to the pressure of work, it was not possible to discontinue the use of the oven for several days. After the oven had cooled down, it was found that eight adjoining tubes in the middle row had failed, one having opened out at the furnace end for a length of 7 in., and the others were found to have small fissures near the furnace ends, varying in extent from ¼ in. to 1½ in. in length, through which the contents of the tubes had escaped into the furnace. The explosions were due to the material of the tubes having become weakened by overheating, and thinned by the action of the fire to such an extent as to be unable to withstand the internal pressure developed.

REINFORCED CONCRETE PIER ON THE THAMES.

IN connection with the building of the new Dreadnought battleship Thunderer on the Thames, it will interest our readers to note that after being launched at Canning Town by the Thames Shipbuilding and Engineering Company Ltd., it will be taken for completion to Dagenham, on the Essex side of the river Thames, where she will lie alongside a pier, receiving her material from Canning Town and from workshops to be specially erected and equipped in the vicinity of the pier. The latter is worthy of note as illustrating another instance on a large scale of the use of concrete in a reinforced form for submarine and superstructural purposes.

This pier will be 352 ft. long from the shore and 23 ft. 6 in. wide on the deck. The deck will be 6 ft. above Trinity high water and 26 ft. above low water, and at low water a depth will be provided of 29 ft. About 52 ft. from the end the pier will widen to 64 ft. in the course of 30 ft. distance, in order to form an approach to the head of the pier, which is 22 ft. wide and 147 ft. long, the whole construction being in the form of a letter T. All this work is being carried out in reinforced concrete, with the Williams patent steel and concrete piles. The details of the superstructure have been designed by Messrs. Samuel Williams and Company (Limited), of Dagenham Dock, who are also the contractors for the undertaking.

In all there are 113 reinforced concrete piles, 14 in. square, the reinforcement consisting of a 9¼ in. by 4 in. steel joist weighing 20½ lbs. to the foot. These piles are placed in rows of three across the width of the pier, spaced at 10 ft. 5 in. centres, while lengthwise the rows are 15 ft. apart. Four 225 ft. longitudinal rakers, also 14 in. square, are placed between the piles 10 ft. below the deck of the pier, the reinforcement consisting of four 3⅛ in. by 1½ in. I joists; and cross walings of similar size and construction are provided at this level, and a cross girder at the top of the piles to take the deck. About 165 ft. from the shore single diagonal cross braces, also 14 in. by 14 in., but reinforced by two 9 in. by 4 in. joists, are added to every alternate row of three piles for a distance of 60 ft., and beyond this point to the end of the pier a second row of longitudinal rakers is added at a depth of 22 ft. below the deck of the pier, the whole being braced diagonally. The reinforcement in the cross braces consists of two 9 in. by 4 in. joists, and throughout the construction the piles, rakers, walings, and braces are 14 in. square.

At the junction of the walings and rakers with the piles the sets of 3⅛ in. by 1½ in. joist are bolted together, and are also secured to the joist in the pile, this being done, however, merely for convenience in erection. In order to accomplish this the piles, which at the end of the pier are 66 ft. in height, were driven in sections. The pile forming the first section at the end of the pier is about 35 ft. long, and when driven the concrete was removed for a short distance from the top, which was above water. The reinforcement of the second pile having been bolted to that of the original one, it was strengthened with a timber joist bolted on each side, and wooden staging was afterwards laid on the top. The piles were driven with a 7-ton Grafton crane, weighing about 35 tons, which was specially provided for the purpose of driving 50 ft. concrete piles, and is furnished with a 65 ft. jib. After the piles had been built to the full height, the crane was propelled forwards upon the wooden staging, and when it had proceeded for a safe distance from the reinforcement for the new piles, the timber supports were removed, the concrete moulds were placed in position around the joists, and the concrete was poured in. This process was adopted for the rakers, etc., the completed structure thus consisting of a steel skeleton surrounded with concrete. The head of the pier, which is now being constructed, consists of 45 piles placed in rows of three across the width, with rakers, walings, and braces of similar construction to the above.

The cross girders to support the deck of the pier measure 19 in. by 14 in., and are reinforced with two 4 in. by 3 in. joists weighing 9½ lb. to the foot, and with ⅜ in. vertical fish-tailed stirrups placed 9 in. apart. Four 9 in. by 15 in. concrete girders, each reinforced with two 4 in. by 1¾ in. joists weighing 8 lbs. to the foot, and with a 1 in. bar, are placed along the length of the pier to carry the rails for a 30-ton crocodile truck capable of transporting 30 tons of armour—a live load of 60 tons. The deck of the pier itself is formed by a 6 in. layer of concrete containing 3 in. by 1½ in. joists placed across the pier at intervals of 2 ft., and a lacing of 1¾ in. by 13 S.W.G. hoop steel.

Change of Address.—The Pulsometer Engineering Co. Ltd. inform us that they have moved from their city offices to Broad Sanctuary Chambers, 20, Tothill Street, Westminster, S.W., which will in future be their sole London address. Their telegraphic address will be as heretofore "Pulsometer, London," but their telephone number will be changed to 545, Westminster.

MACHINING A 21 in. SLUICE VALVE BODY AND PLUG.

By J. A. Gray.

The following method of performing the various operations in machining a sluice, or gate valve, body and plug, may be of interest to our readers. According to the author, in the *American Machinist*, it was adopted with success where a large quantity of these valves were handled, and he thinks will commend itself as expeditious and economical in labour cost. The times given are approximate and might be reduced. The greater part of the machining may be done on a good 18-in. centre traversing lathe.

The first requirement will be a box fixture of not very elaborate design. This fixture, shown in fig. 1, bolts on to the lathe saddle, first removing the slide rest and screw of same. It is faced on its base, and also has a stout centre pin on which it swivels. It really has a double base, as there is a separate parallel plate in addition to the box itself. This plate B P (fig. 1) is permanently bolted to the lathe saddle, and has a central hole for the pin of the box to swivel, this hole being first set central with axis of the lathe.

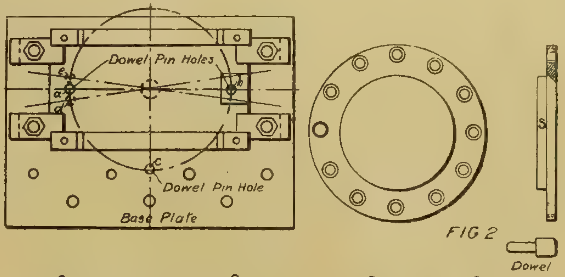


FIG 2

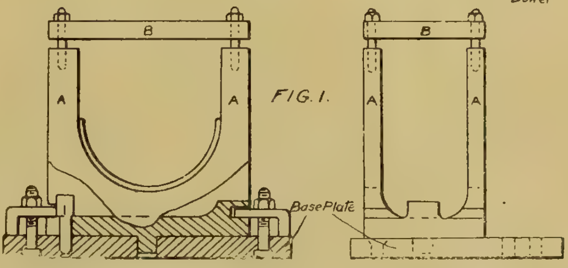


FIG. 1.

The jig is now set in place upon the base plate, with the arms, marked A A, lying at right angles to, or true for boring with, the axis of lathe. It is clamped in this position to base plate, and also located to same by means of a stout dowel. There are altogether five dowel pin holes in the base plate. Two positions are for the arms A A to be at right angles to the lathe bed, one being exactly opposite to the other. They are shown on the sketch (fig. 1) as *a* and *b*. There is also a position for the arms to lie parallel with the lathe bed, for facing the cover flange, and two other positions for the centre of jig to incline, either side of the lathe centres, an exact number of degrees. This is necessary for truing the inside facings and recesses to suit the required taper of plug.

Having located these five positions and drilled the dowel holes in base plate to suit, the jig is returned to its first position *a*, and bored out in the two arms A A, an easy fit to the body of valve marked X (fig. 6). In these arms the valve body lies when being machined, clamped down securely by the cover plate B. By this means the body of valve is held true, and with the thinnest parts of its walls free.

The jig being now ready for use, the first operation is facing the branch flanges. This is done as shown in the general arrangement, fig. 6, by means of a traversing arm, bolted to the face plate, the feed being put on by a star wheel. If a traversing arm is not at hand, a good stiff slide rest will answer the same purpose, bolted to face plate in the same way. In this case the turning tool will have to be cranked, as shown in sketch.

When one flange is faced in this way, the jig is unclamped, dowel pin removed and jig turned right around for the opposite flange. This brings dowel-pin hole in jig over hole marked *b* in base plate. During these changes of jig positions the base plate is not moved, the jig merely swivels on it. The jig being doweled and clamped in this position, the second flange is faced. The next facing is the top or cover flange. For this the jig is set square to its first position, doweled in *c* on base, clamped up, and operated on in the same way as the other two flanges.

This now leaves the inside seatings or recesses to be done. These are operated upon with multicutter face mills. Two are required; one for the iron body, and one for the brass facing. These cutters are not expensive tools to make. A cast-iron disc is slotted out on its face, to sizes given, and high-speed steel pieces are fitted in each slot. A steel wedge is then driven in at the back of each piece. These pieces are turned true when assembled in disc, then backed off and hardened. A cutter and wedge assembled in disc is shown in fig. 5, which also shows formation of disc.

It will be noticed, in sketch of general arrangement (fig. 6) that a bar is used for these two-face mills. The bar is squared for a portion of its length, for the face mill to fit upon, and a collar, as shown, takes the thrust.

To place cutter on bar, the saddle of the lathe is run back, nearly clear of the bar, the cutter is then put into the throat of the valve and guided on to the squared part of bar, as you advance the saddle toward the head of the lathe.

The cutter in place, the next thing is to set the jig to one of its angular positions, either *d* or *e* in base plate, so as to bring the face that is to be recessed parallel with the cutter face. This is located by the dowel, as before, jig clamped up and the saddle slowly advanced by hand till the required depth of recess is attained (a fixed mark on cutter disc will give this). Leaving the cutter in valve, the saddle is drawn clear of bar and the jig turned around for the opposite inside recess. The same process is gone over as before, and now the body of valve will be finished, preliminary to the facings being fitted, except drilling. By the above method, really five operations are done at one setting of valve in the fixture.

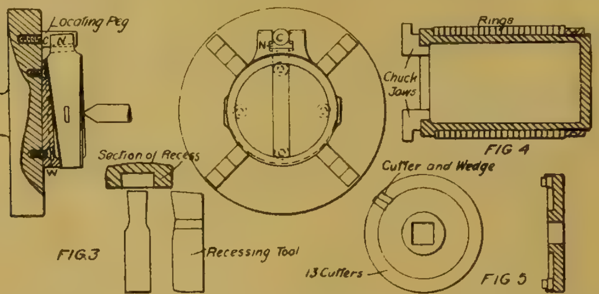


FIG.3

FIG 4

FIG 5

The time estimated for this machining, including setting, should not be more than three hours.

When the complete set has been machined as above, the next operation will be the drilling of branch flanges. For this a plate jig should be used. A cast-iron flange is machined, as shown in fig. 2; the spigot S turned an easy fit to the average bore of valve, that is, 12 in. diameter; holes pitched off to the number required, at given pitch circle diameter; then bushed with steel bushes, to sizes given. There need not be any exact tool making about this job, and it pays for the making. The jig is located central on flanges, by means of the spigot S, and when the first hole is drilled a dowel pin is set in through jig, and hole just drilled to prevent the jig turning while drilling the remaining holes.

The time taken on the two flanges should not be more than twenty minutes, assuming high-speed drills are used.

The cast-iron plug is now ready to be faced and recessed. This operation can be done in an ordinary 18 in., four-jaw concentric chuck. The only provision is to have a wedge piece the same taper as plug, so when the two are laid one on the other the two outside faces are parallel. This wedge piece, marked W in fig. 3, is slightly smaller in diameter than the plug. It is set true on face of chuck and then set-screwed to same. A peg C screwed into face of chuck engages with the nut recess marked N on plug, and so locates the plug in the correct position on the wedge W. The jaws of chuck do not engage with this fixture in any way, but grip the plug only. A centre is held up to plug, to keep it hard against the wedge. The turning is done with an ordinary front tool and a recessing cutter. In machining, it is as well to draw the recessing cutter to either side of recess, thereby producing a slightly dovetailed section to give a tighter bind on brass facing.

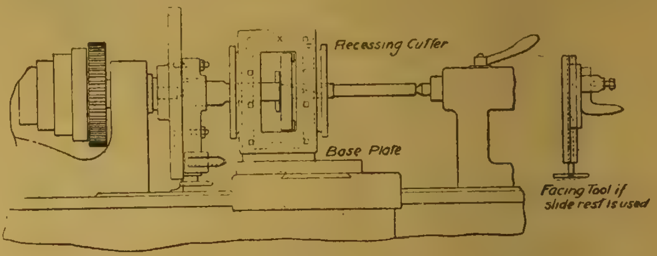


Fig. 6.—General Arrangement of Valve Body in Jig.

Time occupied in doing the two faces and fixing, 30 minutes.

There are now only the brass facings to machine. The best method is to hold them in a four-jaw chuck by the outside diameter, on a capstan; have a tool bar in turret for boring at one cut and a facing tool in cross slide. Of course, there will be two different bore sizes, that of the plug facings being smaller. These, then, will be done in sets. When faced on one side only and bored, the facings should be mounted on a mandrel to suit the bore. There will be two mandrels required. This is shown in fig. 4. They are then turned on their outside diameters for a press fit in recesses of valve body and plug. A ring gauge should be used for sizing. These facings can be mounted, about 20 at a time, on their respective mandrels. About 10 minutes should be the time for each facing.

This leaves only one side of facing rough, which is machined in place, when pressed in valve body and plug. After being pressed in, in their respective recesses, with red lead to make a tight joint, the valve body is placed in box fixture, doweled in its angular position as before, and the facing mill for brass put on bar. Each facing is then carefully surfaced. This leaves a true surface, and each valve body has its facings exactly the same taper. The plug facings, when pressed in, are faced on their same taper wedge in the four-jaw chuck.

When the plug is assembled to its valve body, it will be very little short of a water-tight joint, only a touch with a scraper on a high point here and there being required to let it right up close and tight.

Time required for pressings in facings, setting in fixtures, facing and finishing, for test on valve body and plug, four hours. This makes a total time for all operations on one valve body and plug of eight hours.

The world's largest ship is being built by the Vulcan Co., of Stettin, for the Hamburg-American Line. It will be more than 45,000 tons gross register and of the following dimensions: Length, 872·2 ft.; breadth, 95·2 ft.; depth, 64 ft. It will thus be about 110 ft. longer than the Mauretania. The vessel will be driven by turbines, and a working speed of 22 knots is to be provided for.

CHARGING APPARATUS FOR BLAST FURNACES.

In connection with the feeding of blast furnaces the methods and appliances adopted for the purpose are many and various, devised to suit the local conditions. In small works with a limited output the primitive means in use generations ago still exist, but in large concerns it has been found essential to have the very best mechanism available for charging purposes. Amongst the numerous inventions of recent years in the latter domain may be noted with interest in the iron and steel industries the improvements effected by Mr. E. J. Windsor Richards, of the Glengarnock Iron and Steel Co. Ltd., N.B., whose name is coupled with that of Mr. Thomas Lewis, Glengarnock, in a recently-accepted patent office specification. The invention has specific relation to improvements in charging apparatus for blast furnaces, and has for its object to more perfectly distribute the materials into the furnace for making pig iron; to simplify the construction of such apparatus, reduce manual labour, and effect a saving of gas. It is claimed that in the process and means adopted to achieve these desired ends there is no complication of parts at the head of the furnace, and therefore nothing to get out of order. Further, such parts as are employed to effect the charging of the blast furnace do not project from the top of the furnace footplate to any great extent as hitherto.

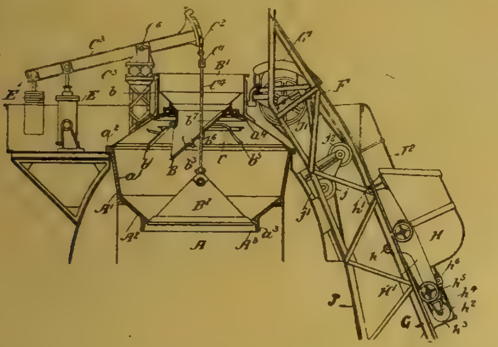


Fig. 1.

Most appliances of this kind are objectionable on account of the enormous head gear above the top of the furnace, and, owing to the great amount of mechanism, they easily get out of order. In the accompanying sketches fig. 1 shows a sectional elevation of the upper portion of a blast furnace, with charging and conveying apparatus applied thereto. Fig. 2 is a plan thereof, with the skip as shown in fig. 1 removed. Fig. 3 shows a diagrammatical view of the skip track and power house in relation to the blast furnace and charging apparatus. Fig. 4 shows an enlarged sectional elevation of the manner in which it is proposed to carry the rotating shute, preferably on ball bearings; and also showing the manner of carrying the means for imparting a motion of rotation to the revolving portion of the shute.

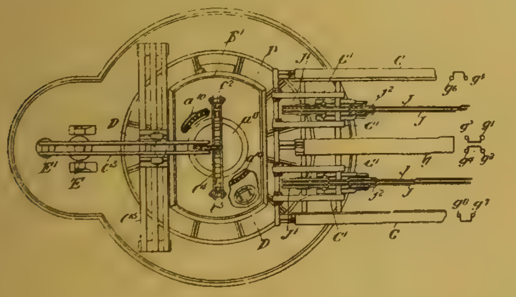


Fig. 2.

Referring more particularly to figs. 1 and 2, A is the interior of the upper portion of a blast furnace, having arranged in the mouth thereof a stationary hopper A^1, preferably round in shape and having at the lower depending end a tun-dish shaped ring A^2, having the sleeve portion a^3, and being formed with the opening A^3. The upper portion of the hopper A^1 is provided with an opening a, through which the shute B protrudes into the hopper A^1.

The hopper in construction is formed of the portions a^1, having the portion A^2 provided with the sleeve portion a^3; the upper portion a^2 of the hopper A^1 being preferably provided with the ring a^4 having the opening a.

The ring a^4 of the fixed hopper carries the ball ring a^5, the said ring being secured to the ring a^4 and bearing on the ball bearings a^6 of the ring a^5 is the upper cap a^7 of a corresponding circular shape to the ring a^5. The cap portion a^7 is secured to the revolving shute hopper portion a^8 and also to the revolving shute portion a^9, so as to make these portions integral all as shown more particularly in the enlarged detail view fig. 4.

The top of the cap a^7 formed with the bracket portion as a means for attaching to the hopper a^8 is provided with a ring of ratchet teeth, and the arrangement is such that when the cap portion a^7 is rotated, the hopper portion a^8 and shute B are caused to rotate therewith, the ring a^5 and ball bearings a^6 forming the support for the said hopper a^8 and shute B.

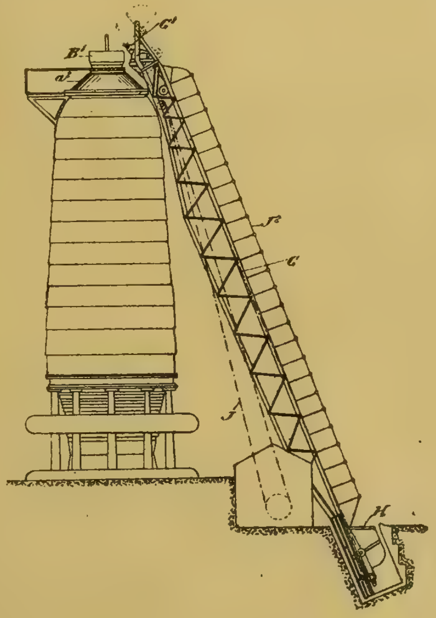


Fig. 3

Within the rotating hopper a^8 may be provided the stationary elongated hopper B^1, which may be carried from the portion a^2 of the hopper by means of stays such as b.

The mouth of the shute B from which the material discharges into the hopper A^1 is closed at the required period by means of the door b^1 pivoted at b^2 by means of a snug or snugs formed on the shute B, and being controlled in its inoperative position by means of the lever b^3 with counterweight. On the outside of the said door b^1 a projection or steady b^4 is provided, and another b^5 may also be placed on the outside of the shute B.

In order to dispense with any intricate mechanism or gearing for closing the door b^1 of the shute B, the novel method has been devised, as shown in fig. 1, for effecting the closing of the door b^1 at the correct period.

Although a track with an arrangement of skips is shown for charging material into the hoppers of the furnace, such track may be dispensed with and skips and ordinary conveying hoists used for conveying the material to the mouth of the furnace, and in this case charge into the furnace from the barrows, after the manner as is done in hand feeding.

In the improved arrangement of track and skip the haulage house may be situated beneath the track or tracks, and on the base of the ground or therebelow; the haulage house being shown in fig. 3 beneath the tracks. If desired the skip or skips may be partly enclosed within a recess, such as the skip H is.

It may be preferred that the hoppers which rotate be so arranged that they slightly gain in each revolution, and so that the point of discharging on to the bell valve and consequently to the furnace is varied. Further, a perfect mixing of the ore, limestone, and coke is effected, because they are not discharged in the same position within the furnace at every revolution of the shute. It may also be preferred that the gearing of the shute be enclosed within half cases, to prevent dust or dirt having access to the gearing.

The casement top of the furnace may be mounted on small roller wheels, say, two sets at opposite sides; the rollers engaging with and resting on the top of the furnace plate or the top flange of the hopper, and the arrangement is such that by removing the studs that hold the casement top in position, it can be moved to one or the other side, so as to effect any repairs in the hopper, or to replace the old bell valve by a new one; the rod of the bell valve, and other parts requiring to be disconnected, being dismantled previous to this operation.

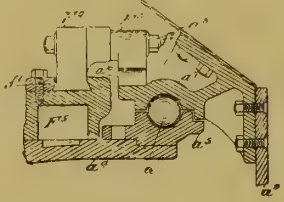


Fig. 4.

In the limited space at our disposal we regret we have been unable to do more than indicate the chief features and scope of the ingenious mechanism devised for the object refered to. Probably the accompanying illustrations will supply to the minds of those of our readers interested in work and machinery used in connection with the charging of blast furnaces the smaller details of the mechanism which we have not described.

THE MAINTENANCE, CARE, AND UP-KEEP OF PNEUMATIC HAMMERS.

By George H. Hayes.*

Having been connected for a number of years with the manufacturing end of the largest pneumatic tool company in the world, I have been asked to write a few words concerning the maintenance of pneumatic hammers and the abuses which they receive at the hands of the men on the job.

The material used in the construction of pneumatic hammers is the very best that money can buy, and is the result of long periods of experimenting at an outlay of a great deal of time and money to get material that is best able to withstand the vibrations, jar, and wear which pneumatic tools are called upon to withstand. The treating of the material, fitting up, and testing must be done by experienced and competent men. Pneumatic tools are made with the most extreme care, the moving parts are accurately and closely fitted, and when the proper lubrication is neglected, which is the most unpardonable offence to which a piece of fine machinery can be subjected, the moving parts of a pneumatic hammer will wear rapidly, and in very short time refuse to work.

Another source of trouble is sometimes located in the pipe line. Moisture carried in the air will rust the pipes, and if a hammer is connected up without first blowing out the pipes, a sediment is liable to be blown through into the tool, causing the valve or piston to stick. Rubber deteriorates very fast, and particles of the hose may blow into the valve box and stop up some of the parts. Many times we have had hammers that would not operate sent into the factory, and on dismantling them found the port holes plugged up with pieces of rubber, or sediment from pipes, which when thoroughly washed out with gasoline, reassembled and properly oiled, would operate perfectly.

Another abuse is practised in taking a hammer apart and putting it together again. Some repair men, instead of using a wrench or soft hammer, in loosening or tightening the handle, use a hard steel hammer, battering the parts badly and in many instances breaking them. The finished parts should never be struck with anything but lead or copper hammers, and even when this is done, good judgment should be used as to the strain put on the threads of the handle and the cylinder.

There are many abuses practised in connection with the operation of pneumatic hammers which are hard to locate, one of the most flagrant being the use of short pistons in riveting hammers. The manufacturers, after long and careful experimenting, have decided on a piston of proper length to perform satisfactorily the work for which the tool was designed, and all parts are made in proportion to withstand the strain. Workmen who are anxious to perform their day's task in the shortest possible time, or to increase their volume of work where they work on a per-piece basis, have little or no regard for these labour-saving devices. Having discovered that a piston a fraction of an inch short will do the work more rapidly, they resort to all manner of means to secure them, even having them made in outside machine shops. They carry them in their pockets, and when they take a hammer from the tool room, they substitute the short piston for the one of proper length, again making the exchange before returning the hammer to the tool room. The result is, sets and handles are broken and cylinders frequently split. Where these breakages are occurring at short intervals, it would be well to detail someone to go through the shop and examine the pistons while the hammers are in use, otherwise the cause of the breakages will not be definitely located.

Some of the large plants using pneumatic tools have adopted the practice of issuing a given tool to the same workman continually, which has had a tendency to cause better care to be taken of the tools. If breakdowns occur frequently, it enables them to compare the amount of work being accomplished by different tools, and the more careless workmen are located and disciplined. Where this practice is followed, many times when the output of the shop is being forced to such an extent as to require all tools in service, and a workman is delayed in completing his work, while the men who are more careful of their tools finish in good time, it has a tendency to cause others to exercise greater care, which accrues to the benefit of all parties interested, even back to the manufacturer.

A great majority of men who operate pneumatic hammers in the shops know very little, if anything, about the construction of the tools, and it pays any large institution using pneumatic tools to employ a competent man to look after them, see that they are properly lubricated and returned for cleaning when through with their work. I have been in foundries using large numbers of hammers in cleaning and chipping castings, where, at the sound of the whistle the hammers would be thrown down, generally in the sand, and enough sand or grit would get into the tool, so that when the air was again turned on, the piston would stick fast after one or two blows. This necessitates a cleaning of the tool causing a loss of time in its use from 20 to 30 minutes.

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* Works Manager of Chicago Pneumatic Tool Co., Detroit, Mich.

In starting to drive rivets in cold weather, especially on structural or out-of-door work, the hammer should be warmed up enough to take the frost out of the steel, as a hard piece of steel full of frost is liable to break at the first blow; after a few rivets have been driven, there will be enough heat from the rivets to keep the frost out. On the other hand, never allow the temper in the rivet set to be drawn too low, as a soft set will break very quickly. When driving rivets rapidly, have a pail of water handy and put the set and end of the hammer cylinder in the water occasionally to keep from drawing the temper, or change the set occasionally.

The wearing of parts in a hammer will always take place, but the life of the tool can be prolonged greatly by proper care and attention. Crystallisation of the steel takes place owing to the rapid blows of the piston and the vibration. The life of the hammer depends mostly on the care which it receives and the character of the work being performed with it. A piece of fine machinery, such as a pneumatic hammer, can be ruined in a few minutes by ill usage and neglect.

It has been proved conclusively during the past few years that pneumatic tools are invaluable in shop practice wherein they are adaptable. Either a small or a large installation of pneumatic equipment is the most economical in maintenance cost. The small installation does not require a special attendant, but can be looked after by the regular mechnical force, reducing the labour charge to a minimum. With an equipment consisting of 40 tools or more, it should be put in charge of a special machinist, whose duty it is to follow the equipment closely and to keep it in good repair. It has been clearly proved that one man can care for 100 tools where the proper attention is given by the men handling them. We have recently had our attention directed to tools in service which have been working regularly for a period of seven years. These tools, of course, have been well cared for, and the workmen using them appreciate their value in aiding them in their labours, and handle them as they should be handled.

Pneumatic tools are outrageously abused in many cases without the knowledge of the management, and, at other times with their sanction, the latter being on account of these tools having such a large earning power that they are considerd an economical investment even though their life be but three months. This latter remark may seem an exaggeration; however, it is borne out by actual knowledge. One of the largest steel concerns in the world is using chipping hammers, where nine hammers in the hands of men skilled in their operation easily perform work which would require 90 unskilled men with mauls and cutters. The tools in this case are appreciated by both the management and the workmen, and are well cared for. Even when the tools have a short life, a great many concerns having adopted them, state that the saving in wages and increased output make them an extremely economical investment.

Modern labour-saving machines are sometimes blamed for lowering the standard of skilled workmen by transferring him into a mere automaton—a droning machine tender. Undoubtedly in some crafts there is less call for men of manual dexterity than there was before the invention of labour-saving devices, leading to a decreased demand for all-round mechanics, and an increased demand for men of only sufficient intelligence to guide an almost sentient machine. On the other hand, many types of labour-saving devices have counteracted this tendency by offering mechanical means for doing the drudgery of a shop, making necessary a higher average of intelligence than before. Pneumatic hammers and drills, portable electric drills and hydraulic riveters are in this class, as skill and judgment rather than mere brute strength and endurance are called for in their operation.—*Machinery*.

NOTES ON THE OPERATION AND TESTING OF POLYPHASE INDUCTION MOTORS.

By J. W. Rogers.

(Continued from page 717.)

Let V = terminal voltage, H = horse-power output, and n = apparent efficiency. Then amperes per phase

$$= \frac{746 \times H}{n \times V} \text{ for single-phase motors,}$$

$$= \frac{746 \times H}{n \times V} \times \frac{1}{2} \text{ for two-phase motors,}$$

$$= \frac{746 \times H}{n \times V} \times \frac{1}{\sqrt{3}} \text{ for three-phase motors.}$$

The watts input are practically the same for a single, two, or three phase motor of given output, but the input current depends upon the number of phases. The primary current taken by an induction motor is made up of two components, viz., an energy and an inductive component.

The energy component represents that part of the primary current which is in phase with the terminal voltage; it gives true energy and varies with the output of the motor.

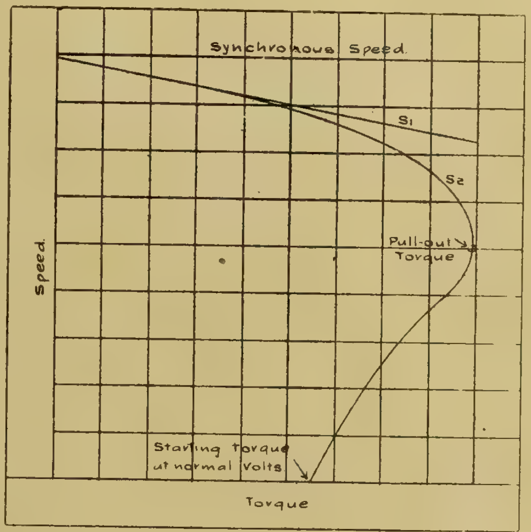

Fig. 1.

The inductive component represents the wattless or idle part of the primary current, which lags 90 deg. behind the terminal voltage. It depends upon the magnetising current taken by the motor, and also upon the magnetic leakage. It performs no useful work, and is constant at all loads, but as it gives rise to a lagging current, it affects the regulaton of the supply circuit.

The apparent input to a motor

$$= \sqrt{(\text{energy component}^2 + \text{inductive component}^2)}$$

$\therefore$ The inductive component

$$= \sqrt{(\text{apparent input}^2 - \text{energy component}^2)}$$

that is to say, the true value of the magnetising current taken by a motor

$$= \sqrt{(\text{total current}^2 - \text{energy current}^2)}$$

where energy current

$$= \text{real watts} \div \text{terminal volts.}$$

As an example of this, the following figures may be quoted. The light readings on a certain three-phase motor were: Terminal volts = 400, amps. per phase = 7·5. Total watts = 580, and energy current

$$= \frac{580}{400} = 1{\cdot}45 \text{ amperes.}$$

Substituting these values in the above formula we get

$$\text{Magnetising current} = \sqrt{(7{\cdot}5^2 - 1{\cdot}45^2)} = 7{\cdot}35 \text{ amperes.}$$

$$\text{The ratio } \frac{\text{energy component}}{\text{inductive component}} = \frac{1{\cdot}45}{7{\cdot}35} = 19{\cdot}7 \text{ per cent}$$

represents the power factor of the motor, and as a large inductive component will give a low power factor, a motor must take a small magnetising current if its power factor is to be high; the power factor also depends upon the air-gap, as this affects the magnetic leakage. The inductive component of the primary current taken by an induction motor having a power factor of 80 per cent

$$= \sqrt{(100^2 - 80^2)} = 60 \text{ per cent};$$

that is to say, the wattless or idle component would be 60 per cent of the total input current, which clearly shows the importance of having the power factor of induction motors as high as possible; also, when a motor is to develop a large torque at starting, the inductive component must be kept down. The apparent power taken by a motor = total primary amperes × terminal volts, the ratio

$$\frac{\text{true watts}}{\text{apparent watts}}$$

representing its power factor.

The total power input includes the energy transformed into brake horse power on the motor shaft, also the losses in the iron and copper circuits.

The brake horse power developed is proportional to torque × speed, and if it were possible to design a motor having a resistanceless secondary, there would be no secondary copper loss, and the motor would run at its synchronous speed at all loads, in which case the horse power developed would be proportional to the torque. These conditions are, however, not obtainable in practice, and the resulting copper loss in the rotor circuits is accounted for by a certain drop in speed, viz., "the slip," which is the same percentage of the synchronous speed as the rotor copper loss is of the total watts supplied to the rotor windings. The "no-load" losses consist of (1) stator and rotor iron loss, (2) C^2R loss in stator windings, (3) bearing friction and windage.

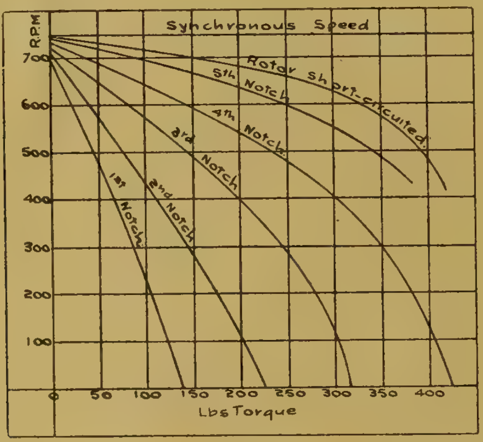

FIG. 2.

The stator iron loss is practically constant at all loads, and depends upon the saturation of the iron circuits, but the rotor iron loss varies slightly with the load being proportional to the slip, which is due to the fact that an increase in the slip causes an increase in the frequency of the rotor currents. The stator copper loss is proportional to the square of the current, and varies with the load, but the friction and windage losses are practically constant at all loads.

Having considered the general theory of the working of induction motors, reference will now be made to the testing of these machines. The "shop tests" carried out on all kinds of electrical machinery may be divided into two distinct classes. The first class includes tests made chiefly for the benefit of the "designers," and which are known as "experimental" tests. They are made on all machines of new type to obtain a knowledge of their performance under working conditions, and also to prove accuracy in design, the tests required for this purpose being those for (1) insulation, (2) rating and efficiency. Those of the second class, known as "commercial" tests, are made to locate faults in manufacture, due to (*a*) defective material, (*b*) bad workmanship, (*c*) faulty assembling; the tests required for this purpose being those for (1) iron loss, saturation, and friction, (2) temperature run at full load, (3) insulation. Nearly all defects in the iron circuit of a machine would make themselves apparent in the temperature test, in the form of (*a*) excessive iron loss at normal voltage, and (*b*) excessive temperature rise of the iron circuit. As it is generally found that nearly all defects in manufacture are shown up in the temperature test, the most important tests are those for efficiency and temperature rise.

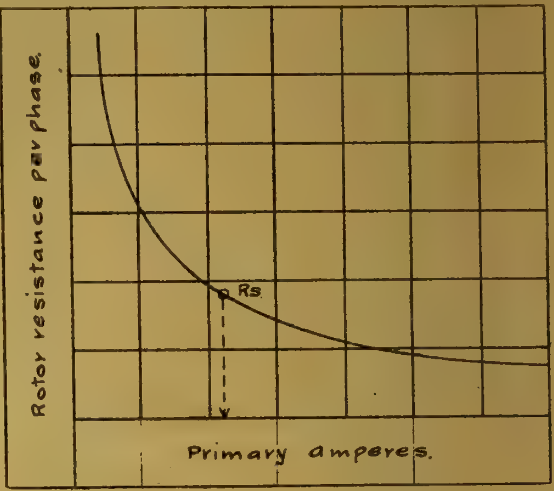

FIG. 3.

The experimental tests made on induction motors to determine the iron loss, saturation, and efficiency are those for (1) resistance, (2) running saturation, (3) locked saturation, torque and impedance, (4) power and slip curves.

The methods of making these various tests and the information to be derived therefrom will now be considered, and although reference will be made more particularly to three-phase motors, the following remarks will also apply to a certain extent to single and two phase machines.

Resistance.—The ohmic resistance is measured between the terminals of a motor by the "drop of potential" method, and in the case of single-phase machines, the total resistance of the primary winding is given by R = volts drop between terminals ÷ current.

With a two-phase motor, as there are two separate circuits to be taken into account, the total primary resistance will be half the value of the resistance between the two terminals of one phase

$$\therefore R = \frac{\text{volts drop between terminals of one phase}}{\text{current}} \times \frac{1}{2}.$$

(*To be continued.*)

WE understand that a well-known firm of engineers and shipbuilders on the River Thames have acquired a shipyard situated at the entrance of the old harbour of the port of Hull, originally built by Messrs. Samuelson, and subsequently tenanted by other firms. This item of news will no doubt be a matter of interest to local shipping circles.

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"Marine Engineering." A Text Book. By Engineer-Commander A. E. Tompkins, R.N. Third Edition. Re-written, revised, and enlarged. London: Macmillan and Co. Ltd. Price 15s. net.

The advent of the third edition of this excellent work has given the opportunity for the author to cut out matter which has become obsolete, to re-write the greater portion of it, and add new matter.

It is no little recommendation to those unfamiliar with the earlier editions to note that the author has held the post of instructor at the Royal Naval College, Greenwich, and lecturer at the Royal Naval War College, and having had charge of machinery in warships of many types, is fully qualified to write on present-day practice.

Practically every detail of warships' machinery is dealt with in the 812 pages composing the book, while the 400 odd illustrations leave nothing to be desired in selection and execution.

Mathematics have been reduced to a minimum, but the synthetic treatment, and many explanations by diagram, lead up to the more complicated modern practice. There are ten parts, each of which is a complete department. In the introduction is included the early developments of the steam engine, the principle of compound working, the physical units, the nature of heat, properties of vapour, expansion, the indicator diagram and measurement of power. The second part concerns boilers of the usual marine types, the various furnaces, construction of manholes, stays, tubes, water-tube boilers, automatic feeds, and boiler mountings. The next part is on combustion, and explains the principal constituents evolved from burning coal, the volume of air required, forced and suction draught, furnace temperature, heating surface apparatus for measuring flue gases, liquid fuel, how it is controlled, and its comparison with coal. Part IV. is devoted to the reciprocating marine engine. It is limited to modern types, the design of the cylinders, pistons, various types of packing rings and glands, also details of connecting rod ends, bearings, the system of lubrication, thrust blocks, valve motions, link arrangements, and reversing gears. Under Part V. are included all the important main accessories, such as condensers, air and circulating pumps, steam and exhaust systems, feed pumps, evaporations, and distillers.

The foregoing very exhaustively describes, from the engineer's point of view, the construction and working of all the main elements in the boiler and engine room, and well covers all the ordinary requirements of the engineer.

Turning now to Part VI., this shows how the power of the steam is measured by the indicator in its various forms. The indicator diagram is explained, the reasons of the faults are analysed, while the efficiency of high pressures, superheating, effect of different cut-offs, and the thermodynamics are touched upon.

There are 40 pages devoted to the hull or skin resistance and power of steamships with the effects of air resistance, and the relations on power and speed and fuel consumption. This part includes a chapter on the paddle wheel, single and multiple screws, and the special design of propellers for turbine machinery.

Part VIII. occupies almost 70 pages, with particulars of auxiliary machinery to be found on warships. In a modern vessel this includes steam plant, air compressors, refrigerators, hydraulic and electrical machinery, and much of this descriptive matter is entirely new.

Part IX. The three chapters on the care and management are of considerable importance. The chapter on the duties of the engineer of the watch will be much appreciated by many of the less experienced engineers.

The final chapters on the marine steam turbine and the internal-combustion engine are practically new, and constitute a volume in themselves of 114 pages.

As a test of the reader's knowledge, he should not fail to tackle the 237 questions, which are taken from examination papers, and have answers to the arithmetical ones. An ample index concludes the book.

We look upon this work as a painstaking record of marine engineering practice in the Navy, being written by one specially qualified in the service to do so. It is as indispensable to the needs of engineers in the mercantile marine as to those already in or intending to adopt naval engineering as their profession.

"The Art of Aviation." A Handbook upon Aeroplanes and their Engines, with Notes upon Propellers. By R. W. A. Brewer. London: Crosby Lockwood and Son. Price 10s. 6d.

In connection with aviation, theory and practice are far from one another. There are many principles and fundamental formulæ yet to be determined, and until this has been accomplished, the art of aviation will still follow the line of trial-and-error method. This is unfortunate for our pioneers, as it spells expense and fatalities. The author's efforts have been confined to taking a middle course between the highly scientific and the purely descriptive.

But little space is devoted to early types of gliders and machines. The relation between sustentation area, weight and power are considered in connection with the shape and angle of the planes. The author clearly brings out the points that have to be borne in mind when designing engines for aeroplanes, and explains how the problems have been met in many of the engines now in use, such as lubrication, carburation, radiation—all of which are of the utmost importance, especially reliability. The engines described include the Antoinette, Gnome, Gobron-Brillie, Green, Aster, Wright, Simms, and Darracq. The tables giving particulars of British and foreign makes are especially useful.

The success of an aeroplane depends to a great extent upon its rigidity and lightness. Although it is not intended that the data given is sufficient to enable anyone to design an aeroplane throughout, the mention of the materials chiefly in use and details of many of the parts will prove serviceable.

Readers will much appreciate the descriptions and records of performances of aeroplanes, some views on future development, and the means devised for attacking them while in flight, while the twelve folding plates are exceptionally instructive.

The book is exceedingly well got up, is full of useful information, and is a technical work with a leaning towards the popular.

Books Received.

"The Design and Construction of Oil Engines." By A. H. Goldingham. Third Edition. Revised and Enlarged. London: E. and F. N. Spon. Price 10s. 6d.

"Official Gazette of the United States Patent Office." Vol. CLV., Nos. 1 and 2. Published by Authority of Congress, Washington.

"Model Balloons and Flying Machines." By J. H. Alexander, M.B., A.I.E.E. London: Crosby Lockwood and Son. Price 3s. 6d.

Change of Address.—Messrs. J. B. Petter and Sons Ltd. have now removed to larger premises at 61 and 63, Queen Victoria Street, London, E.C. The firm's works are at Yeovil.

THE BRUSSELS EXHIBITION.—V.

(Continued from page 775.)

Air compressors receive the best representation on the stands of Mr. A. Borsig, of Tegel, and Messrs. Pokorny and Wittekind, of Frankfort-on-Main. The machines of the second-named firm are on the "Köster" system, and in this country they are better known as made by Messrs. W. H. Bailey and Co. Ltd., of Manchester, who are the sole makers in the United Kingdom. An elevation of a two-stage motor-driven compressor is shown in fig. 16, the vertical cylinder being the intercooler. The chief feature lies in the valve gear, and a section of this is given in fig. 17; the lower part shows the cylinder in which the differential piston works. For the positions of valves and differential piston, air is being sucked in at A to the low-pressure cylinder, and when the piston reaches the end of this stroke the valve will also have returned and closed port B, the some movement closing the discharge port I of the high-pressure cylinder K. The piston valve continues to move to the left, and sweeps all the air out of the valve clearance spaces through discharge valve M. All this time the air will be compressed in the low-pressure cylinder, and the piston valve movement to the left opens port B, and establishes communication through valve D to space F, which leads to the intercooler. When the piston is to the extreme right, the piston valve will be moving in the same direction, and will continue to do so until it has cleared out the low-pressure valve clearance spaces.

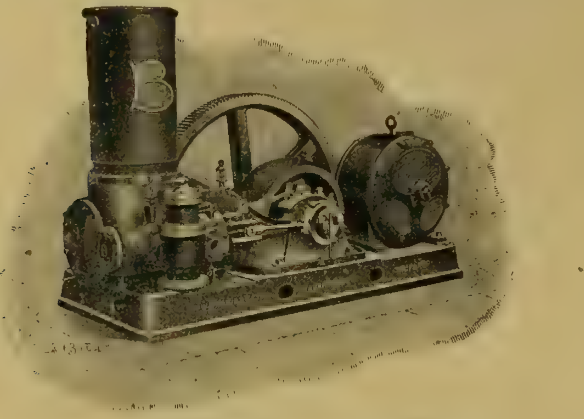
Fig. 16.—Two-stage Motor-driven Compressor.

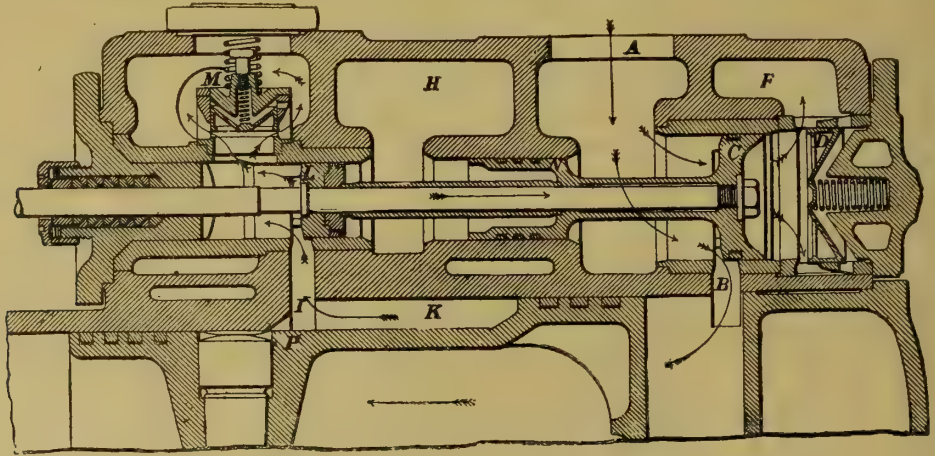

Fig. 17.—VALVE GEAR FOR TWO-STAGE MOTOR-DRIVEN COMPRESSOR.

As there are no valves in the cylinder head, and also since the valve clearances are mechanically cleared out by the piston valve, the clearance losses are the least possible.

It will be noticed that the discharge valves D and M are air cushioned, and are only loaded by very light springs; and as the seats are very narrow, the cylinder pressure is practically equal to that of the receiver at the instant of discharge. When discharge is complete, the piston valve shuts off communication between cylinder and receiver, and therefore chances of leakage spoiling the suction are absolutely avoided.

The automatic air regulator is very sensitive, and acts by closing the suction port. A turbo-compressor, driven by a steam turbine of the exhibitor's own make, can also be seen on this stand, which in addition contains a very interesting line of pneumatic tools, the most interesting of which is a drilling machine, in which double-acting cylinders are used; and a special riveter, in which, by a new type of valve, the blow is increased, but the overall size of the machine decreased.

The exhibition of gas engines is very disappointing. Germany, with all her reputation of having developed the large blast furnace, double-acting and two-cycle engines, is in no way represented, except by small Otto cycle producer plants. The only large gas engine to be seen is on the stand of Messrs. John Cockerill, of Seraing; it is for blast-furnace blowing, and is of 2,500 H.P. on producer gas; there are four power cylinders disposed in tandem on two cranks, the blowing cylinders being placed to the rear. In the German section, the Gas Motoren Fabrik of Cölu-Ehrenfeld have several "Schmidt" gas engines and producer plants; above 20 H.P. the engines are built with the water jacket in one with the bedplate, giving the minimum cylinder overhang and making the horizontal bearings rigid. It has not been found necessary to water cool the piston even at 100 H.P., but the exhaust pipe is jacketed. Governing is effected by a "Hartung" governor, and is by variable changes, the governor regulating the depression of the inlet valve. The producer plant is of wrought iron, the furnace having an internal boiler. The gas on leaving the furnace is passed through two coke scrubbers, and then through a sawdust drier. The Berlin-Anhaltische Maschinenbau have a number of gas-producer plants. Messrs. Diesel and Co., of Munich, exhibit three 5 H.P. oil engines. In the International Hall, Messrs. E. Hanappe and Co. exhibit a number of Hornsby-Stockport gas and oil engines; and in addition there are engines by Alphonse Roland, of Brussels; the Soc. Anon des Ateliers Oughena, of Ghent; Jules Mennig and Co., of Mons; and the Establishment Fétu-Défize, of Liége.

There are several firms exhibiting marine oil engines, including Messrs. Crossley, Blackstone, Daimler, Drakenburg, and Gordkoop. With the exception of the "Blackstone" engine, all these are for canal boats and other commercial vessels. The "Kromhout" engine, made by Messrs. Gordkoop, of Amsterdam, sold in England by Messrs. Perman and Co., and manufactured in this country by Messrs. Plenty, of Newbury, is shown in fig. 18. There were several engines up to 76 H.P. shown in the one and two cylinder types. The engines are very simple, having atmospheric inlet valves and very simple vaporisers, automatically heated. The oil (paraffin or gas oil) is injected by a separate pump on each cylinder, and can be adjusted by hand. Governing is by "hit and miss" in the exhaust valve, with a "pendulum" governor. The consumption of paraffin is about ·7 pint per horse-power hour. Starting is by petrol, and the change-over to paraffin is automatic and safe. The engine is fitted with a reversing gear. The construction is good, crankshaft bearings are ring oiled, and the lubrication of other parts is under a slight head. Water circulation around the cylinders is by a centrifugal pump. The levers connecting to the reverse gear and governor are carried up on deck, so that the man at the helm can have them under his immediate control.

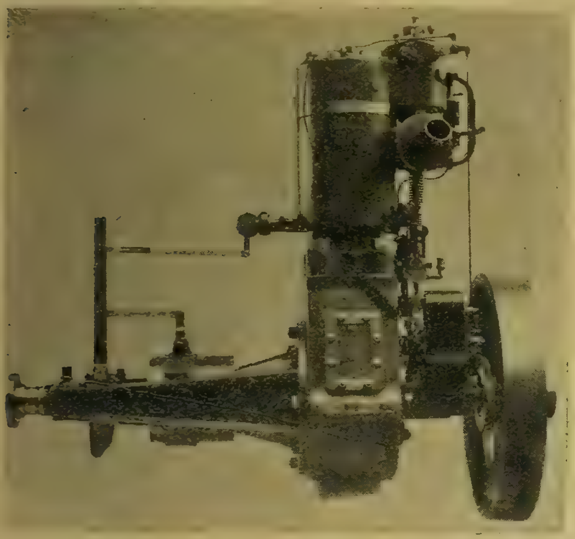
FIG. 18.—The "Kromhout" Engine.

Messrs. Bosch Magneto Company's exhibit in the German section may be mentioned in connection with the internal-combustion engines. A number of the standard rotary motor-car magnetos are shown, together with several of the oscillatory low-tension type for use on stationary engines. All the models are arranged to work, and in one case the difference between the spark obtained with and without a condenser is very forcibly shown. A very interesting machine of new type is arranged to ignite the charges of 1,000 H.P. four-cylinder stationary gas engines; it is fitted with a distributor, and is driven from the layshaft; a most important feature is that the timing of each cylinder can be adjusted independently of the other, thus allowing for any difference in the cylinders. A special magneto has been designed for flying machines; it is arranged for engines having six or eight cylinders, and is made, as far as possible, of aluminium; the total weight is 17 lbs.

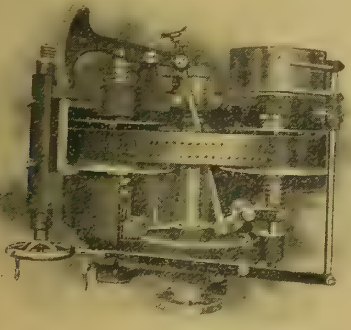
FIG. 19.—Variable Speed Gear for Lathe.

Machine tools find a numerous and varied exhibition; those of the British section have already been described. In the International and Industrial Halls are to be seen the metal-working tools of the firm of Bliss, of Paris; wood-working machinery in large variety by Panhard and Levassoir; a huge shearing machine by Ed. Delattre et Cie., Fevrière la Gland. This machine is designed to cut, cold, plates 10 ft. 6 in. long by $1\frac{5}{8}$ in. thick, it is fitted with a 20 H.P. to 25 H.P. electric motor, and makes four working strokes per minute; the weight is 145 tons. The largest tools in the Exhibition are on the stand of the Soc. An. de Constructions Mécaniques de Longdoz, of Liége; they include lathes, boring and planing machines, and tools. The best assortment of tools is made by Mr. Alfred Schutte, who is the Brussels agent for about 20 American firms, including Messrs. Landis, Prentice, Warner and Swasey, Gray, Shipley and Hendry, Potter and Johnson, Cleveland, Acme, Manville, Cincinnati, Bath, Gishold; each firm shows about two of their specialities. A semi-automatic pattern maker by the Pattern-making Machine Co., Glasgow, and a lathe by Messrs. Lang and Sons, Johnson, are also to be seen; with regard to the lathe, a description of the firm's patent variable-speed drive may be of interest. Referring to fig. 19, A and B are the fast and loose pulleys, which are driven direct from the main shaft. C is a belt connecting the shaft, on which fast pulley A is keyed with shaft D. The belt is made very thick, and drives entirely by its bevelled edges through cones seen in the illustration. The shaft D connects with main spindle E, either through single or treble reduction gearing. The cones F and G are stationary, while H and K are free to slide longitudinally, and are moved by levers M and N, the motion being given by means of a handwheel L. The levers are arranged so that as cone H moves towards F, cone K recedes from G. Thus the diameter of driving part of cones H F becomes larger, and that of driven part of cones H K becomes smaller; by turning handwheel L in opposite direction the operation is reversed.

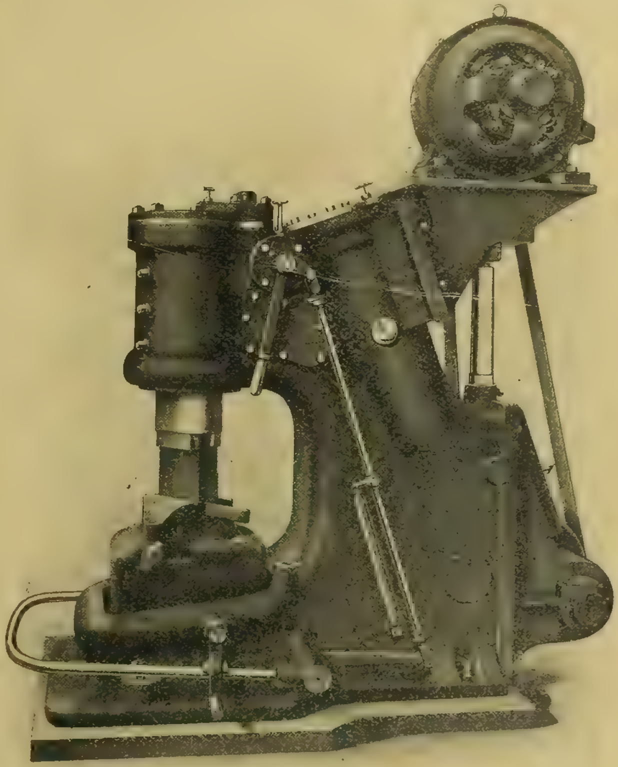
FIG. 20.—Pneumatic Hammer.

It will thus be seen that the speed of shaft on which A is keyed is constant, and that the main spindle speed can be varied gradually, a point of great importance when surfacing. The machine exhibited is for boring and surfacing, is of massive construction, and built to the makers' latest designs.

A number of other American machine and small tools are to be seen on the stands of Messrs. Brown and Sharpe, Pratt and Whitney, and Fenwick.

The first impression on entering the Machinery Hall of the German Section is that all is crowded far too closely together—if there was only one-half the number of tools, and those spaced out, the effect would be greatly enhanced. It would be impossible to give any detailed description of the exhibits; there seemed to be nothing new; all the tools were small, and the majority would be well known to British engineers through the stands of their agents at various recent exhibitions in England. The makers include Ludw. Löewe, Reinecker, Meyer and Schmidt, Braun and Bloem, L. Schuler, H. Pels, and many others. The exhibit of Messrs. Billetu and Klunz deserves special notice; this firm specialises in the manufacture of pneumatic hammers and open-sided planers. The hammer is shown in fig. 20, and it will be seen that it is exceedingly massive. It is motor driven, and the valve, by means of which the air can be regulated either by hand or foot in its passage from the power to the main cylinder, can be seen in the middle at the top. The open-sided planer, which is illustrated in fig. 21, through the kindness of Messrs. Schuchardt and Shutte, the London agents, is driven by means of a reversing electric motor. In order to withstand the severe strains consequent on its construction, the arm is very heavily built, and has a very large bearing surface on the pillar. The makers claim that work is more easily handled and set than in the usual double standard machine, and also, if necessary, by means of a special fixture, work up to double the table width can be planed. From an examination of these machines at work, all doubts of rigidity are dispelled.

Among the firms exhibiting wood-working machinery, the best known in this country is Messrs. Kirchener, of Leipzig-Sellerhausen, who have an extensive stand. It should be mentioned that all the German and nearly all the other machine tools in the Exhibition are shown at work.

Foundry appliances have not received great attention, but Messrs. Tketin and F. Thiriart, of Liége, show a cupola, blowers, and similar plant. M. Jules Munier, of Paris, has models of a blast furnace, pit-head gear; similar models are shown by Messrs. Ludwig, Stuckenholz, and the Beurather Machinenfabrik, who also combine with Messrs. Bechem and Keetman to exhibit a remarkable collection of models of cranes for all purposes, as for shipbuilding, harbour work, mining, etc. In this connection may be mentioned the many large overhead travelling electric cranes to be seen in the International Machinery Hall and in the German section.

The metallurgical exhibits of France have already been remarked on; and those of Germany, although not arranged to give the same striking effect, form a very fine collection. The largest stand of this kind is by Messrs. Henschel and Son, of Hattingen-Rube, and includes steel castings and machined forgings for large crank and propeller shafts, connecting rods, locomotive axles, and large chilled rolls. Messrs. Ernest Brockhaus and Co., and others, show large numbers of drop forgings for automobile work.

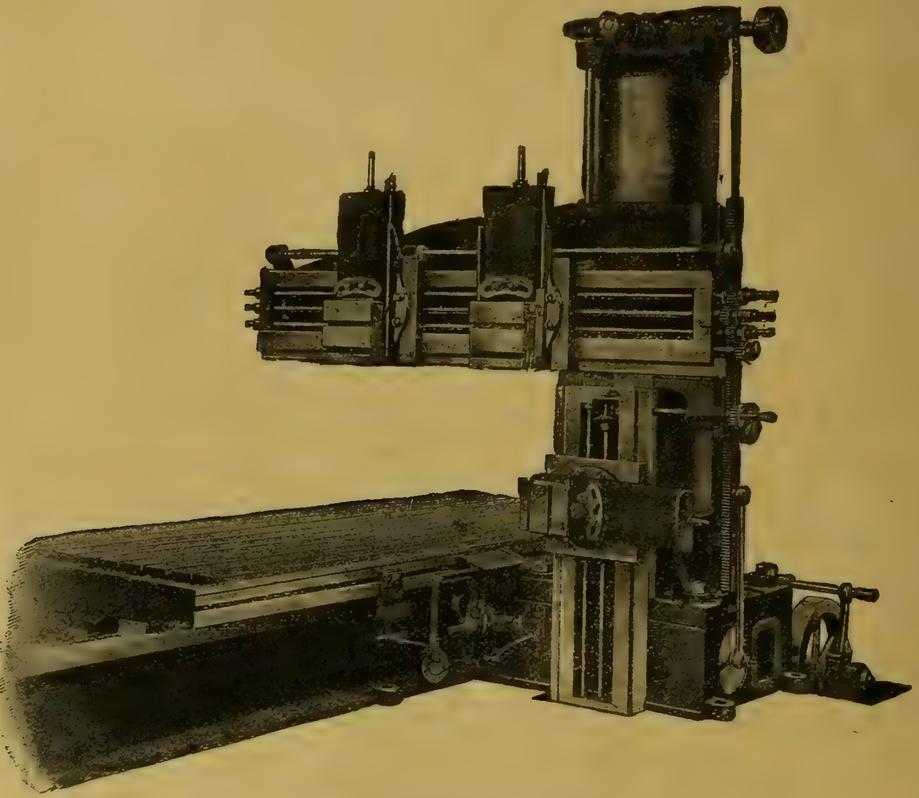

Fig. 21.—OPEN-SIDED PLANER.

(*To be continued.*)

A SUPPLEMENT to the *Canada Gazette* of 4th June contains the text of an Act incorporating the Canadian Northern Alberta Railway Co., and providing for Government aid in the construction of its railway from Edmonton, Alberta, to the Yellowhead Pass, British Columbia, with a branch line from Wolf Creek to the coal areas at the Brazean and McLeod Rivers. The gauge is 4 ft. 8½ in. The supplement also contains the text of an Act providing for advances by the Canadian Government to the Montreal Harbour Commissioners up to a total of 6,000,000 dols. (about £1,233,000) for the construction of the terminal facilities of the port.—*Board of Trade Journal.*

THE CUTTING PROPERTIES OF TOOL STEEL.*

By E. G. Herbert.

(Concluded from page 788.)

High-speed Steels—Effect of Cooling Process on Durability.

We have next to consider the results of some experiments which were made with a view to ascertaining how the durability of the high-speed steels is affected by the various methods of hardening commonly employed. The heat treatment of these steels was kindly undertaken by Mr. S. N. Brayshaw, who was largely responsible for the plan of the experiments.

The tools for the first series of these experiments were all cut from the same bar, ½ in. square, of a well-known brand of tungsten steel. The tools were all heated alike by being placed in the top chamber of Mr. Brayshaw's twin-chambered furnace at a temperature of 950 deg. Cen. They were left in this chamber for 2 minutes 30 seconds, at the end of which time they had attained a temperature of about 850 deg. Cen. They were then transferred to the bottom chamber at a temperature of about 1,275 deg. Cen. for 50 seconds exactly, and were subjected respectively to the following cooling processes:—

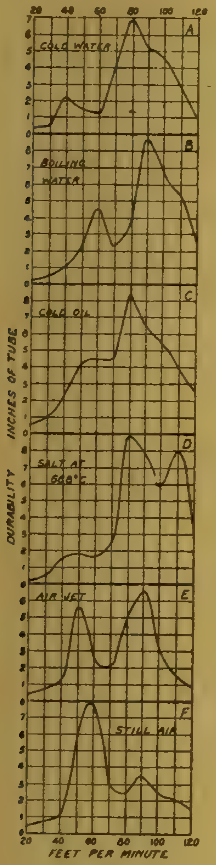

Fig. 20.

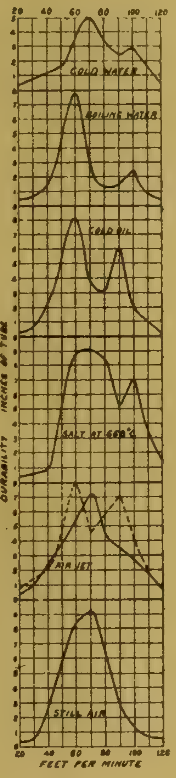

Fig. 22.

Tool A was stirred vigorously in cold water (11 deg. Cen.).
Tool B was stirred vigorously in boiling water.
Tool C was stirred vigorously in cold oil.
Tool D was plunged into fused salt at 668 deg. Cen.
Tool E was cooled in an air jet.
Tool F was placed in wire-netting, and allowing to cool in still air.

The tools were then tested, and the resulting speed curves are shown in fig. 20. These curves are placed as far as possible in the order of slowness of cooling, but the series is not in this respect a perfectly uniform one. Tool D was quenched in liquid salt at a high temperature; the cooling would therefore be extremely rapid down to this temperature, and this process is not strictly intermediate between the oil and the air jet. Again, it is not certain whether the oil or the air jet was the more rapid in action. Bearing these facts in mind, it will be seen that the curves, which are all of the double-peaked variety, display a fairly uniform and highly interesting series of changes.

Considering first curves A, B, E, and F, which are certainly in the correct order of cooling, we see that A has a small first peak and a much larger second peak. In B the first peak has considerably increased in size. In E the first peak has further increased, while the second has decreased. In F the first peak has enormously increased, while the second has almost disappeared.

In curve C the first peak has almost coalesced with the second It is difficult to determine the position of this curve in the order of cooling, since a tool quenched in oil is probably surrounded by an envelope of incandescent oil vapour for an appreciable time. A similar difficulty arises with regard to tool D. This curve has two features of special interest; the very low durability at all speeds below 70 ft., and the high durability at a comparatively wide range of high speeds. It is instructive to compare the behaviour of tools D and F at 60 ft. and at 110 ft. In view of such a complete reversal produced by a simple change in the manner of cooling, it is not difficult to account for the disappointing results which sometimes follow the substitution of a better or a more correctly hardened steel, when it is put to work under the same conditions which were found suitable for an inferior steel. Taking a general view of the results, one cannot fail to be impressed by the enormous influence exercised by the method of hardening on the cutting properties of the steel—an influence which is not merely quantitative in its effects, as hitherto supposed, but which may totally alter the characteristics of the steel. It would obviously be impossible to identify two samples of the same steel differently hardened. It is equally impossible to form an estimate of the quality of any steel by testing at any one speed, or even at a whole range of speeds, unless the hardening were known to have been such as to produce the best results. It also appears that the hardening process which gives the best results for rapid or heavy cutting is the least suitable for light work.

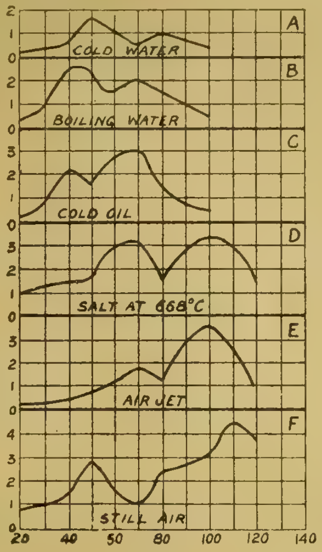

Fig. 21.

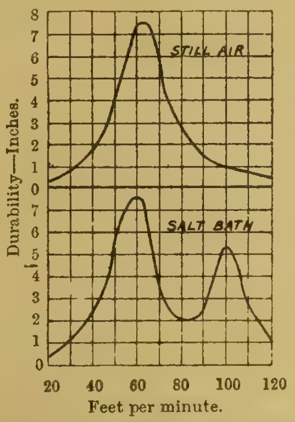

Fig. 23.—Tungsten-vanadium Steel Hardened at Low Temperature.

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* Abstract of a paper read before the Iron and Steel Institute, May, 1910.

These conclusions are confirmed by the next series of tests, made with tools cut from a bar ⅝ in. square, of a standard tungsten-vanadium steel. These tools were treated by Mr. Brayshaw in exactly the same manner as the preceding, except that they were allowed to remain in the top chamber of the furnace for only 1 minute 40 seconds, and in the bottom (high temperature) chamber for 40 seconds. The various cooling processes were exactly the same as before.

The tools when tested gave the curves in fig. 21, which are arranged in the same order as those in fig. 20. The most striking feature of these results is the very low durability of all the tools, as compared with that of the ordinary high-speed steel. This was not due to any defect in the quality of the steel, but to the fact that very little had been ground away in preparing the tools, so that the cutting edge came very near to the original surface of the bar. When this had been remedied by grinding well below the surface, the same tools gave the curves in fig. 22. A comparison of the two series of curves is instructive. It would be possible to name at least one engineering works where it has been the practice to use expensive high-speed steels in tool holders without forging, and without taking special care to remove the outer surface of the bar. The discontinuance of this practice dates from the production of the curves in figs. 21 and 22.

A comparison of the curves in fig. 22 with those in fig. 20 reveals a remarkable difference in the order of the changes which take place. The quickest cooling (in cold water), in the case of the vanadium steel, produces a relatively large first peak, and a small second peak exactly the reverse of what was found in the simple tungsten steel. With slower cooling both peaks increase in height, but retain much the same relation. The salt bath broadens the curve and throws the second peak to the right, and the slowest cooling produces only one peak.

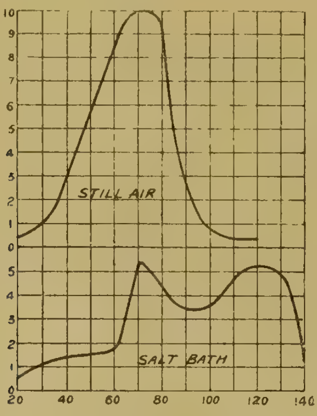


Fig. 24.

The tool cooled in the air jet gave two distinct curves. The single-peaked curve was first obtained, but, as the tool was ground away in repeated sharpening, it was noticed that the durability at some speeds was altering. A complete curve was therefore made from the opposite side of the tool, and this curve shown dotted, has two peaks.

The probable explanation of this is uneven cooling in the air jet, and a comparison with the curves above and below suggests that the double-peaked curve was given by the side of the tool on which the jet directly impinged. The cooling of the opposite side of the tool would be slower, the result being similar to that obtained by cooling in still air.

A somewhat similar phenomenon may be observed in the curves at the bottom of figs. 21 and 22. These curves were obtained from the same tool, but the outer surface, which came into direct contact with the air, gave a double peak, fig. 21. When this outer surface had been ground away, the single-peaked curve in fig. 22 was obtained.

A great deal remains to be done in the way of determining the relation between hardening temperature and durability in high-speed steels. A number of experiments have been made with a view to taking a preliminary survey of this field of inquiry, but no definite conclusions can yet be put forward. The experiments were made with the tungsten-vanadium steel, which gave the curves in figs. 21 and 22. Two methods of cooling were adopted—the bath of fused salt and still air. In figs. 23 and 24 are given examples of the resulting curves. Those in fig. 23 were obtained by heating to about 1,200 deg. Cen., and those in fig. 24 by using a temperature of about 1,275 deg. Cen., the tools being "soaked" at this temperature for three minutes. The chief interest of these curves lies in the very definite development of the second peak by the use of the salt bath. In fig. 23 the first peak remains practically unaltered in form and position, the maximum being at a speed of 60 ft. per minute in each case, but the salt bath cooling produces a perfectly distinct peak at 100 ft. Hardening at the higher temperature, fig. 24, the first peak occurs at the rather higher speed of 70 ft., and as before the salt bath develops the second peak, but in this case there is a great loss of durability at the lower speeds and a marked extension of the curve to the right.

Taking a general review of the results put forward, it is clear that the three classes of steel experimented with are all capable of producing either a single or a double-peaked curve. The second or high-speed peak is strongly developed in high-speed and carbon steels which have been quickly cooled. The first or low-speed peak is developed in high-speed steel by slow cooling, and in the case of carbon steel by tempering at a high temperature. The effect of tempering high-speed steels has not been determined.

A moderate rate of cooling, or in carbon steels a moderate tempering, produces a double-peaked curve, the steel having great durability at both low and high speeds, but very little durability at some intermediate speeds. The curve of the tungsten-vanadium steel differs essentially from that of the tungsten steel similarly treated; but whether this is generally characteristic of the two classes of steel, or peculiar to the particular brands used in the experiments, has not yet been determined. Salt bath hardening seems to be generally beneficial in the case of tools intended for high temperature cutting.

No plausible hypothesis can yet be offered in explanation of the peculiar changes in the durability of steels—indeed we have yet to determine what constitutes durability. It cannot be mere hardness, since there is no increase of hardness at increasing temperatures corresponding to the increasing durability shown by the rise of the left-hand portion of the speed curve. It seems more probable that this first increase of durability is due to a decrease of brittleness—a stronger coherence of the molecules as the temperature is raised. The decrease of durability shown by the descending portion of the curve may be due to an actual softening or tempering of the steel by the heat generated in cutting. The decrease of durability corresponding to the depression in the double-peaked curve can scarcely be due to a tempering process, since the steel could not in that case be expected to regain its durability at higher temperatures. This temporary loss of durability may, however, be due to an increase of brittleness occurring at certain temperatures.

If this can be established by means of breaking tests on hot specimens of steel which have been so treated as to give a double-peaked curve on the tool steel testing machine, it should not be difficult to establish a partial temperature scale corresponding to the testing machine scale of cutting speeds.

Nothing has been said about the relation between the speeds used in the tests and the corresponding speeds appropriate to any given set of actual working conditions. This relation cannot be established by direct application of the cube law, since this takes no account of the shape of the cutting tool and the hardness of the material operated upon.

In the absence of any means of measuring actual cutting temperatures, the relation can only be established by making a complete speed curve in the lathe under ordinary working conditions, and comparing this with the curve made from the same tool on the testing machine. By preference the tool chosen should be one which gives a double-peaked curve, since it would in that case be possible to correlate three distinct points on the curves, two maxima and a minimum. The author is not aware that a speed curve has ever been made on the lathe, and no doubt it would be a matter of some difficulty, but it is possible to hope that the attempt will be made by some institution having special equipment for this class of investigation.

LAUNCHES AND TRIAL TRIPS.

Ushla.—Messrs. John Cran and Co., shipbuilders and engineers, Leith, launched on the 7th ult., a twin screw steel tug for Russian owners. The dimensions of the vessel are as follows: Length, 75 ft.; breadth, 15 ft.; and depth, 7 ft. The machinery will be supplied by the builders.

Muratai.—This new twin-screw steamer left Messrs. Workman, Clark, and Co.'s finishing berth at the Milewater Basin on the 8th June to the Carrick Roads, where compasses were adjusted and speed trials run. These were highly satisfactory, and the vessel afterwards left for Barry and London to load preparatory to leaving for Australia. The Muratai is 486 ft. in length, with a gross tonnage of 7,300. She is fitted with an efficient installation of refrigerating machinery on the carbonic acid system. The propelling machinery consists of two sets of triple-expansion engines complete with all the necessary auxiliary appliances, and supplied with steam from four single-ended steel boilers working under forced draught.

Duchess of Richmond.—On Saturday, the 11th ult., Messrs. David and William Henderson and Co. Ltd., Partick, launched a paddle steamer, which they have constructed for the London and South-Western and London, Brighton, and South Coast Railway Co.'s for their Portsmouth and Isle of Wight traffic. The dimensions of the vessel are: 198 ft. by 26 ft. by 9 ft. moulded. The vessel will have compound diagonal engines with cylinders 27 in., and 51 in. diameter, by 54in. stroke, and one double-ended multitubular boiler working at a pressure of 130 lbs.

Lincluden.—The new steamer Lincluden left Sunderland on the 18th inst. for her official trial trip, having just been completed by Messrs. Joseph L. Thompson and Sons Ltd., of the North Sands Shipbuilding Yard, Sunderland, to the order of Messrs. The Lincluden Steamship Co. Ltd. (Messrs. Sivewright, Bacon, and Co., managers), of Manchester. The principal dimensions of the vessel are: Length, 367 ft.; breadth, 50 ft. 11 in.; and depth moulded, 27 ft. 4 in. The machinery has been constructed by Messrs. John Dickinson and Sons Ltd., of Sunderland, the sizes of the cylinders being 25 in., 41 in., 68 in., by 48 in. stroke, supplied with steam by three large boilers working at 180 lbs. pressure. The trial was most successful in every way, the machinery and auxiliaries running smoothly and giving every satisfaction, and a mean speed of about 11½ knots being easily attained.

Solent.—There was launched from the yard of Messrs. John Crown and Sons Ltd. on Tuesday, 21st June, a steel screw steamer, built for the coasting and general trade. The vessel is designed with self-trimming hatches to carry a dead weight of about 2,100 tons on a light draught of water. Engines will be fitted by the North-Eastern Marine Engineering Co. Ltd., of Sunderland. During construction the hull and machinery have been under the superintendence of Messrs. Thomas Boulton and Co., of Newcastle-on-Tyne.

Canadian Transport.—On Thursday, 23rd June, Sir Raylton Dixon and Co. Ltd. launched from their Cleveland Dockyard, Middlesbrough, the steel screw steamer Canadian Transport, being constructed to the order of the Empire Transport Co. Ltd., of London. The vessel will be classed 100 A1 at Lloyd's, her principle dimensions being 377 ft. 6 in. by 51 ft. 2 in. by 28 ft. 4½ in. moulded, and she will have a dead-weight carrying capacity of over 7,400 tons on a light draught of water.

Fridland.—On Thursday, 23rd June, Messrs. William Gray and Co. Ltd. launched the steel screw steamer Fridland, which they have built to the order of Messrs. Axel Brostrom and Son, Goteborg. She is built to the highest class in Lloyd's, and is of the following dimensions: Length overall, 415 ft.; breadth, 52 ft. 9 in.; and depth, 28 ft. 6 in.; and is specially designed for the owners' Swedish iron ore and general trade. The machinery consists of a first-class set of triple-expansion engines and boilers capable of developing over 1,800 H.P., cylinders 27½ in., 43 in., and 73 in. diameter, with a piston stroke of 48 in., and two large main boilers to work at a pressure of 180 lbs. per square inch under Howden's system of forced draught. Weir's pumps and feed heater and a number of "C.M.E.W." donkey pumps are fitted; also a bronze propeller and other specialities, all by the Central Marine Engine Works of the builders.

Joseph Chamberlain.—On Friday, 24th June, Messrs. William Gray and Co. Ltd. launched the steel screw steamer Joseph Chamberlain for Messrs. J. and R. O. Sanderson and Co., of West Hartlepool and Cardiff. She will take the highest class in Lloyd's Register, and is of the following dimensions: Length overall, 361 ft. 6 in.; breadth, 50 ft.; and depth, 25 ft. 11 in.; with long bridge, poop, and topgallant forcastle. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders having cylinders 25 in., 40½ in., and 67 in. diameter, with a piston stroke of 45 in., and two large steel boilers for a working pressure of 180 lbs. per square inch.

Malaespera.—On Friday, 24th June, the patent cantilever framed steamer Malaespera, built by Sir Raylton Dixon and Co. Limited at their Cleveland Dockyard, Middlesbrough, to the order of Messrs. Ocharan and Aburto, of Bilbao, proceeded to sea for her official trials, the principle dimensions being 298 ft. by 44 ft. by 22 ft. 6 in. moulded, and she has a dead-weight carrying capacity of about 4,000 tons on a light draught of water. Triple-expansion engines, having cylinders 22 in., 36 in., and 59 in., by 39 in. stroke, supplied with steam by two large single-ended boilers working at 180 lbs. pressure, have been fitted by Messrs. Blair and Co. Ltd., of Stockton-on-Tees. The trials passed off most successfully, and the vessel proceeded to the Tyne to load a cargo of coal for St. Nazaire.

Bampton.—On Thursday, 23rd June, Messrs. Richardson, Duck, and Co. launched from their yard a steel screw steamer of the following dimensions: Length overall, 393 ft. 6 in.; breadth extreme, 50 ft.; depth moulded, 28 ft. 11 in.; with a dead-weight carrying capacity of 7,500 tons. This vessel, which has been built to the order of the Tatem Steam Navigation Co. Ltd., of Cardiff, will take highest class in British Corporation Registry, and has been built under special survey. The engines, by Messrs. Blair and Co. Ltd., have cylinders 25 in., 42 in., and 68 in., by 45 in. stroke, steam being supplied by two extra large single-ended boilers having a working pressure of 180 lbs., and fitted with Howden's forced draught.

Bogstad.—On Friday, 24th June, Messrs. Osbourne, Graham, and Co. launched from their yard at Hylton, Sunderland, the steel screw steamer Bogstad, which they have specially constructed for Messrs. Fearnley and Eger, of Christiania, being the third vessel they have built for this firm. The vessel carried 2,800 tons on a shallow draught, and is equipped with the most modern appliances for economical and quick working of cargo. She has been constructed under special rules to Norske Veritas Survey, and also fulfils the requirements of the Sjofartskontaret Rules. Engines and boilers will be supplied by Messrs. Geo. Clark Ltd., of Sunderland, and are capable of driving the vessel a speed of 9½ knots, loaded.

TRADE CATALOGUES.

We have received from **Messrs. The Electric and Ordnance Accessories Co. Ltd.,** Aston, Birmingham, a copy of their current catalogue F86 dealing with small ventilating fans. The fans are of substantial make, and the designs suited to the various purposes for which they are required. The makers claim for the 12 in. universal D.C. fan (page 3) it can be run for 10 hours at a cost of less than 1½d., with current at 3d. per unit. The majority of the fans can be run on the ordinary lighting circuit.

Messrs. Ruston, Procter, and Co. Ltd., of Lincoln, have sent us two sections of their catalogue which they have recently issued—section E and section H. There are 24 pages in section E showing various classes of their compound steam engines (condensing and non-condensing). Condensers, feed-water heaters, and accessories are also included. Section E comprises 48 pages and deals with steam navvies. These are very well shown by numerous half tones which are accompanied with descriptions and specifications of the various types.

A copy of a new machine tool catalogue is to hand from **Messrs. Perkin and Co. Ltd.,** Leeds. It contains particulars and illustrations of a numerous and varied collection of useful tools, with prices of same, and should be of interest to the trade and buyers generally.

We have received an illustrated pamphlet of the "Pillow" flexible coupling as manufactured by **Messrs. C. E. Lugard and Co.,** magnetic clutch makers, Chester. This list gives 17 standard sizes, ranging from ·007 to 7·610 H.P. per revolution per minute.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 23rd June, 1910.

Cardiff.—*First class:* C. Orchard, T. R. Jenkins, V. O. Lawson. *Second class:* W. J. Bowen, I. Brimer, H. P. Brown, J. G. Peters, E. Phillips, D. N. Price, A. R. Stephenson, R. S. Wood.

Cork.—*First class:* J. C. Murphy.

Glasgow.—*First class:* W. Steven, R. Buchan, G. W. Watt, J. Jackson, J. H. Macaulay, P. G. McMillan, M. H. Lofthouse. *Second class:* M. S. Davis, G. Irvine, A. M. Meil, G. C. McNaught, J. Robertson, H. W. Spottiswood, T. Wallet.

Leith.—*Second class:* M. Robb.

Liverpool.—*First class:* R. L. Williams, J. A. Taylor, W. H. Blood, H. Winstanley. *Second class:* H. E. Baile, J. McEwan, J. J. Gibson, T. N. Hendry, W. H. Savage, C. Tregenza.

London.—*First class:* E. T. Rutherford, C. Thomson, J. C. Sparling.

North Shields.—*First class:* J. J. Sparkes, T. J. Thubrun, W. Thomson, A. T. Straker, W. Booth, M. Walker, J. W. Thomson. *Second class:* R. D. R. Morley, E. D. S. Pope.

Plymouth.—*First class:* W. J. Liddicoat.

Southampton.—*Second class:* C. Fishers, A. Turner, E. H. Wallis.

West Hartlepool.—*First class:* J. Cransfield, J. W. Ronchetti. *Second class:* A. P. Mallaby, C. McKinlay.

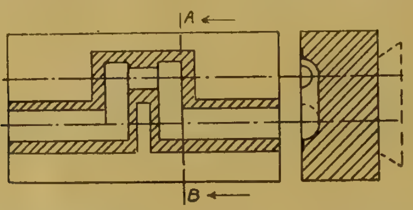
QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2256. **Drop-forging a Motor Crank Shaft.**—Can any reader of *The Practical Engineer* give me full details as to how to drop-forge a motor crank shaft?—Burma.

Answer.—Possibly the most important item to consider is the nature of the steel which the die must be made from, as upon this depends the life of the die. A steel containing about ·6 per cent carbon will probably be most effective for the die in question. This steel is fairly easy to work, and is sufficiently tough to render hardening unnecessary, thus obviating the necessity of carrying out a process which often results in the dies being made defective, as the hardening of a die requires experience. The querist will obtain much excellent information as a result of his own experience as to contraction allowances, as no hard and fast rule can be laid down. In the sketch a die for a single throw shaft is shown. The part sectioned lined denotes the "fin" allowance, *i.e.*, space for the residue metal, and should be roughly ·05 deep in each block, and extending about an inch from the edge of shaft profile. Both dies (top and bottom) are identical. The first process would be to place the blocks top and bottom, cutting the dovetail as shown, if blocks are to be held in the usual manner. The figure of shaft is then marked out and templates made for the die sinker. The templates necessary for the job would soon be discovered by the operator. The milling of the "fin" allowance should obviously be left until after the die sinker has finished, as this would interfere with the proper application of the templates.



For a multiple crank shaft an extension of the die shown in the sketch could be made, all the cranks being in one plane in the die and set to the desired angle afterwards. In the actual forging, the material must first be forged roughly to the shape of the die, care being taken to allow sufficient metal to completely fill the die. In this case, round bar forged to elliptical section with the major axis perpendicular is the best manner to commence operations. This ensures the rough forging dropping well into the die. If, after the first blows, the blocks do not meet, too much metal has been allowed, and the "fin" must be chipped off and operations commenced again. With a little experience the necessity for repeated operations will be avoided.—Engineer.

2264. **Thermometer for Superheated Steam.**—Will any kind reader of your valuable paper let me know through your notes the best and most serviceable thermometer for testing superheated steam. Boiler pressure 160, and superheat 100. I have tried two, such as Greens, of Wakefield, use on their economisers, but I find they are of no use, owing to the mercury splitting up.—W. J. (Batley).

Answer No. 1.—Since 100 deg. superheat is apparently only an approximation, perhaps there is sufficient superheating in W. J.'s thermometer to cause vaporisation. Doubtless better results would be obtained by trying one of the various resistance thermometers or pyrometers. The platinum resistance thermometer (consisting of a spiral coil of fine platinum wire, wound upon a mica frame, and protected by a tube of glass, porcelain, or steel, the electric resistance of the platinum wire varying with the temperature to which it is subjected) would probably be suitable. A recorder or indicator would be required.

W. J. could have his thermometer, or several thermometers, in places where it would be impossible to read a mercurial thermometer, such as flues, furnaces, or pipes, only one indicator being required, as he could by means of a switchboard have any thermometer in connection with indicator.

He could also have a recorder to produce on squared paper, a temperature chart, a clockwork arrangement completing a chart in 24 hours, and showing all the variations of temperature during that time.—Fitter.

Answer No. 2.—In reply to above, would recommend the use of a hydrogen-filled tube as being necessary for testing superheated steam instead of with mercury.—C. A. C., London.

TO CORRESPONDENTS.

J. H.—We do not think such appointments are easily obtainable. You had better make your application direct to the Civil Service Commissioners, Parliament Street, Westminster, S.W.

MISCELLANEA.

The Cost of Producing Coal.—Nos. 8, 9, and 10 of the "Coal Trade Pamphlets," issued by *The Colliery Guardian*, have been bound together, forming a most convenient and instructive booklet, showing the cost of the various departments and the causes that affect prices. It is a valuable threepennyworth.

British Shipping.—The British Shipping Register, just issued for the past month, shows that there were 88,000 tons of new steamers added to the registers of the United Kingdom in May. There were removed from the registers by loss, sale, etc., about 58,900 tons of steam shipping, and the net loss of sailing vessels was 10,000 tons, so that there was of steam and sailing vessels a gain in the month of about 19,000 tons. The new steamers registered last month included 27 of less than 200 tons each, and 17 of above 3,000 tons each. Fourteen of the steamers removed were broken up.

Clydebank Shipyard Extensions.—At Clydebank Dean of Guild Court on June 21st plans were presented by Messrs. John Brown and Co., shipbuilders, for the erection of a boat shed in their yard. At the previous court day objections were raised by the Clyde Navigation Trustees on the ground that the structure would encroach on their territory at Rothesay Dock. Since then an amicable arrangement has been arrived at, and the plans were passed. The new building will be an important addition to the firm's equipment, and is extended to facilitate the construction of smaller vessels. Messrs. Brown also received permission to make an addition to the new offices now being constructed at the main entrance to the yard.

High Power Water Turbine.—Up to a short time ago Norway held the world's record for the most powerful turbines—those at Rjukananlagget. These machines are of 14,450 B.H.P. each, the power being attained by two runner wheels, each developing 7,225 B.H.P. These figures have now been largely exceeded, inasmuch as Messrs. Escher, Wyss, and Co., the Swiss turbine builders, have turned out from their works at Zürich three Pelton turbines for Necaxa, South America, the output of which will be of 16,000 B.H.P., each under normal head and about 18,000 B.H.P. under overload. This power is obtained by a sole runner wheel fitted with Escher-Wyss patent buckets and mounted on a vertical shaft. The diameter of action of the runner is 8 ft. 8 in. The wheel is driven by four jets of water under a head varying from 1,280 ft. to 1,345 ft. The speed attains 300 revolutions per minute. Each turbine is fed by an individual pipe line of 2,500 ft. length and 3 ft. 8 in. to 4 ft. diameter.

Reinforced Brickwork.—An interesting series of experiments were recently carried out before a numerous company of local builders and architects at the stoneyard of Mr. Alexander Pringle, Newcastle-on-Tyne, and tests witnessed of brickwork reinforced by means of a wire mesh embedded in the mortar joints, thus forming a continuous bond. The action of the wire mesh when resisting tensional stresses is to reduce the sectional area, which in turn tends to close the meshes of the wire and so compresses the mortar locked therein. Walls reinforced with wire mesh gain, it is claimed, immensely in strength, and that a 9 in. wall constructed on this system is stronger than an ordinary 14 in. wall. For small cost building can thus be secured against cracks and bulging, faulty foundation, and badly distributed and uncertain loads. The tests were carried out on a hollow storm wall with a cantilever built a month ago. The distance between the piers of a 9in. wall was 10 ft., and the length of the cantilever portion 5 ft., the height 3 ft., and it was about 3 ft. from the ground. On the cantilever 4 tons 8 cwt. of pig iron was placed by degrees, and when the wall at length gave way under the weight the end broke off in a piece, only a small portion of the pillar being dislodged. It was thus shown that with the wire mesh in each course of bricks the cantilever was able to bear a very heavy weight, and that the masonry itself was bound solidly together. The cantilever broke suddenly without showing any tendency to crack or deflect.

PATENTEES' CHRONICLE
OF
Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

JUNE 20th, 1910.

14768 Gas producer. Stainer.
14769 Tobacco cartridge. Garsed.
14770 Hoes. Moon.
14771 Air purifier. Samuelson.
14772 Hat box. Whitelock.
14773 Electric current control. Taylor.
14774 Internal-combustion turbine. Bentwood.
14775 Electric battery. Somers.
14776 Manifold writing. Bailey.
14777 Cycle pumps. Tong.
14778 Mechanism for pianoforte action. Yarrow.
14779 Yarn printing, etc. Knecht.
14780 Men's suit hanger. Godham.
14781 Cycle seat. Nunn.
14782 Game. Spinks.
14783 Rotary engine. Butt.
14784 Horn blowing device. Elias.
14785 *Rotary sprinkler. Leigh.
14786 Chimney pot. Boulton.
14787 Delivering sheets from printing machines. Helliwell.
14788 *Soldering metal tubes. Bruckwilder.
14789 *Cycle fork head manf. Bruckwilder.
14790 *Cycle crank manf. Bruckwilder.
14791 *Mine props. Pittroff.
14792 Door safety device. Schruff.
14793 Railway couplings. Marks.
14794 Aeroplane engines. Lewis.
14795 Wheels. Clarkson.
14796 *Rubber tyres. Cann.
14797 Extracting latex from rubber trees. Schneider.
14798 *Cycle stand. Schneider.
14799 *Non-refillable bottle. Willert.
14800 *Ozone generator. Douzal.
14801 *Hose coupling. Lancaster.
14802 *Feeding device for liquids. Rosenstock.
14803 *Controlling driving shaft. Plant.
14804 Securing capsules on bottles. Smith.
14805 *Lathe tool. Greatorex.
14806 Moulding boxes. Plötz.
14807 Three-way valve. Simon.
14808 Chimney cleaning. Pace.
14809 Money box. Tucker.
14810 Signalling device. Lilley.
14811 *Petrol vapour burner. Johansen.
14812 Water gauge glass. Manson.
14813 *Wearing apparel. Goldstein.
14814 *Reinforced concrete posts, etc. Grahn.
14815 Internal-combustion engine. Nicholson.
14816 Optical illusions. Boult.
14817 *Dough cutters. Leibenguth.
14818 *Line casting machine. Degener.
14819 Collapsible lasts. Creese.
14820 Typewriter cover. Boult.
14821 Amusement. Taylor.
14822 Finger rings. Aller.
14823 *Roasting furnaces. Ettlinger.
14824 Hay making machine. Bamford.
14825 Gas globe holder. Rawlings.
14826 Cultivators. Fowler.
14827 *Solders. Daudelin.
14828 Exhausters, etc. Lamplough.
14829 Steam pipe. Skipworth.
14830 Manf. of isoprene. Perkin.
14831 Potato digger. Bamford.
14832 Brake. Pook.
14833 Motor driven vehicles. Magarey.
14834 Tennis racquet press. Altman.
14835 *Rotary engine. Edwards.
14836 *Rotary engine. Birrell.
14837 *Pneumatic tyres. Doherty.
14838 *Rotary printing machine. Asmussen.
14839 *Pipes. Bradley.
14840 Box fastening. Moore.
14841 *Carburetters. Mack.
14842 *Emptying superphosphate chambers. Malmsten.
14843 *Securing carpets, etc. Doyle.
14844 *Soap manf. Cassel.
14845 Bag fastenings. Helling.
14846 Aeroplane. Sauber.
14847 Pen fasteners, etc. Widmer.
14848 Buttons, etc. Critchley.
14849 Pneumatic tyre. Connell.
14850 *Cigar lighter. Hofmann.
14851 *Electric motors. Adams.
14852 *Memorandum tablets. Rosen.
14853 *Velocipedes. Hallyer.
14854 Table forks. Alabaster.
14855 *Looms. Bosset.
14856 Delivering postage stamps, etc. Fawns.
14857 *Electric apparatus. Podszus.
14858 Drawing liquid from vessels. Berry.
14859 *Electric welding. Presser.
14860 Map, etc. Norbery.
14861 *Tannic acid production, etc.
14862 *Dynamo.
14863 *Dynamo.
14864 *Metal cutting, etc., burner. Knapp.
14865 Fluid pressure turbine. Boad.
14866 Advertising device. Kipping.
14867 Gun damping apparatus. Hecht.
14868 Flying machine. Windham.
14869 *Tinder box, etc. Koch.

JUNE 21st, 1910.

14870 Mops, etc. Lester.
14871 Device used in spiritual intercourse. Braham.
14872 Envelope. Hey.
14873 Rope grip. Robinson.
14874 Milk cans. Riley.
14875 Siren. Hooper.
14876 Oil burner. Grier.
14877 Potato digger. Wilson.
14878 Boot, etc., protector. Turner.
14879 Tyre. Smith.
14880 *Feeler or protector mechanism. Butterfield.
14881 Indicating board. Reynish.
14882 Housemaid's bucket. Yeldham.
14883 *Bedstead. Evans.
14884 Music stool. Ingram.
14885 Fruit packing case. Le Couteur.
14886 Gear cutters. Perrot.
14887 Gear cutters. Wiesengrund.
14888 Spinning machines. Cuttill.
14889 Galvanic batteries. Richmond.
14890 Lubricators. Atkinson.
14891 Cement manf. Wilson.
14892 Cement manf. Wilson.
14893 Heating public buildings. Wilson
14894 Tobacco pipe. Brownlow.
14895 Suspenders, etc. McGregor.
14896 *Water closet disinfecting valve. Kneen.
14897 *Hydraulic apparatus. Don-Delattre.
14898 Liquid delivering device. Jackson
14899 Percussion fuses. Hoyle.
14900 Curtain peg. Fabian.
14901 Tins, etc. Waller.
14902 Pipe joints. Joseph.
14903 *Stereotypes, etc. Mills.
14904 *Time checking device. Strandberg
14905 Blasting cartridge. Smith.
14906 Sunshades, etc. Round.
14907 *Drill attachments. Boozer.
14908 *Nut locks. Dyrssen.
14909 *Envelopes. Griffin.
14910 Internal-combustion engine. Currin.
14911 Writing table. Abbott.
14912 Electric heating device. Wilkinson.
14913 *Suspending device. Austin.
14914 *Railway car wheels. McLannen.
14915 *Bed springs. Roberts.
14916 Telephone system. Conner.
14917 Boiler furnace regulators. Coles.
14918 Electric oscillating system. Wilson.
14919 Boring tool. Emery.
14920 Mudguard, etc. Shrapnel.
14921 *Pavements. Jennison.
14922 *Toys. Lemon.
14923 *Bottling mechanism. Pindstofte.
14924 Bell push. Jones.
14925 *Measuring instrument. Hartman.
14926 *Colour determining device. Lovibond.
14927 *Engine speed controlling gear. Shaw.
14928 *Jet condensers.
14929 Photographing device. Hart.
14930 Chimney cowls. Andrew.
14931 Internal-combustion turbo-motor Hutchings.
14932 Curtain brackets. James.
14933 *Explosion engine. Frager.
14934 *Explosion motor. Frager.
14935 *Machine tool. Sellier.
14936 *Hame line rings. Hanlon.
14937 *Rolling staircase. Hocquart.
14938 *Hydraulic jacks. Olvis.
14939 *Curtain fastenings. Dötsch.
14940 *Aluminium alloy. Smart.
14941 *Trays, etc. Marks.
14942 *Soap manf. Cassel.
14943 *Weighing machine. Hillmer.
14944 *Detonator cap attachments. Smith.
14945 Adding machine. Fiennes.
14946 *Electric motor control. Adams.
14947 *Rock drill. Lake.
14948 *Cellulose esters. Walker.
14949 *Railway carriage couplings. Berglund.
14950 *Gas lamps. Pintsch.
14951 *Adjustable chaplet. Wells.
14952 *Inclined elevator, etc. Benrather.
14953 Fumigator. Deakins.
14954 Reversible tie. Holmann.
14955 Steel manf. Beardmore.
14956 *Electric motor control. Adams.

14957 *Roasting furnace. Edwards.
14958 Shelter for invalids. Steel.
14959 *Galvanising, etc., machines. Oliver.
14960 Furniture castors. Jones.
14961 *Insulating device. Meirowsky.
14962 Frame dyeing, etc. Stevens.
14963 Sodium-hydrogen sulphide manf. Rule.
14964 Extracting water from washed goods, etc. Greenhill.
14965 Harvesting machine. Demtschinsky.
14966 Shackle. Ellis.

JUNE 22nd, 1910.

14967 Cleaning apparatus. Trantom.
14968 Cycle tyres. Hardy.
14969 Garden hose. Purser.
14970 Colouration of metals. Longford.
14971 Motor screen. Birchley.
14972 Loading, etc., device. Sutcliffe.
14973 Cycle luggage carrier. Ashby.
14974 Incubators. Lawrence.
14975 Foster-mother. Ashworth.
14976 Building blocks. Sellar.
14977 Tobacco pipe. Todd.
14978 *Suction dredgers. Lobnitz.
14979 Flying machine. Baglin.
14980 Sewing machine. Bell.
14981 Fire brick manf. Mankau.
14982 Letter sealing. Pritt.
14983 Sausage filling machine. Dare.
14984 Cricket bat handles. Breeden.
14985 Electric bell push. Laxton.
14986 Reducing tool. Blacker.
14987 Free wheels. Allen.
14988 Spinning machine. Boydell.
14989 Polishing powder, etc. Helliwell.
14990 Games. Stewart.
14991 Racks for hat bodies. Goodall.
14992 Game. Baldwin.
14993 Vacuum tight seals. Sand.
14994 Typewriter fitting. Yelf.
14995 Aerated beverages. Chambers.
14996 Clothes rack. Allen.
14997 Blackboard. Holiday.
14998 Candlestick. Emanuel.
14999 Cigar box stand. Gill.
15000 *Pneumatic tyres. Gareley.
15001 Pocket knives. Priestman.
15002 Cigar case. Fray.
15003 Bevel gear wheels. Smith.
15004 Pocket electric lamp. Thornton.
15005 Game. Stewart.
15006 Cycle brake. Hemsley.
15007 Water closet. Lambert.
15008 Pipe filler. Mackenzie.
15009 Cycle toe clip. Barnett.
15010 Tool bag, etc. Barnett.
15011 Carrier. Barnett.
15012 *Game. Meader.
15013 Check valve union. Craddock.
15014 *Motors. Biber.
15015 Wood clamp. Bolle.
15016 Protractor. Friebel.
15017 Tobacco case. Detmold.
15018 *Electric arc lamp. Nebel.
15019 Shoes, etc. Hirst.
15020 Thread waxing. Boult.
15021 Window sash fastener. Evans.
15022 *Moulding machine. Harrison.
15023 Keep net. Dibben.
15024 *Match holder. De Kempeneer.
15025 Tyres. Donkin.
15026 Steam boiler. Feeny.
15027 Electric lamp. McLean.
15028 Targets. Walker.
15029 Wind screen. Burton.
15030 *Hydraulic machine. Bohn.
15031 *Electric welding. Pursser.
15032 *Electric welding. Pursser.
15033 *Electric welding. Pursser.
15034 Purifying flue gases. Koenigs.
15035 Ordnance loading. Hooloossy.
15036 Ammonium sulphate manf. Brougham.
15037 *Electric switch. Sweetser.
15038 *Railway crossings. Dickson.
15039 *Rolls for staking machines. Steinharter.
15040 Sealing tin cans. Waller.
15041 Pipe couplings. France.
15042 *Type casting machine. Stempel.
15043 Towing blocks. Fletcher.
15044 *Safety razor. Gaisinan.
15045 Safety dock for aerial craft. Zobel.
15046 Toys. Barrington.
15047 Fire alarm.
15048 Aeroplanes. Neale.
15049 Aeroplanes. Neale.
15050 *Magazine dark slides. Goerz.
15051 *Acetylene generator. Harris.
15052 Fire screen. Menzies.
15053 Elevating gear for ordnance. Dawson
15054 Pneumatic wheels. Richter.
15055 *Sash windows. Philip.
15056 Shoe trees, etc. Boult.
15057 *Internal-combustion engine. Dion-Boulton.
15058 Valves. Ransom.
15059 Weight determining device. Yorke.
15060 Motor cars. Davenport.
15061 *Nut locks. Skelton.
15062 *Bending plates. Upham.
15063 *Venier presses. Aeschlimaven.
15064 Aeroplanes. Neale.

JUNE 23rd, 1910.

15065 Lock nut. Tabot.
15066 Boats. Cleives.
15067 Ladies' skirts, etc. Humphreys.
15068 Dye manf. Levinstein.
15069 Dye manf. Levinstein.
15070 Dye manf. Levinstein.
15071 Cloth stretchers. Mason.
15072 *Excavating machinery. Grossmith.
15073 *Excavating machinery. Grossmith.
15074 Hatpin. Rudham.
15075 Bacon holder. Harvey.
15076 *Cleaning device. Spencer.
15077 Lawn tennis racquets. Wallis.
15078 Perambulator lock. Wallis.
15079 Curtain hanging. Timmis.
15080 Brooms. Jameson.
15081 Gas lamp burner. Helps.
15082 Motor cycle stand. Cooper.
15083 Sugar basins. Pascall.
15084 Extinguishers. Oxley.
15085 Tins, etc. Coventry.
15086 Arc lamp. Ridings.
15087 Cycle tyres. Pickup.
15088 Motor cycle driving mechanisim. Cave.
15089 Bottle. Phillips.
15090 Rammer for ordnance. Bacon.
15091 Lifting, etc., projectiles. Bacon.
15092 Baby carrier. Allum.
15093 Recoilless gun. Whiting.
15094 Motor car tyres. Terry.
15095 Garment fasteners. Skremka.
15096 Chimney pot. Bromley.
15097 Filling, etc., angular junctions. Goodwin.
15098 Furze igniting device. Hart.
15099 Coaling ships. Reid.
15100 Advertising device. Taylor.
15101 Calculator. Cox.
15102 *Submarine signalling. Bowlker.
15103 *Tuning pins. Dominguez.
15104 *Rotary engine. Herrick.
15105 *Rotary engine. Herrick.
15106 *Rotary engine. Herrick.
15107 *Steam engine. Kerchove.
15108 Hydraulic jacks. Lucas.
15109 *Cameras. Placzck.
15110 *Trapping insects. Wolf.
15111 *Water discharging device. Bartholomew.
15112 Lids for cans, etc. Edmund.
15113 Electric light holder. Mays.
15114 Advertising board. Frazer.
15115 *Aeroplane. Hayes.
15116 *Cooking ranges. Warchalowski.
15117 *Cooking vessel lids. Warchalowski.
15118 Tyres. Rees.
15119 Polishing appliances. Dickson.
15120 *Fluid pressure motor. Sundh.
15121 *Variable speed gear. Sundh.
15122 Cigar, etc., holders. Ashton.
15123 *Telegraphic transmitter. Potts.
15124 Steam generator. French.
15125 Sulphuric acid manf. Diehl.
15126 *Dress support, etc. Sander.
15127 *Typographic machine. Derriey.
15128 *Clockwork. Moritz.
15129 *Loose leaf binder.
15130 Ladies' hat securing device. Barnett.
15131 *Tobacco pipe. Knochenhauer.
15132 *Envelope sealing. Boult.
15133 Multiple cylinder engines. Redrup.
15134 Internal-combustion engine. Redrup.
15135 Fluid pressure engine. Redrup.
15136 Internal-combustion motor. Redrup.
15137 Internal-combustion engine. Redrup.
15138 Engine parts. Redrup.
15139 *Electric furnaces. Hering.
15140 *Wired glass manf. Hermann.
15141 Buffers of indiarubber. Gray.
15142 Files. Boult.
15143 *Arc lamps. Klostermann.
15144 *Line casting machine. Deginer.
15145 *Mechanical tillage. Meyenburg.
15146 Exhibition devices. Newmann.
15147 *Chalk line reels. Whitmore.
15148 *Cigar wrapper. Thorbecke.
15149 *Scissors. Brooke.
15150 *Electrical contact device. Engel.
15151 *Cement railway ties. Will.
15152 Photo printing frames. Curtis.
15153 *File manf. Bêché.
15154 Fountain pens, etc. Duffy.
15155 Alcohol collecting device. Lunt.
15156 *Street sweepers. Thompson.
15157 *Brooders. James.
15158 *Horse shoe. Frey.
15159 *Motor car steering wheel. Heilmann.
15160 Disinfectants. Maw.
15161 *Baling press. Cummins.
15162 Explosion engines. Mort.
15163 *Football case manf. Turner.
15164 *Electric furnaces. Thomson..
15165 *Electric furnaces. Thomson.
15166 *Electric furnaces. Fitzgerald.
15167 *Electric furnaces. Thomson.
15168 *Electric furnaces. Thomson.
15169 *Electric furnaces. Thomson.
15170 Electric meter. North.
15171 *Typographical composing machines. Walker.
15172 Petrol can spout. Cox.
15173 Steel manf. Richardson.
15174 Steel manf. Richardson.
15175 *Railway signalling. Grape.
15176 *Bottle labelling machine. Faye.
15177 Moustache guard. Griner.
15178 *Winding device for paper.
15179 *Ticket printing.
15180 *Electric lamp. Kruger.
15181 Steam superheater. Proudhon.
15182 Carburetter. Alexander.
15183 Loose leaf binder. Wale.

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15184 Book cases. Munn.
15185 Folding cots. Tidman.
15186 Garden furniture. Berry.
15187 Skin disease remedy. Twigg.
15188 Folding seats. Moon.
15189 Fasteners for garments, etc. Young.
15190 Shuttle. Hall.
15191 Speed indicator. Leslie.
15192 Shuttles. Robinson.
15193 Coal holders, etc. Dunn.
15194 Utilisation of siliceous matters. Spencer.

15195 Steam engine. Smith.
15196 Gas mantles, etc. Ainley.
15197 Gland with oil well. Hill.
15198 Cotton, etc., cleaning. Hitchon.
15199 Hatpin. Selby.
15200 *Measuring high frequency currents. Burstyn.
15201 Boots, etc. Lawrence.
15202 Cattle slaughtering. Ross.
15203 Firegrates. Winder.
15204 Golf club, etc., cleaner. Cox.
15205 Shaping earthenware, etc. Ford.
15206 Motor car lifting jack. Lamkin.
15207 Milling cutters. Roberts.
15208 Steam generators. Dobbs.
15209 Therapeutic appliances. Burks.
15210 Hydraulic power transmitter. Smith.
15211 Tobacco pipe. Davis.
15212 Writing pens. Louis de Curnex.
15213 Moulds for hats. Bruckshaw.
15214 Metal bar cutter. Clifton.
15215 Heating, etc., liquids. Walker.
15216 *Piston cooling device. Krupp.
15217 *Couplings. Krupp.
15218 Hose pipe coupling. Penn.
15219 Rotary pump. Drake.
15220 *Coin sorting apparatus. Westfelt.
15221 *Coin sorting apparatus. Westfelt.
15222 Winches, etc. Essberger.
15223 Cycle seat. Whitfield.
15224 Goods suspending hook. Newton.
15225 Speed gear. Hesketh.
15226 Advertising device. Lagan:
15227 Garden hose. Bloch.
15228 Rubber cutters. Seymour.
15229 Reels, etc. Heaton.
15230 Copying books. Kirkby.
15231 Flying machine. Trykle.
15232 Acetylene lamps. Lucas.
15233 Mathematical compasses. Smith.
15234 Hair curling. Challen.
15235 Free wheels. Allen.
15236 Measuring distances in bowls. Hibbert.
15237 *Liquid fuel burners. Price.
15238 Railway wagon coupling. Askew.
15239 Reaping machine. Harrison.
15240 Collapsible box. Webb.
15241 Paper manf. Milne.
15242 Motor car lamps. Neale.
15243 Sparking plug. Hall.
15244 Manf. of a physiologically active base. Wellcome.
15245 Fireirons. Henn.
15246 Petrol tanks. Fellow.
15247 Trip hooks. Midgley.
15248 Lubricating device. Chandler.
15249 *Signalling device. Thiéme.
15250 Air compressor. Kassner.
15251 Brush handles. Woodcock.
15252 Locks. Singh.
15253 Scissor, etc., sharpeners. Jacoby.
15254 *Rubber substitute. Bayer.
15255 Gas mantles. Brown.
15256 *Vending machine. Liddle.
15257 *Locks. Marston.
15258 *Plant protection. Harrison.
15259 *Internal-combustion engine. Davidson.
15260 Looms. Hollingsworth.
15261 Picture hook manf. Lawrence.
15262 Automobiles. Crossley.
15263 *Distilling, etc., liquids. McClelland.
15264 *Drain pipe trap. Lehmann.
15265 Billiard cue. Cawderoy.
15266 Hinge, etc., Barfoot.
15267 Looms. Hollingsworth.
15268 Colouring matter production. Johnson.
15269 Thread filament manf. Napper.
15270 *Anti-skid motor tyre. Moore.
15271 Looms. Hollingsworth.
15272 Ball bearings. Hess.
15273 Expansible cone pulley. Hollingsworth.
15274 Work holder. Fairbank.
15275 Live stock houses. Eckley.
15276 *Plastic production for medical, etc., purposes. Fagnays.
15277 *Flushing apparatus. Lombard.
15278 Aeroplanes. Bonstead.
15279 Fastening articles on to the person. Benjamin.
15280 Crane hook. Alston.
15281 Controlling valve. Glover.
15282 Brake gear. Crossley.
15283 Looms. Turner.
15284 Wheels. Davies.
15285 Ammonia production. Woltereck.
15286 Cigar, etc., holder. Castell.
15287 Propellers. Mays.
15288 Soap. Koller.
15289 Internal-combustion engine. Cloudslev.
15290 Internal-combustion engine. Cloudesley.
15291 *Linoleum manf. Gray.
15292 *Railway points. Monard.
15293 *Shafts. Allgemeine.
15294 Leggings. Davies.
15295 Boot rack. Watts.
15296 Coffee pot. Gardener.
15297 Oxygen preparation. Harger.
15298 Brace buckle. Taylor.
15299 *Wearing apparel. Feierabend.
15300 *Railway wagons. Spencer.
15301 Steam condensing device. Armstrong.
15302 Elastic fluids. Towrtel.
15303 Boots, etc. Bates.
15304 *Dog lead. Label.
15305 *Hydarulic presses. West.
15306 Electric transmitters. Osling.
15307 Brake gear for automobiles. Crossley.
15308 *Aeroplanes. Schneider.
15309 *Preserving perishable goods. Prenzhand.
15310 *Metal skeletons. Eberlein.
15311 Targets. Taylor.
15312 *Producing cooked foods. Hatcheon.
15313 *Producing cooked foods. Hatcheon.
15314 Spanner. Mealor.
15315 *Knife cleaner. Nosworthy.
15316 *Couplings. Hergstenberg.
15317 Mowing machine. Baker.
15318 *Telephone apparatus. Höfermann.
15319 *Embossing press. Mann.
15320 *Pipe wrenches. Aosonoff.
15321 Lamps. Barnett.
15322 Indiarubber stamps. Houten.
15323 Furnace tuyeres. Zohrab.
15324 *Explosion motor. Lake.
15325 Electric traction system. B. T.-H. Co.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to August 1st, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post ree for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1908.

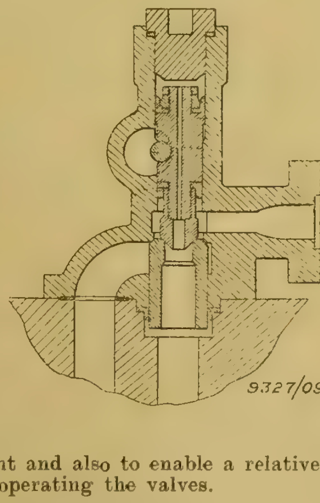
12795 Coleman: Railway and like signalling systems. [Date applied for under International Convention, July 12th, 1907.] 13468 Mitchell: Apparatus for rifle gunnery and like practice. 22308 Baron, Baron, and Tingle: Aerial machines. [Post-dated May 21st, 1909.]

1909.

736 Thompson: Furnace grates. [Post-dated July 10th, 1909.] 4285 Wood: Feed-water heaters and purifiers for steam generators. 4531 Martin: Process for the separation of complex ores. 4937 Hunter and Hardon: Wick for oil lamps, oil stoves, and the like. [Post-dated January 25th, 1910.] 6693 Kemp: Detachable rim and method of attaching a detachable rim to a permanent rim of the wheel of motor cars and other road vehicles and the like. [Post-dated September 17th, 1909.] 7018 Richards and Lewis: Charging apparatus for blast furnaces. 7208 Coffey: Subaqueous rock-breaking machines. 9241 Wagner and Von Radinger: Manf. of compound stratified plates, sections, and structural elements from paper, fabrics, and the like. [Date applied for under International Convention, February 16th, 1909.] 9261 Marks (Crown Cork and Seal Co.): Bottling machines. 9300 Martin: Process for separating complex ores or their concentrates. 9310 Langton: Tobacco pipes.

9327 Brindley and Berry: Valves for the control of fluid pressures.

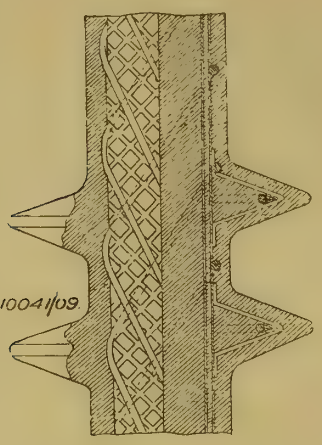
This invention relates to valves of the type in which the inlet and exhaust valves are concentrically arranged in a common chamber, the seat for the inlet valve being formed in the exhaust valve and the seat for the latter being provided in the valve case for the control of pressure fluids, either liquids or gases, and has reference more especially to valves for use with hydraulic machine tools and for other purposes. Means are provided for the automatic retention of the valves on their seatings in a single-acting arrangement and also to enable a relatively small force to suffice for operating the valves.



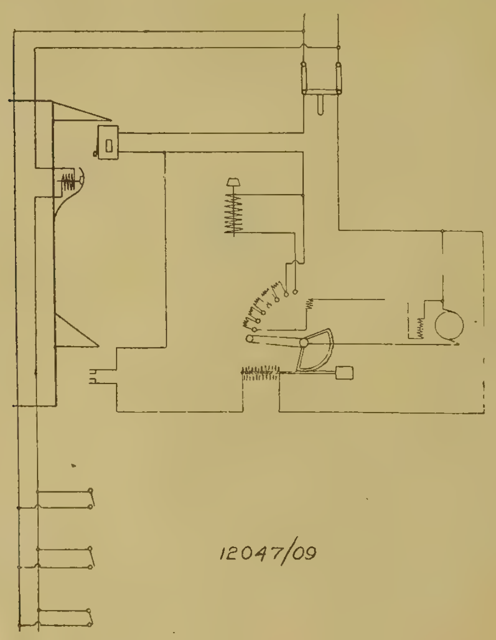
9694 Boult (United Shoe Machinery Co.): Machines for inserting fasteners or the like.

10041 Vernon-Inkpen: Concrete piles for foundations and similar purposes. [Post-dated October 27th, 1909.]

This invention consists in the method of constructing and reinforcing concrete screw piles in which reinforced concrete spiral flanges, worms, or blades around their circumference form an integral part of the concrete pile body or shaft and by the application of continuous helical metallic bars, rods, bands, or wrappings embedded in the concrete and possessing strength and efficiency to resist a twisting or torsion strain in conjunction with a suitable continuous vertical reinforcement of the concrete pile shaft to resist a lateral or breaking off strain or fracture such as might occur to a screw pile when being screwed into a compact mass, also providing means for securing to the reinforced concrete pile shaft metal encasements or moulds as protection to the concrete spiral flanges, worms, or blades of the screw.


10041/09.

10630 Halliday: Furnaces. [Post-dated May 19th, 1909.] 10673 Davies: Apparatus for actuating signals on engines and trains. 11777 Heath: Adjustable valve for controlling the velocity of water through the ball tap of cisterns. 11820 Jackson: Yarn-preparing machines for treating or polishing yarn. 11833 Carmichael and Wild: Shaving, bath, and similar brushes. 11862 Rose and Rose: Apparatus for applying labels or wrappers to blocks, packages, or tins or other containers of material. 11897 Ansell: Method of constructing a device for use in tipping cues. 11905 Henning and Wetter: Flexible and elastic plastic compositions. 11940 Cowie: Azimuth fitting for a mariner's compass. 11961 Nyborg: Guiding and governing flying machines of the aeroplane type. 11990 Webb and Butler: Single-stroke pneumatic bells. 12032 Layton: Calculating machines. 12038 Kosinski and Stawecki: Methods of grinding and separating flour and analogous materials, and machines therefor.


12047/09

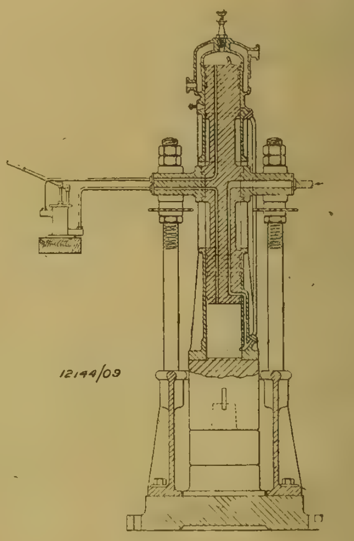
12047 British Thomson-Houston Co., and Kingwell: Control of electric motors.

In controlling motors operating pumps, etc., it is usual to automatically regulate the pump motor, so that when the store of energy in the accumulator becomes partially depleted the pump motor will be brought into action automatically to restore energy and *vice versa* to throw the motor out of action when the energy has been fully restored. In some cases this regulation is effected by a mechanical device assuming different positions according to the amount of energy stored in the accumulator, the device controlling the electric motor circuits directly or indirectly. This invention consists in the employment of an electrically-controlled device for tripping the circuit breaker in the motor circuit, the device being electrically interlocked with the apparatus taking power from the accumulator and adapted to trip the circuit breaker only when the accumulator is fully restored and no power or a small amount of power being taken therefrom.

12053 Osmond and Jacombs: Mops and bobs for polishing. [Cognate Application. 14237, 1909.] 12054 Allbook, Hashfield, and Ainley: Embroidery sewing machines. 12070 Ziron: Permutation or changeable key locks. 12087 Ingham: Breakers of the roller type for breaking coal, coke, and other materials. 12090 Thorp: By-pass for gas meters. 12107 Fauber: Hydroplane boats. 12140 Preston and Deeley: Blast pipes of locomotive and similar boilers.

12144 Robinson and Frerichs: Working of power stamps, hammers, rock drills, pile drivers, and the like.

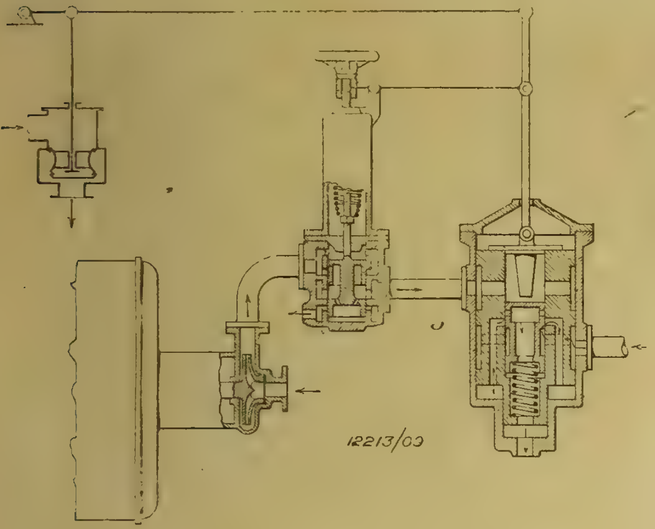
The stamp head, hammer head, pile driver, or similar reciprocating part of the apparatus is actuated by a cylinder and piston arranged in such a manner that the presure incidental to the expansive force of the explosion of a combustible mixture lifts the stamp head or other part to be operated; the arrangement may be such that the lift of the reciprocating part and the blow delivered thereby may be accomplished by means of the aforesaid pressure or force so that the blow may be increased in effect. In order to work the stamp or other reciprocating part, the piston may be stationary and the cylinder reciprocatory or *vice versa* according to requirements. One or more cylinders or pistons may be employed as may be necessary for the work to be accomplished.


12144/09

12145 Soliani: Ship construction. 12183 Adams, Richardson, and White: Envelopes, bags, or other coverings. 12201 Lay: Construction of ironing stoves. 12204 Gaunt: Propulsion of vehicles, cycles, ships, and the like. [Application for Patent of Addition to No. 17014, 1908.]

12213 Bloxam (Firm Geb. Sulzer): Governors for steam engines.

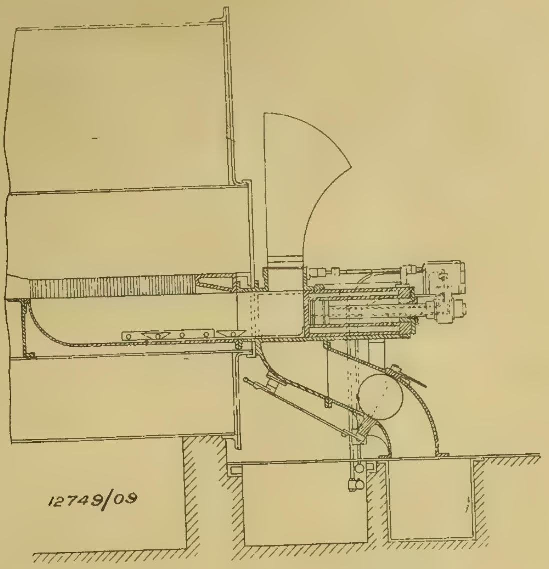
This invention relates to a governor for steam engines, particularly for steam turbines, based on the use of a centrifugal pump driven by the engine. The pressure produced by the pump acts on the distributing valve of an auxiliary motor, and is partly balanced by a spring, the effect of which is dependent on the working piston of the auxiliary motor; for instance, the spring may be supported either directly or through levers by the working piston of the auxiliary motor. For every pressure of the pump, or number of revolutions of the engine, there is therefore a corresponding position of the working piston of the auxiliary motor. An example of the invention is shown in section in the accompanying drawing, in which the valves and working piston are shown in the normal positions at the end of a regulating phase.



12228 Boult (Sulzer): Propulsion of vehicles or ships. [Application for Patent of Addition to No. 28040, 1906.] 12287 Adam: Air suction inlets for abstracting dust-laden air. 12329 Golby: (Svenska Kvarnstensfabriken S. Wallen): Grinding wheels and the like. [Rights under Section 91, Patents, etc., Act, 1907, not granted.] 12337 Reid: Processes of separating and refining metals. [Date applied for under International Convention, September 23rd, 1908.] 12361 Cramer: Hygrometers for regulating humidifying and heating systems. 12367 Andrews: Endless chain elevators for lifting sacks and for similar purposes. 12369 Waller and Statter: Flying machines and/or other aerial vessels. 12370 Green and Miller: Carburetters for internal-combustion engines. 12372 Imray (Pittman and Carr): Air motors. 12437 Mills (Maschinen und Dampfkesselfabrik "Guilleaume Werke" Ges.): Annealing pots. 12442 Hamilton: Combined section insulator and double action quick break switch for electric trolley conductors. 12453 Pollen (Mergenthaler Setzmaschinen Fabrik Ges.): Means for composing matter in several faces, especially applicable to linotype machines using circulating matrices. 12460 Gobbe: Process and apparatus for case hardening the interior of metal tubes. 12462 Sandow and Wallis: Treatment of air, rendering it more beneficial or agreeable to persons who may breathe the same. [Post-dated November 26th, 1909.] 12464 Lennox: Machine for moulding or pressing peat and the like into blocks. 12470 Giorgi: Means for controlling the supply of gas to gas burners and for igniting the same. 12480 Eckford: Purification or treatment of red or orange lead or lead paste and making paint therefrom. [Cognate Application. 26729, 1909.] 12493 Duke: Apparatus for making vertical or zig-zag stripes and other ornamental designs on hosiery fabric. 12523 Zanotti: Preventive and curative substance for infectious diseases. 12530 Trousdale: Apparatus applicable to sliding sashes for windows for domestic and other purposes. 12550 Hounsell: Mechanism and devices for converting rotary into angular motion. 12553 Grice, and George Anderson and Co. (1905): Diamond-carrying saws or blades. 12556 Dring: Flying machines. 12585 Weekes: Fuse switches. 12620 Jarvis: General joiner or variety wood worker. [Cognate Application. 17515, 1909.] 12645 Stumpf: Condensing engines. 12651 Dawson and Buckham: Recoil and running-out gear for ordnance. [Cognate Application. 25356, 1909.] 12667 Fieldhouse, and Oxychlorides (1907) Ltd.: Purification of sewage or trade waste by the under drainage system. 12669 Cartwright: Printing presses. 12673 Turner, and Yost Typewriter Co.: Typewriters. 12674 Daimler Motoren Ges.: Carburetter for explosion engines. [Date applied for under International Convention, December 14th, 1908.] 12694 Nash: Collapsible traps for the purpose of catching vermin and animals and for like uses.

12749 Cooper: Mechanical stokers.

This invention has reference to and comprises improvements in mechanical stokers of the class in which the fuel is forced along a central trough causing the fuel to overflow upon firebars at each side of the furnace, in which a double-acting hydraulic power cylinder is used to feed the fuel forward by means of reciprocation of power cylinder, the fuel being supplied from a hopper. The invention also comprises a system of automatically working valves for controlling the pressure fluid, and the combination of a hydraulic valve upon the discharge pipe leading fluid from pressure cylinder, with a valve upon air pipe for regulating the air supply in correspondence with the pressure fluid supply, and of devices for pushing the fuel as it is being fed to the furnace.

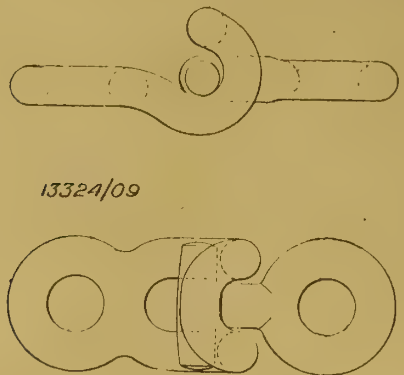


12760 Robinson: Star maps and holders therefor. 12761 Lorenz: Typewriting machines. [Date applied for under International Convention, June 3rd, 1908.] 12762 Anderson: Paper-feeding mechanism for typewriters. [Date applied for under International Convention, June 3rd, 1908.] 12785 Foucar: Fuel for gas fires. 12790 Sharman: Production of harmonic variations in the amplitude of high frequency alternating currents applicable to musical signalling by radio telegraphy. 12795 Taylor and Blake: Ladies' dress skirts. 12797 Liney: Tins, canisters, and similar receptacles. 12806 Hamilton: Combined angle of sight meter and director. 12863 Ronchetti: Key actions for typewriters. [Date applied for under International Convention, June 5th, 1908.] 12864 Lorenz: Typewriting machines. [Date applied for under International Convention, June 5th, 1908.] 12892 Plant: Work holders for heeling machines. 12908 Svedberg: Process of producing colloidal sols or gels. 12910 Gibbs: Nails or spikes.

13324 Bullivant and Selby: Device more especially intended for connecting together ropes, cords, chains, and the like.

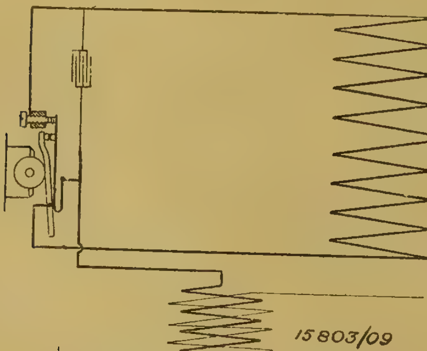
This device consists of two parts, one part consisting of a link with an eye at one end for the attachment of one of the ropes, the link being bent at the other end into a hook form, the length of the loop of the link being such as to allow of the ready engagement therewith, and with the hook of a tee-shaped piece at one end of the other part of the device, the tee-shaped piece at its projecting parts bearing on each side of the hook formed by the bending of the link of the other part. The shank of the tee-shaped piece is formed with an eye for the attachment of the other rope. When the two parts of the device are engaged together it will be impossible for them to become disengaged when strain is on the ropes, and they will not be liable to become accidentally disengaged at any time.

13572 Linderman: Lumber-joining machines. 13693 Lonsdale, and Lonsdale Bros. Ltd.: Manf. of non-conducting covering. 13697 Greenwood: Manf. of tubes, crucibles, or other articles of magnesia. 13708 Lewis: Horseshoe. 13852 Improved Railway Signals Ltd., and Bounevialle: Means or apparatus for operating the brake mechanism and steam regulator of railway locomotive engines and vehicles independently of drivers. 13871 Brown: Means or apparatus for heating, ironing, pressing, shaping, or smoothing flat and other surfaces. 14088 Buck: Generators of mixed steam and combustion products. 14237. *See* 12053, 1909. 14274 Whitehead and Galloway: Noble's combing machines. 14367 Sherwood: Certain kinds of central draught oil burners. 14427 Lentz-Getriebe Ges., and Lentz: Fluid-pressure transmission gear. 14511 May: Handles for metallic hollow-ware and lids. 14512 May: Kettles, saucepans, and the like. 14680 Wilson: Domestic wringing and mangling machines. 14691 Bedwell: Combined folding leg and locking lever for tables, seats, chairs, and the like. 14710 Tickell: Folding and portable furniture, more especially for use in tents or for transport. 14767 Darwin: Incandescent gas lamps. [Date applied for under Rule 13, May 26th, 1909.] 14861 Wood: Candlesticks. 14981 Fleming: Bottles, jars, and the like. 15496 Jahoda: Process for the manf. of metallic filaments for electric incandescent lamps. [Date applied for under International Convention, May 10th, 1909. 15684 Baines and Schmidt: Thread spooling or winding machines. 15687 Rees and Moreton: Buffers for railway vehicles.


13324/09

15803 Brooks and Alston: Electric ignition systems of internal-combustion engines.

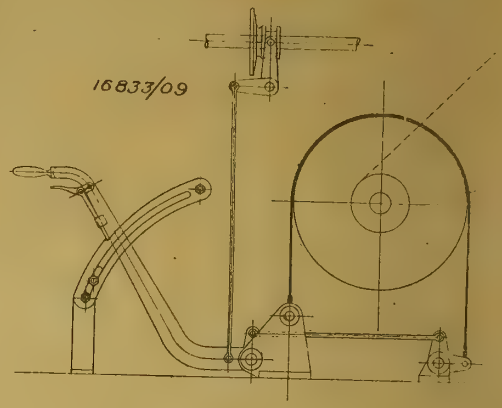
Two branch circuits are provided through which the current is caused to pass alternately and in opposite directions by means of an automatically-operated change-over device, it being arranged that when the current reaches its maximum value the circuit through which the current previously passed is broken, and at the same instant, or immediately before or after, the other circuit is completed, it being so arranged that the current now passes through this second circuit in an opposite direction. The current passing through the primary winding of the coil or transformer is by this means suddenly reversed in direction, the suddenness of the change in the strength and direction of the magnetic field producing a very intense spark in the engine cylinder.


15803/09

15848 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new dyes of the anthracene series. 16241 Cotton: Speed indicators for ships. 16366 Thompson: Filling and capping machines. 16383 Busby: Billiards and like games. 16410 Koref and Nemecek: Means for cleaning ring-spinning frames. 16427 Cleather and Hawkes: Timpani or kettledrums. 16520 Tattersall: Telephone and other similar mouthpieces. 16727 British Steel and Wire Co., and Saville: Continuous wire-drawing machinery. 16767 Brooksby: Circular knitting machines. 16794 Allen: Piano frames.

16833 Henderson: Winches for use in working grabs.

This invention relates to means for working grabs, and particularly to the winch employed for raising the grab, the object being to secure the more effective control of the winch drum. According to the usual mode of working, the grab is raised by depressing the winch lever, thereby slackening the brake strap upon the winch drum and at the same time moving the clutch into position to drive the pinion whereby the winch drum is rotated to wind the lift chain or rope. In working grab winches a latch is mounted on the winch lever and adapted to be brought into engagement with a catch so disposed as to retain the winch lever in such a position that the brake strap is slackened and the rotation of the winch drum is permitted during the opening of the grab.

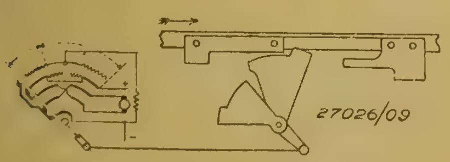

16833/09

16851 Laycock and Wild: Buffers for use upon rolling stock. 16893 Shepel: Combined dog's coat and chest protector. 17002 Boucherie: Process for impregnating wood. 17153 Valentine: Windmill. 17160 Barr and Stroud: Torsiometers. 17223 Sutton: Brackets or supports for curtain rods, laths, and the like. 17299 Murray and Cox: Gas driven or explosion rotary engine. 17306 Hollingworth (Crompton and Knowles Loom Works): Weft-replenishing looms. 17383 Huguenin: Rotary compressors. 17422 Jeffree and McGregor: Metal bars and braces for reinforced concrete structures. 17515. *See* 12620, 1909. 17536 Stothert and Pitt Ltd., and Peters: Hydraulic brake mechanism of cranes and the like. 17606 Giddens and Bolam: Two-speed gears. 17648 Salmon and Capper: Printing machines. 17660 Zilliox: Boiler tube cleaners. 17721 Robinson: Hand signalling lamps. 17761 Deutsche Electro-Sparlicht Ges.: Closed circuit transformers. [Date applied for under International Convention, July 31st, 1908.] 17961 Driscoll and Thompson: Apparatus for heating asphalt pavements. [Date applied for under International Convention, August 1st, 1908.] 18019 Bruhn: Taxameters. 18394 Dudley: Combined vacuum cleaning and sweeping machines. 18429 Welcome: Means for deodorising and drying night soil and the like. 18465 Battey: Pocket lighters. [Date applied for under International Convention, August 24th, 1908.] 18512 Wayss: Manf. of reinforced concrete ribbed floors. 18749 Hall and Kay Ltd., Hall and Kay: Ventilating plant for gassing rooms. 18867 Rowbotham: Self-acting mules for spinning. 18981 Chisholmes and Hendry Brothers Ltd., and Whimster: Clothes posts. 19192 Girouard: Glass substitutes for use in glazing greenhouses and the like. 19202 Grimwade: Pie funnel and divider. [Application for Patent of Addition to No. 12833, 1909.] 19753 Bruce: Stoppers for bottles. 19834 Lavy: Telegraph or telephone insulators and the like. 19872 British Thomson-Houston Co. (General Electric Co.): Propulsion of ships. 19911 Justice (Millet Signal Co.): Apparatus for detecting sound vibrations in non-gaseous media. 20034 Pedersen: Screw-cutting machines for cutting wooden screws. 20071 Wolseley Sheep Shearing Machine Co., and Hudson: Separating cones or plates of cream and other centrifugal separators. 20277 Fitzpatrick (Soc. Anon. des Fabriques d' Armes Reunies): Automatic small arms. 20335 Crerar: Shelter sheets for sheep. 20356 Ransome and Jones: Ball bearings.

20369 Grimwade: Security bolt for pneumatic tyres. 20372 Hobbies Ltd., and Jewson: Manf. of castings. 20379 Gee, and Ukanusa Trading Co.: Soap stands or the like. 20439 Grant: Devices for controlling the supply of water to cisterns or the like. 20488 Coulthard: Spindles for spinning and twisting frames. [Cognate Application. 4568, 1910.] 20819 Maconochie and Vasey: Nutritive food. 20834 Vickery: Secret locking means for drawers and other applications. 20875 Eaves: Biscuit box, packing cases, and the like. [Cognate Application. 4483, 1910.] 21109 Damey: Means for securing electric incandescent lamps. 21206 Christian: Anti-corrosive anti-fouling compound. 21234 Boyd: Rimless eyeglasses and spectacles. 21317 Jackson: Mud and splash guards for motor cars, cycles, motor cycles, and the like. 21342 Armitage: Means for preventing tampering with valves. 21419 Hodgkinson: Method of carburising iron, iron alloys, and mild steel, and articles thereof. 21437 McNab and Link: Mechanism applicable for lighting and extinguishing gas lamps and operating valves from a distance. [Date applied for under International Convention, September 25th, 1908.] 21944 Wait: Benches for greenhouses. 22260 Williams: Ejectors. 22468 Smith: Wheatmeal. 22866 Carboni and Tironi: Electric signalling for railways. 22871 Crone: Douche apparatus for use in hydrotherapy. 23196 Clark: Music stools. 23385 Mackay: Apparatus for automatically indicating the weight of cargo or the like placed on board ship. 23642 Colman and Peterson: Spinning, twisting, and doubling machines. [Date applied for under International Convention, November 5th, 1908.] 23937 Monnier: Distributing box for cables with multiple electrical conductors. [Date applied for under International Convention, October 19th, 1908. Request under Section 19 not granted.] 24072 Whiteman (American Box Ball Co.): Amusement apparatus. 24316 Smedal: Means for assembling the component parts of boxes. [Date applied for under International Convention, October 23rd, 1908.] 24318 Newbold: Pince-nez or eyeglasses. 24420 Ramsay: Sheaves and pulleys or the like. 24662 Rees and Rees: Tyre treads for motor vehicles and the like. 24784 Maschinenfabrik Oerlikon: Electro hydraulic press. [Date applied for under International Convention, November 19th, 1908.] 24856 Dronsfield: Machine for pulling on roller skins or leather coverings and such like. 24978 Lake (Goss Printing Press Co.): Plate clamping mechanism for printing presses. 25041 Lauterwasser: Door holders. 25087 Cohen: Bars for fastening doors. 25301 Buchan: Stoneware hot-water bottles. 25356. *See* 12651, 1909. 25358 Dunn: Mechanism for feeding pulverised coal to furnaces or the like. 25678 Sefton-Jones (Quade): Process for the manf. of sodium-glycero phosphate and a preparation containing the same. 25758 Lantz: Machine for measuring cloth and like material. 25855 Guastavino: Reinforced tile and like structures. 25879 Lake (C. B. Cottrell and Sons Co.): Pressure mechanism for printing plate shaving machines. 25894 Lake (C. B. Cottrell and Sons Co.): Processes of treating printing plates. 26016 Mauser: Means for fastening side arms to rifles or the like. [Date applied for under International Convention, November 21st, 1909.] 26043 Thompson (Union Special Machine Co.): Feeding mechanism for sewing machines. 26089 Day: Starting, stopping, and reversing of internal-combustion engines. 26143 Mills: Perpetual calendars. 26417 Cowburn and Godfrey: Lamp support. 26456 Schwenk: Apparatus for expressing the water from washings. 26462 Kahlenberg: Coal scuttles or the like. 26475 Rey, and Chance Bros. and Co.: Lanterns of lighthouses and the like. 26477 Rey, and Chance Bros. and Co.: Catoptric apparatus for lighthouses and the like. 26546 Blake: Scaffold standard. 26620 Evans: Toy and game trap shooters and projectile catchers. 26729. *See* 12480, 1909.

27026 Boult (Felten and Guilleaume Lahmeyerwerke Akt.-Ges.): Apparatus for electrically controlling machine tools.

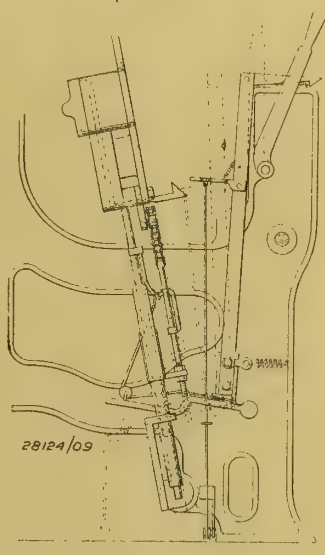
The method according to this invention enables the direct reversing of machine tools to be applied also to the heavy machine tools with reciprocating motion. According to the new method, the driving motor is reversed not by simply turning over the starting switch at the end of the operative travel or of the idle movement, but by reducing the speed of the motor by means of stops or cams or the like secured, for instance, to the table of the planing machine, a certain time before the reversing of the electric motor, and by maintaining the reduced speed for a given variable time, whereupon the proper reversing of the driving motor can be effected as simply as in the case of smaller motors. The speed is reduced by increasing the field by switching out or short circuiting resistances or the like.



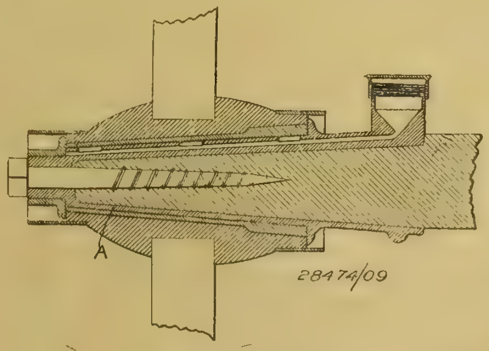
27105 Davidson: Tea-leaf rolling machines. [Application for Patent of Addition to No. 692, 1909.] 27106 Davidson: Tea-leaf rolling machines. [Application for Patent of Addition to No. 692, 1909.] 27148 Schaumann: Armour plating. 27211 Swanson: Combination extracting implement. 27222 Brooks: Collapsible tubes or containers. 27230 Krag: Post-marking machines. 27367 Goldsmith, and J. Liversidge and Son Ltd.: Tyre fastenings. 27440 Polack and Staegemann: Horse gears. 27455 McKenna (I. B. Kleinert Rubber Co.): Dress shields. 27526 Rennspiess: Car coupling. 27891 Lunken: Window-shade supporting devices. [Date applied for under Rule 13, June 14th, 1909.]

28124 Johnson and Moorhouse: Stop motion for looms.

This invention relates to a stop motion for looms having rising and falling shuttle boxes, the function of this stop motion being to cause the stoppage of the loom upon any derangement of the action of such rising and falling shuttle boxes. A pair of hooks or other catch devices are employed normally out of engagement with each other, one member being operatively connected with the setting-on handle of the loom, and the other with the going part. One of these two members is adapted to be brought by detector mechanism dependent upon the correlated movements of the shuttle-box rod and the chain or the like which operates the rod into such a position as to be engaged by the other member, so that the stroke of the going part effects thereby the stoppage of the loom.



28313 Meyer and Franceschetti: Tin openers.



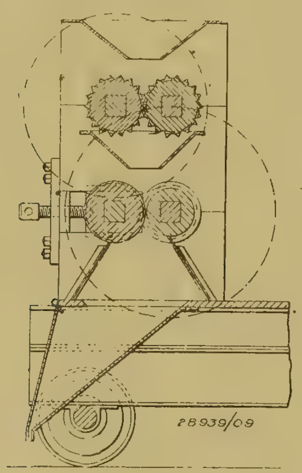
28474 O'Connor: Axle lubricators.

The skein A is provided with a rib or thickened portion arranged longitudinally of the skein, the rib being provided internally with a lubricating passage communicating with the journal portion of the skein so as to lubricate the bearing surface thereof. This lubricating passage is preferably provided with a plurality of discharge openings communicating with the journal portion of the skein, the openings being located at the opposite ends and at an intermediate point of the journal portion. The passage further preferably extends from a point to the rear of the inner side of the journal portion where it is provided with a compression grease cup

28573 Aitken, and London Electric Supply Corporation Ltd.: Liquid strainers. 28702 Mitchell: Hat holders for attachment to chair seats, lids of boxes, or the like. 28723 Schaffelke: Bolt and nut-locking devices.

28939 Wright: Crushing and rolling mill.

This invention is designed to meet the necessity of crushing and rolling fouled oxide of iron containing sulphide of iron FeS and free sulphur, and consists in the arrangement for effecting the rotation of the rolls, the interposition of a hopper between the upper and lower set of rolls, scrapers carried by the frame and adapted to engage in the corrugations of the lower rolls, a chute for the reception of the refined oxide arranged so as to deposit the same in front of the mill, and means controllable for spraying water on to the oxide during its passage down the delivery chute. The mill is mounted upon a wheeled frame which is provided with a boiler and steam engine to work the mill, thus rendering the mill self-contained and portable.



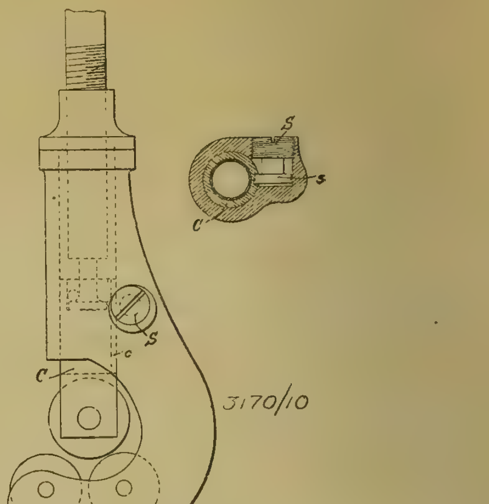
28949 Freud: Supporting arms for shop window cases and the like. [Application for Patent of Addition to No. 17336, 1906.] 29087 Siemens Bros. Dynamo Works Ltd. (Siemens Schuckertwerke Ges.): Electric cartridge fuses. 29202 Boult (Typograph Ges. Setzmaschinenfabrik): Matrix-setting and line-casting machines. 29235 Quinn and Quinn: Apparatus for facilitating or expediting and cheapening the cost of recording dictated matter or speech. 29254 Geis and Geis: Machine for filling, closing, and delivering bags or the like. 29374 Hodgkinson: Fluid-pressure plants. [Date applied for under International Convention, January 2nd, 1909.] 29519 Page: Safety vents for gasoline tanks and the like. [Date applied for under International Convention, December 16th, 1908.] 29662 Baumgarten: Woven elastic fabrics. 29714 Marshall: Collapsible hopper draught screens for windows. 29738 Spalding: Tilling machines or rotary disc ploughs. [Date applied for under International Convention, December 30th, 1908.] 29739 Spalding: Frames for rotary disc ploughs and other tilling machines. [Date applied for under International Convention, December 30th, 1908.] 29835 Van Kannel: Amusement apparatus with undulating floor. 30002 Giorgi: Inverted incandescence gas lamps. 30069 Haddan (Aktiebolaget Separator): Centrifugal separators with filtering apparatus. 30086 Cambier: Manf. of imitation cane-plaiting work. 30403 Hemsteger: Nut locks. 30514 Dow: Demountable tyre rims. [Date applied for under International Convention, December 30th, 1908.]

1910.

4 Frederiksen: Hairpin. 259 Walkden: Studs or protectors for the treads of tyres. 348 Jonsson: Milking machines. [Date applied for under Rule 13, September 3rd, 1909.] 475 Chemische Werke vorm. Dr. Heinrich Byk: Method or process for treating borates containing active oxygen. [Date applied for under International Convention, March 1st, 1909.] 519 Musgrave: Device for "making ready" in cutting and creasing machines. 576 Carl Zeiss: Carrier for hinged stereo telescopes. [Date applied for under Internaional Convention, September 13th, 1909.] 1004 Switzer: Closures and protecting devices for bottles. [Date applied for under International Convention, February 8th, 1909.] 1526 Chertemps: Resilient wheels for vehicles. [Date applied for under International Convention, January 30th, 1909 Request under Section 19 not granted.] 1552 Hutchinson: Cigarettes. [Date applied for under International Convention, February 3rd, 1909.] 1581 Walker, Walker, Walker, and Walker: Braces for personal wear. 1692 Goldberg: Rotatable windows. 1774 Chivers: Buffers for railway vehicles. 1868 Bulger: Lock joint coupling for pipes and the like. 1892 Baulino and Zini: Internal-combustion engines. [Date applied for under Rule 13, May 25th, 1909.] 1903 Taraglio: Devices for absorbing shocks. 2037 Fraser: Wire mattresses. 2057 Aitken, and British Insulated and Helsby Cables Ltd.: Telephone switching apparatus. 2131 British Automatic Co., and Savage: Coin-freed delivery machines. 2261 Allner: Stud for fixing the collar to the shirt at the back. 2268 Perry (Sachsishe-Kartonnagen-Maschinen-Akt.-Ges.): Machines for bending leatherboard, pasteboard, and the like. 2307 Arbuckle: Means for introducing and distributing mixtures of solids and liquid in settling or other vats or vessels. 2419 Gooding and Taft: Machine for randing and cutting in the shanks of shoes. [Date applied for under International Convention, February 15th, 1909.] 2481 Short, Short, and Short: Valves for gas containers employed as balloons or in airships. 2625 Baulino and Zini: Fluid-pressure engines. [Date applied for under Rule 13, May 25th, 1909.] 2645 Pene: Bottle wrappers. 2809 Holmes: Fixing or securing of a member or part to, in, or on its carrying or supporting body. [Application for Patent of Addition to No. 3971, 1908.] 2972 Watts: Reinforced air tubes for tyres. 2979 Pistonless Hydraulic Press Co., Goyder and Beckwith: Hydraulic presses. 3134 Loxam: Apparatus for covering rollers.

3170 Hunt (Mitchell): Pipe cutter.

Difficulty is frequently experienced in securing the proper alignment of the movable cutter with the fixed cutters. To overcome this difficulty the block C is provided with a groove *c*, and open into the slideway for the block a threaded hole to receive the screw S, the shoulder *s* on which engages in the groove *c* when the block is in position and the cutters are in substantial alignment. If the cutters happen to be out of alignment, a slight turn of the screw S imparts a rotary movement to the block C and thus at



once trues the movable cutter with relation to the fixed cutters.

3303 Fouque: Kite. [Date applied for under International Convention, February 11th, 1909.] 3626 Lotery and Winkel: Devices for holding up ladies' dress skirts and the like. 3742 Yamamoto: Method of making knotless netting. 3927 Lundberg, Lundberg, and Lundberg: Electric switches. 3930 Feinenburg and Clemens: Pocket knives. 3983 Warwick Machinery Co. (1908) (General Electric Co.): Shaft-packing devices. 4373 Homer: Cases and the like for holding or displaying rings and other articles of jewellery. 4401 Mower and Williams: Crushing or grinding machinery. 4420 Thompson (Bieneck): Resilient wheels. 4446 Gottschalk: Telephone transmitters. 4483. *See* 20875, 1909. 4552 Pindstofte: Rotary bottling machines. 4568: *See* 20488, 1909. 5888 Marks (Crown Cork and Seal Co.): Bottling machines. [Date applied for under Rule 13, April 19th, 1909.] 5889 Marks (Crown Cork and Seal Co.): Bottling machines. [Date applied for for under Rule 13, April 19th, 1909.] 6293 Hollingsworth: Apparatus for cutting lines of perforations. 7072 Wintermayr and Lehmann: Power looms having freely falling lays or lathes, more particularly adapted for weaving wire cloth. [Date applied for under Rule 13, March 22nd, 1909. Request under Section 19 not granted.] 7082 Juillac: Mast for use in wireless telegraphic apparatus and for other purposes. [Date applied for under International Convention, March 27th, 1909.] 8403 Boult (United Shoe Machinery Co.): Machines for inserting fasteners or the like. [Date applied for under Rule 13, April 23rd, 1909.] 8555 Boult (United Shoe Machinery Co.): Machines for inserting fasteners or the like. [Date applied for under Rule 13, April 23rd, 1909.] 9463 Marks (Crown Cork and Seal Co.): Bottling machines. [Date applied for under Rule 13, April 19th, 1909.]

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1909.

29122 Greenfield: Bottle and similar receptacles. 29684 Bingham: Moving-picture machines and apparatus for winding cinematograph films.

1910.

3415 Kantorowicz: Manf. of adhesive substances from flaked starch-containing matters. 6049 Firm Albert Martz: Adjustable drawing tables. 6653 Firm Robert Bosch: Magneto electric ignition machines. 6782 Compagnie pour la Fabrication des Compteurs et Materials d'Usines a Gaz: Recording galvanometers and other instruments operating with a very small turning movement. 8207 Wilson: Fire resistant shutters or curtains. 8233 Morel: Mechanism for imparting or transmitting various movements. 8563 New: Feeding of relatively low voltage lamps or other translating devices from a network of higher voltage. 9372 Daime: Apparatus or system for continuous straining and purification of water. 9393 Park: Valves for retaining fluid in containers. 9860 Rogers: Line-casting machines. 10197 Lachat: Ball bearings. 11069 Dauker: Manf. of lasts for boots and shoes. 11228 Herbst: Filling for use in concrete ceilings and floors. 11289 Schaller: Valve for vacuum pipes. 11356 Garcin: Dynamo electric machines. 11427 Britting: Reversible window-shade carriers. 11447 Hanington: Means for operating fanlights and the like. 11449 Keith and Keith: Preserving eggs. 11483 Nydahl: Explosion motors. 11498 Tremblay: Box openers. 11617 Sundling: Stoves, ranges, and the like. 11704 Furst: Nail cabinet for hotels and

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ON MEETING THE WORLD'S REQUIREMENTS.

IT does not require any very specialised knowledge to be able to confidently assert that there never was so great a demand upon the engineering abilities of the British nation in the equipment of the world—if we may use a large-sounding phrase. We say this in presence of a fairly intimate acquaintance with the efforts that are being made by separate nations to independently produce their own requirements; in full knowledge of the great advances that have been made recently by one or two foreign nations in scientific and engineering research and practical achievement; and also remembering that there are some who, pessimistically inclined, have allowed themselves to believe that for the time being, at any rate, if not for a lengthy period, a comparatively small number of unimportant undertakings would be available for our firms.

One has only to lift his eyes a little beyond these islands occasionally, and devote a little quiet thinking to the degree of development that has so far taken place in many foreign countries, to be impressed with the enormous field that lies needing either the services of the engineer and his men on the spot, or the manufactures in many varieties of tools and machinery that we are now making or are able to produce. It is close study of this kind which is followed by the conviction which has for years past led engineers to proceed on their own initiative, or at the express instructions of firms by whom they were engaged, to other countries, surveying, examining, and scheming. A great deal of our engineering trade in other parts of the world has been so built up, and anybody who has studied the altered position that has come to pass since some foreign countries began to travel with modernised technical and commercial equipment over the same ground, has seen that much of our future trade will be secured along the same lines. A good deal has been said of late regarding the greater British activity of the past year or so in dispatching representatives to foreign countries with the object of spying out the land, investigating engineering possibilities, engaging suitable agents to actively forward interests after their return, and so more firmly establishing the foreign trade connections of the British engineering manufacturer. Government reports from different parts of the world are frequently pointing out that there is either inadequate British trade representation or none at all in certain countries where developments are either actually taking place or may be expected shortly. From similar quarters comes information respecting alterations in the methods employed by hundreds of thousands of workers in the earning of their livelihood, of the peculiar state of backwardness indicated by even these altering methods, of the great possibilities that lie in store, both for the people themselves and for civilised manufacturing nations, if they can be brought to see the enormous advantages that are available from British, German, American, or other factories. We have seen in the awakening of some Far Eastern peoples how the westernising process promotes innumerable needs that were not thought of before. If these needs are to be supplied, they will add to the demand upon industrially inclined nations, or they will call for the erection and equipment of factories and works in the fitting out of which our engineers are specialists. Every new factory that is firmly established, either at home or abroad, while it meets the needs of one class of requirement in the class of thing it produces, becomes also a sure and certain customer of other manufactories in its turn. The more machinery there is at work, the greater quantity is there, in due course, requiring renewal or replacement, and the average requirement from that cause alone becomes proportionately larger, if a wise and enlightened scrapping policy be pursued, which enables full advantage to be taken of the constantly occurring improvements in design and system making for economy in working and efficiency in production.

We need not particularise in regard to the manifold directions in which there is plenty of scope for us and for other engineering nations, but we have been greatly impressed by what we have read in the reports regarding some of the more or less uncivilised parts of the world, where ways and tools that seem strange enough to us here to-day would soon be abandoned in favour of more up-to-date mechanical and scientific appliances, if it were only fully known that such are available, and that they can do things so differently. In the course of years no doubt information from the outside world may find its way through, and time may bring an increased disposition in favour of new ways of doing things—say, for example, in agricultural occupations—but is it not for us to see whether we cannot do something more to hasten the process. The world's needs are great indeed, and the industrial harvests are for those who are out to meet them.

AN INTERNATIONAL LOAD-LINE.—Progress towards the adoption of an International load-line continues good, and the latest country to signify its agreement with British regulations on the subject is Holland. This follows a similar understanding with France, Germany, Italy, and Sweden, and hopes are now entertained that other maritime nations, more especially the United States and Japan, will be induced to join. The Merchant Shipping Act, 1906, provides that where the Board of Trade certify that the laws and regulations of any foreign country relating to the overloading of ships are equally effective with the like provisions of the British measure, a vessel which has complied with these rules shall not be liable to detention or to any fine or penalty in any United Kingdom port. Shortly after the Act came into operation, the Board of Trade decided to recognise the load-lines assigned by the Bureau Veritas and the Germanischer Lloyd, under the authority of the French and German Governments respectively, and this was the beginning of a movement which has had no setback since.

ELECTRIC LIFTS ON SHIPBOARD.—The White Star liners Olympic and Titanic are each to be fitted with three first-class passenger lifts arranged in one trunkway, and one lift for second-class passengers. Each of the first-class lifts will raise 15 cwt. from the upper deck to the promenade deck, a distance of 37½ ft., and will travel at a speed of 100 ft. per minute. The size of the cages will be 5 ft. 4 in. by 6 ft. 7 in. high. In addition to the usual safety appliances, a special safety gear is provided on each cage to guard against excessive stretching of the suspension ropes. It consists of four steel cams connected by levers, and arranged to come into operation and grip the guides. This apparatus will be actuated by the opposing pull of the ropes, and will not depend upon springs, but in the event of simultaneous failure of both suspension ropes, the safety gear would be brought into action by means of an independent safety line. The guides for cage and counterbalance will be of turned steel, and the cage and weight fitted with adjustable gunmetal guides. The motors will be of the four-pole, totally-enclosed, shunt-wound type, rated at 6 B.H.P. when running at a speed of 500 revolutions per minute, coupled direct to machine-cut worm and wheel-winding gear.

BITUMINOUS SUCTION GAS PRODUCERS.—In a paper read before the Mining Institute of Scotland, Messrs. Crawford and Moores have described the Crossley bituminous suction producer, which claims to be a solution of the bituminous suction producer problem at which so many engineers have worked without satisfactory results. The producer is on the familiar down-draught principle. The fuel is in two portions. The upper portion is like the ordinary air-blown producer with a fire at its lower end. The air passes up through it and is converted into gas, containing a large proportion of volatile matter. The gases are then passed to the lower half of the producer and down through the second body of fuel; the incandescent coal being supposed to convert the volatile matter into fixed gases. In this way the proportion of tar and other dirty constituents in the gas is reduced to a minimum, and therefore the scrubbing plant is simple, usually consisting only of a coke scrubber with water spray. The principle of the down-draught producer is obviously easily applicable to pressure producers, and indeed this type of producer has found considerable favour in the United States, although no very definite information as to its practical success seems to come to this country.

Two new liners now being built by the P. and O. Company for its Australian mail service will be the largest ever built for the company. The Maloja and the Medina, as they are to be named, will be of 12,500 tons gross, or 1,500 tons bigger than their immediate predecessors of the "M" class. Each will be 550 ft. in length, with a breadth of 62 ft. 6 in., and will provide accommodation for 462 first and 216 second saloon passengers. These twin-screw vessels will be propelled by quadruple-expansion engines developing 15,000 H.P., and will have a speed of just under 19 knots. The Maloja, which is being built at Belfast, will, it is expected, be ready for launching in

January. The Medina is being built at Greenock. These two steamships will be among the largest passenger liners sailing out of the Port of London, and will constitute a notable addition to the already fine fleet which links up the Metropolis with the Commonwealth by way of the Suez Canal.

VENTILATION AND DUST REMOVAL IN COTTON MILLS.—II.

[CONTRIBUTED.]

(Continued from page 778, vol. xli.)

ARRANGEMENTS RELATING TO GASSING ROOMS.

In the preceding chapter we considered the nature of the problem of ventilation and dust removal in the card and gassing rooms of cotton mills. We shall now proceed to describe systems and appliances for dealing with the same, taking first the means proposed or adopted for preventing the charred fluff and other products of the combustion occurring at the gassing burners from being inhaled by the operatives.

Whilst it is imperative that the health of the operatives shall be efficiently safeguarded by the adoption of reliable means for preventing the atmosphere they breathe from being contaminated with injurious gases and dust or fluff, it is also very important that the said means shall not prejudicially affect either the efficiency of the machines to which they are applied or the earning power of the operatives. In connection with both gassing machines and carding engines, it is found that their efficiency is really enhanced by the use of suitable apparatus for collecting the products of combustion and the dust where they are generated, and removing the same before possibility of escape into the gassing and card rooms respectively; and as regard the operatives, such apparatus does not obstruct them in their work, and there will thus be no set-off against their increased earning capacity due to improved hygienic conditions.

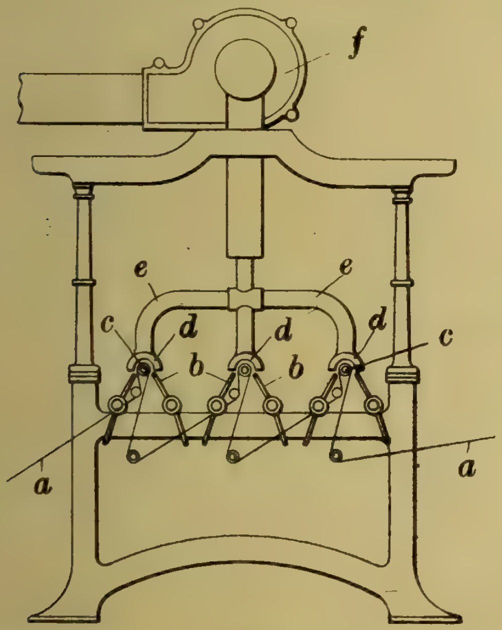


FIG. 5.

A really efficient gassing machine should possess the following qualities, namely:—

(1) Be capable of gassing any counts of yarn perfectly without striping same.
(2) Economy of gas.
(3) Complete removal of the fluff from the yarn without burning the latter.
(4) Perfect ventilation of each burner.
(5) Ease of attention.
(6) Efficient gassing at high yarn speeds.

For many years proposals have been made for providing hoods or canopies over each of the usual type Bunsen burners of a gassing machine, the hoods being connected by exhaust ducts with a fan which draws the products of combustion and charred fluff from the burners and discharges them outside the gassing room.

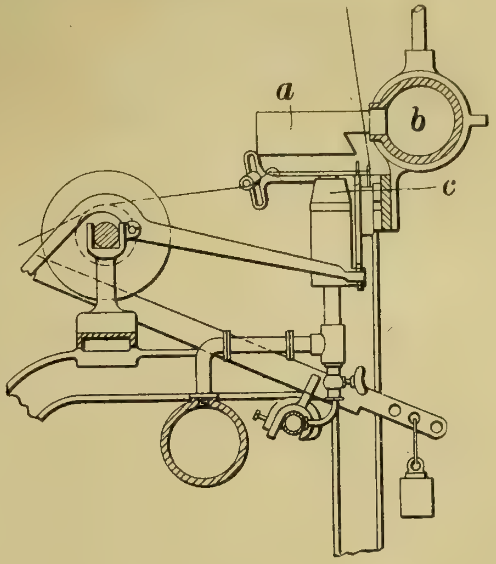


FIG. 6.

A ventilating system of this type is shown at fig. 5, which is taken from Cooke's patent specification No. 2,221, of 1860. The yarn or fabric *a* is gassed by flames from burners *b* arranged one at each side of rollers *c*. Over the latter are provided hoods *d*, which communicate with ducts *e* with the inlet of an exhausting fan *f*.

Fig. 6 shows the arrangement described in Villain's patent specification No. 6,851, of 1905, in which a hood *a*, connected with the exhaust duct *b*, is arranged over each burner *c*. The hood is made of oblong shape so as to extend beyond the burner *c* in order to exert a draught action on the products of combustion which the yarn, by its movement, tends to disperse into the gassing room.

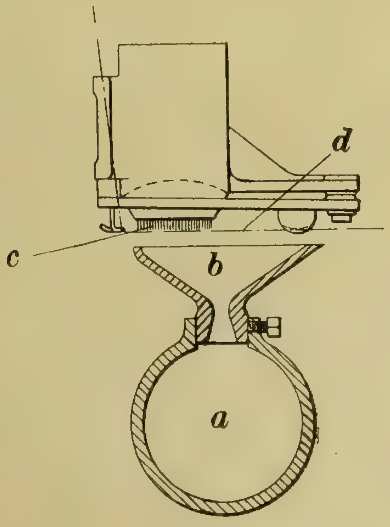


FIG. 7.

Another arrangement proposed by Villain in his patent specification No. 92, of 1906, is shown at fig. 7. In this case the exhaust duct *a* and hood *b* are arranged beneath the gassing burner *c* and yarn *d*. By the aforesaid disposition of parts it is claimed that the ash and like heavy matter removed from the yarn during gassing are more effectually exhausted than when the hood is arranged above the burner.

Mr. Villain has also proposed in his French patent specification No. 342,212, of 1904, to utilise the heat of the gases passing along the exhaust duct for vaporising a spirit which is used for producing the gassing flame. This arrangement is shown at figs. 8 and 9, where *a* indicates the gassing burner, *b* the hood, *c* the exhaust duct, and *d* a coil in which the spirit for the gassing flame is vaporised.

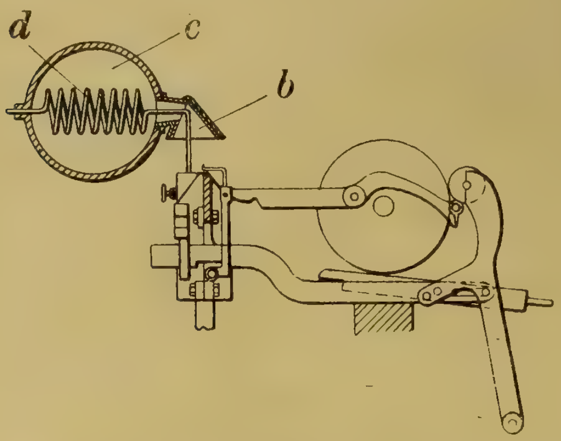


Fig. 8.

In the gassing frame described in Stubbs' patent specification No. 17,466, of 1908, and illustrated at fig. 10, a canopy *a* extends the length of the gassing frame, and has a conduit *b* therethrough which is under the exhaustion action of a fan. Said conduit is provided at intervals with openings having flaps or valves *c*, which control communication between *b* and *a*. The canopies are situated over the gassing burners *d*, so that the products of combustion and charred fluff are drawn into the duct *b* and discharged outside the gassing room. Incidentally the canopies *a* form racks or supports for bobbins.

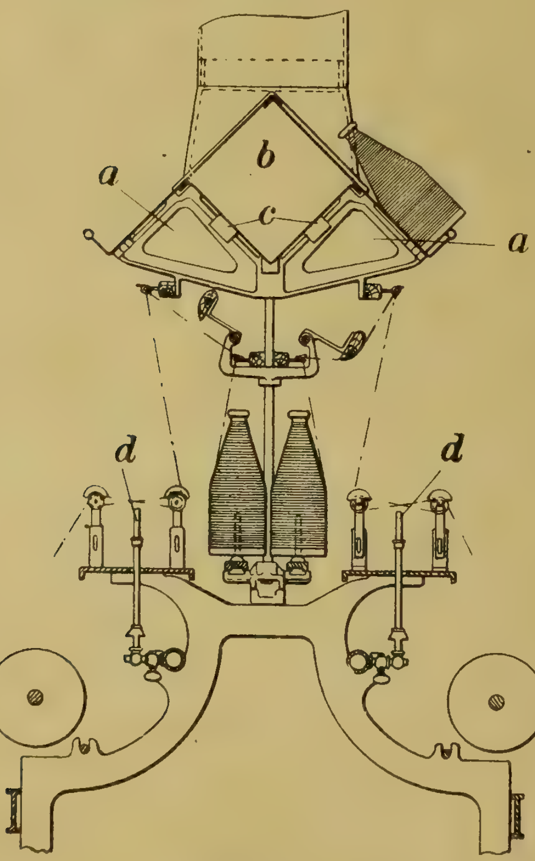


Fig. 10.

A ventilating arrangement very similar to that of Stubbs', illustrated at fig. 10, is set forth in Hall and Kay's patent specification No. 18,749, of 1909. It will be seen that in all the proposals above described an open Bunsen burner is employed, and the products of combustion are exhausted through a hood or canopy arranged adjacent to the yarn whilst it is being gassed. Any disturbing currents of air would materially lessen the efficiency of this system, as the products of combustion would travel beyond the hoods or canopies, and so into the gassing room. The motion of the yarn itself is also a disturbing factor in a system of this kind, in that it tends to carry with it the charred fluff or ash until the latter is removed by frictional contact with a guide eye or scraping surface.

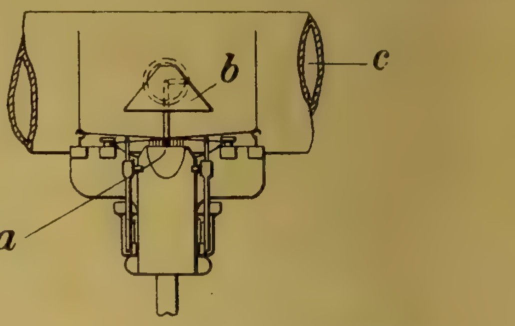


Fig. 9.

(*To be continued.*)

DERIHON "FRICTION MILL" FOR TESTING THE DURABILITY OF METALS.

The apparatus herewith illustrated and described was designed by the firm of Usines G. Derihon, at Loncin-lez-Liége, Belgium, for testing the durability of metals subject to wear. It has found its greatest use in the hands of the makers in investigating the suitability of various materials for use in automobile construction, for such applications as gears, bearing metals, etc., where durability is a prime requirement.

According to a writer in *Machinery*, with this apparatus the metal to be tested is subjected directly to wear under working conditions—that is to say, the wearing is effected by contact with a moving metal surface well lubricated; the only departure from working conditions lies in using a greatly-increased pressure to hasten the action. Suitable means are provided for measuring the wear by an accurate micrometer screw. The machine may be used for measuring the friction developed as well, but it should be noted that its specific purpose is that of measuring the rate at which a test piece of any material is abraded or worn away under the conditions imposed.

The construction of the apparatus is shown in figs. 1 and 2. It comprises a casing R, in which is mounted a disc O of extra hard steel, rotated from a motor or other prime mover at a constant rate of speed. A holder V, containing the sample to be tested, is pressed down on the periphery of the revolving disc by an accurate and adjustable set of weights P and Q. The amount that has been worn off from the sample by the revolving disc is tested from time to time by a micrometer screw K.

Casing R is filled about one-third full of oil to give the condition of lubrication desired. This casing is water-jacketed, space for this being provided at U as shown. By regulating the water supply, the temperature of the casing is kept constant, so that the factor of temperature does not have to be considered in comparing various tests. Disc O is one meter in circumference, and may be revolved at from 500 to 3,200 revolutions per minute, giving a surface speed varying from about 27 ft. to 175 ft. per second.

The test piece is in the form of a small cylindrical plug, set into the square shank V of stirrup G. This square shank is carefully adjusted and fitted in the stuffing-box guide shown, to avoid vibration and oil leakage. Care in the latter particular has to be exercised owing to the high centrifugal force with which the oil is thrown from the revolving disc.

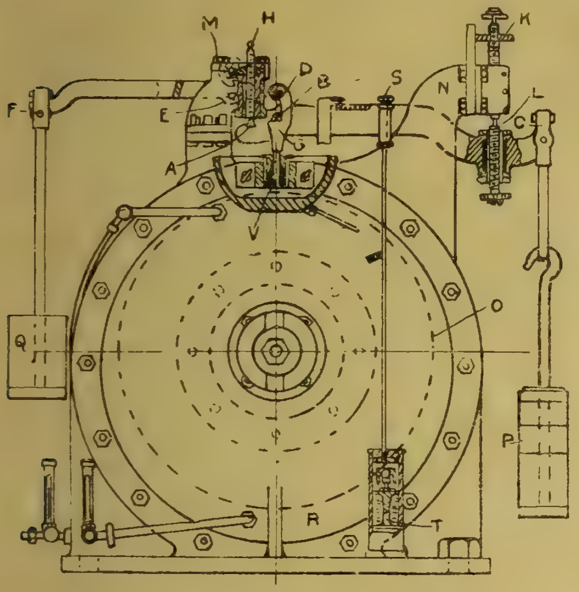


Fig. 1.

The pressure is applied to the sample by means of weights P, hung on the outer end of the lever, whose knife edges are shown at A, B and C. The fulcrum is at A. This bears on an abutment having a screw adjustment by means of screw H and worm M; by using this, lever A, B, C may be brought to the hoizontal position at the beginning of the test. The upper end of stirrup G carries a knife edge D, which receives the upward pressure of a lever pivoted at E, and carrying weight Q at its outer end. The purpose of this lever and weight is simply to balance the system before weights P are put in place. A sliding scale on the weighing lever provides the fine adjustment necessary for effecting this equilibrium. Weight Q, by furnishing another point of contact for stirrup G at D, serves also to hold the latter firmly in position.

With the test piece in place in V, and the levers set to the horizontal position by adjustment M, as described, the first thing to do is to set the micrometer screw to read from zero. Disc K being set at zero, screw L is turned until the points just come into contact. No dependence is placed on feeling in this matter, as that would not be delicate enough. Instead, screw L is insulated from the lever in which it is seated, and is connected by wire with a battery and galvanometer through the frame of the machine. By this means, just as the points of L and K come into the most delicate contact, that contact is registered on the galvanometer.

When the machine is started up with the micrometer dial K thus set at zero, the wear reduces the length of the sample plug of material in V, allowing weight P to drop. At regular intervals, the amount of this drop is noted by screwing down micrometer screw K until the galvanometer again shows contact. Since the ratio of distance A B to distance A L is 1 to 10, and the graduations on dial K read to 0·01 millimeter, actual changes in the length of the test specimen as fine as 0·001 millimeter are read directly, and with accuracy. A dashpot T is supplied as shown, connected with lever A, B, C by spring connection S. This steadies the action of the lever, tempering the vibrations and making fine measurements possible. The ratio of distance A B to A C is 1 to 12, so that the pressure applied is easily found.

The apparatus is provided with revolution counters, galvanometer, and thermometers for indicating the temperatures of the jacket water. The motor may be provided with volt and ampere meters if it is desired to make records of the power absorbed in friction. Since, however, this frictional loss is largely due to the friction between the plate and the oil bath, rather than that between the plate and the test piece, such use is not recommended.

In using this apparatus in testing the durability of metals, some investigations were made to see if there is any relation between hardness as measured by the Brinell apparatus and durability as measured by this machine. No direct relation between the two characteristics was discovered.

In these experiments the test piece was subjected to a pressure of 48 kilogrammes per square centimeter (682 lbs. per square inch), with the friction disc turning at 3,200 revolutions per minute or 175 ft. per second, for a period of ten million revolutions.

An examination of the result proved that the presence of carbon had an unexpectedly small effect on the resistance to wear as compared with manganese and silicon. This is in accordance with the experience in railroad work, in which rails high in manganese and silicon have been found to wear less rapidly than when these elements are lacking. It would seem that the carbon has practically no effect at all, since half-hard steel having a high percentage of manganese and silicon wears much less than hard steel having a small percentage of these two elements.

It is evident, and, in fact, proved by experience as well as by the experiments, that heat treatment has an effect on the resistance to wear. Mild steel which in the natural state wears 0·325 would only wear 0·025 if casehardened and tempered. Similar improvement occurs in nickel chromium steel.

Similar tests have been made on bronze and other bearing metals. Bronzes containing lead and antimony are of the kind which resist wear best, in spite of their weak cohesion. One of the test bars was so soft that an eight-millimeter ball under a weight of 12 kilogrammes made an impression on the metal. This same test bar, however, gave the smallest coefficient of wear. Hard bronze, on the other hand, such as phosphor-bronze, wears more rapidly. Hard bronzes have broken down and abraded as soon as the pressure reaches one kilogramme per square millimeter (1,422 lbs. per square inch) in the machine. On

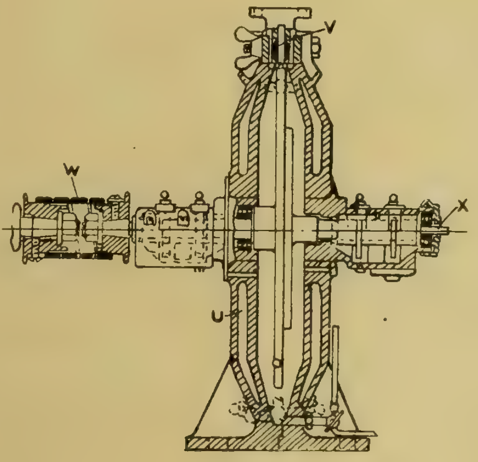


Fig. 2.

the contrary, soft and anti-friction bronzes have never acted in this way, whatever the pressure used.

The designers of this apparatus are now studying the effects of elements other than lead and antimony for bearing metal purposes, and expect to be able to publish valuable results in the near future.

THE MECHANICAL PRINCIPLES OF THE GYROSCOPIC MONO-RAIL SYSTEM.

[In our issue of the 24th June we described the Brennan mono-rail car exhibited at the Japan-British Exhibition. This article is an endeavour to develop by brief elementary methods the mathematics and physics of the gyroscope, and their application to the mono-rail car.]

EARLY in 1907, Louis Brennan, the inventor of the Brennan torpedo, exhibited before the Royal Society of England a working model of a mono-rail car which was able to preserve its equilibrium perfectly while in motion or at rest, while travelling around sharp curves, while running on a swinging cable, or subjected to sudden shifting of load from side to side. The apparatus by which automatic balance is preserved in this remarkable manner consists of a pair of heavy flywheels mounted on the car, which rotate at high speed in opposite directions about axes transverse to the car. The gyroscopic effect of these rotating wheels prevents the car from toppling over, somewhat as a top is prevented from falling while spinning.

On November 11, 1909, a further demonstration was given with a full-sized car in the War Office grounds of Great Britain, at Chatham, England. Accounts state that the car, which was there operated with entire success, was 40 ft. long, 10 ft. wide, and 13 ft. high, and weighed 22 tons. The car ran on a single rail around a circular track 220 yards in circumference at a speed of 25 miles an hour, carrying a load of 40 passengers on its platform, where they had entire freedom of movement. The balance was automatically preserved by the action of the two gyroscopes, $3\frac{1}{2}$ ft. in diameter, weighing three-quarters of a ton each, and revolving at the rate of 3,000 revolutions per minute. The gyroscopes run in a vacuum to reduce friction. A gasolene engine was used to propel the car and keep up the speed of the gyroscopes.

It is reported that a German mono-rail car is soon to be exhibited embodying the same principle, of which the motive power will be electrical. Indeed, synchronous motors would apparently furnish an ideal means of keeping the two gyroscopes in step with each other, and the trolley would be a natural means of propulsion for such a car.

Models to illustrate the working of the Brennan car constructed in America from the designs of Professors Crew and Tatnall, Northwestern University, are open to public inspection, as shown in fig. 1. It is said by the makers to embody the following essential points, which are here quoted from their published statement, with a few emendations and amplifications:—

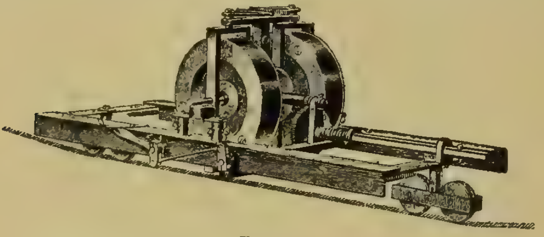


FIG. 1.

A. The use of two gyroscopes or flywheels, mounted side by side in frames, as shown in fig. 1, and rotating about a horizontal axis in opposite directions with equal speed. The precessional couple about an axis lengthwise of the car, due to the turning of the car about a vertical axis in rounding a curve, is equal and opposite for the two gyroscopes, hence the upsetting torque arising from this source vanishes.

B. The employment of a pair of shelves or plates as friction surfaces, attached to the sides of the car, one on each side. When the car begins to tip over to one side, one of these shelves is raised and begins to press against the rotating end of the gyroscope axle, which projects over it. This pressure causes the gyroscope to turn, or precess, about a vertical axis. The frame of the second gyroscope is geared to that of the first in such a way that it is forced to turn equally in the opposite direction, as shown at the top of fig. 1. The axle, on account of friction on the shelf along which it tries to roll, has a force exerted on it whose moment tends to increase the precession. The moment of this frictional force about a vertical axis has the effect, not to increase the precession already taking place, but instead to cause precession about the longitudinal axis. The opposite moments acting on oppositely rotating gyroscopes conspire to cause precession in the same direction about the longitudinal axis of the car. This rights the car and tips it slightly to the other side, to be brought back again by the second shelf. The centre of gravity of the whole car is thus kept oscillating very slightly on either side of the line of upward thrust of the rail.

C. The use of a second pair of shelves next to the first pair, each engaging an idle roller whose friction is negligible, attached to the gyroscope frame, and serving to return the frame after displacement to its normal position transverse to the car.

D. The use of a single central frame in which both the gyroscope frames turn, or precess, which is itself solidly mounted on an axis lengthwise of the car, and on the same level with the gyroscope axes, so that this frame and the gyroscopes it carries can together tip to the right or left with reference to the car, or the car can be tipped with reference to them, to an amount determined by the clearance between the shelves and the gyroscope axes over them.

This description of the car and its action will become more clear after following the developments in the remainder of the article.

Gyroscopic action has up to the present time not been regarded as one of the available devices for securing mechanical effects in machine design, but rather as one to be avoided, and where unavoidable, one to be guarded against in the same manner as is done in most cases of centrifugal action. For example, the centrifugal force tending to burst a flywheel must be carefully guarded against in design and operation, but on the other hand centrifugal action is boldly made use of as the essential element of design of engine and turbine governors of all sorts. In the same way the gyroscopic action of armatures on shipboard must be carefully provided against. But, as appears from this invention, we must, hereafter, be prepared to make use of the peculiar properties of gyroscopic action to produce mechanical effects that are otherwise unattainable.

To this end, it is the purpose of the present paper to set forth the principles of gyroscopic action in general, and in particular to describe their application to the mono-rail car, in such an elementary and geometrical form as to make the action intelligle and calculable without recourse to complicated mathematics. This may be done most readily by help of the close analogy, or, say, identity, which exists between the mathematics of centrifugal action and that of gyroscopic action.

This we now proceed to develop. Suppose a body of mass m revolve in the horizontal plane of fig. 2 about C, to which it is attached by a string of length r. If the linear velocity m along the circle of radius be v, then it is well known that the tension of the string

$$t = \frac{m\ v^2}{r} = m\,u^2\,r = m\,v\,u \quad . \quad . \quad . \quad (1)$$

---

* Abstract of paper by H. T. Eddy in *Journal of the Franklin Institute.*

in which the deviating (or centrifugal) force t continually draws m away from the straight path it would otherwise follow along a tangent of the circle, and u is the angular velocity of revolution, *i.e.*, the linear velocity of a point on r at the distance of unity from C.

Equation (1) may be written in the form

$$1 : m\,v :: u : t \qquad . \quad . \quad . \quad . \quad . \quad (2)$$

from which it appears that if the distance r = C B = C F be taken on some arbitrary scale to represent graphically the numerical amount of the momentum $m\,v$, and it be laid off at right angles to the direction of the momentum along B F, viz., at successive instants along r in its successive positions, then on the same scale the length of the arc B F at right angles to the successive positions of r measures the impulse of the deviating force, which is numerically the same as the tension t, the tension at any instant being at right angles to the arc, just as $m\,v$ at any instant is at right angles to the position of r at that instant.

The elementary considerations by which equation (1) is established will not be here developed, as they may be found in any treatise on the mechanics of motion. Equations (1) and (2) express a necessary relationship of the mechanical and physical quantities concerned. For example, the tension t can be increased only by some suitable change in one of the other quantities, such as using either a greater mass m, or imparting to it a higher velocity v, or making r the radius of the circle of motion smaller.

Now, in order to develop the corresponding equations for gyroscope action, let us assume that a gyroscope or flywheel (whose moment of inertia about its axis of rotation is M) is rotating with its axis initially horizontal at C B. It is to be noticed that the actual linear motion of its particles in space is at right angles to C B, as was the linear motion of m previously treated. Let the axis have a point of support at C only, and let the centre of gravity of the total weight W supported at C be situated at B, a distance of C B = R from C, so that it requires a couple of torque T = W R, combined with a vertical force at C = W (the weight acting at B), in order to keep W from falling. Let the gyroscopic wheel revolve about C B with an angular velocity V, then its constant angular momentum about C B is M V.

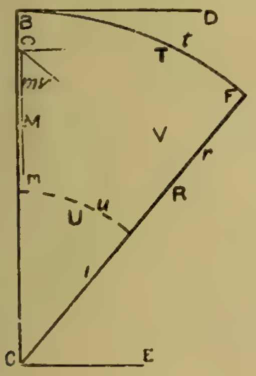


Fig. 2.

On some arbitrary scale let R = C B = C F be taken to represent graphically the numerical amount of the angular momentum M V. On the same scale the arc B F = T may be taken to represent the deviating angular impulse of the torque T, which is numerically the same as the torque T. This angular impulse continuously generated by W at right angles to the angular momentum M V is to be compounded with it in precisely the same manner that the linear impulse generated by the deviating tension t is compounded with the linear momentum $m\,v$, instant by instant, during its generation, in order to produce a uniform deviation in a circle.

The torque T due to the weight W at B acts always at right angles to the axis of the angular momentum M V, just as the tension t at B acts always at right angles to the linear momentum $m\,v$, hence M V and T must be compounded according to the same law as $m\,v$ and t.

Therefore

$$1 : M\,V :: V : T \qquad . \quad . \quad . \quad . \quad . \quad (3)$$

or

$$T = M\,V\,U = \frac{M\,V^2}{R} = M\,U^2\,R \qquad . \quad . \quad (4)$$

in which U is the angular velocity of R about C in the horizontal plane, and the gyroscope is said to precess or turn at the rate U. The apparently paradoxical action of the gyroscope consists in this, that while rotating about one axis a torque acting on it apparently tending to turn it about a second axis at right angles to the first, actually does turn it about a third axis at right angles to the other two, and this is its only effect.

Equation (4) may also be written:

$$W = \frac{T}{R} = \frac{M\,V\,U}{R} = \frac{M\,V^2}{R^2} = M\,U^2 \qquad . \quad . \quad (5)$$

These equations (3), (4), and (5) express physical relations that must necessarily exist in gyroscopic action during dynamic stability of motion. They show, for example, that a decrease in the rotary velocity V through friction or otherwise would require a more rapid precession U in order to support the given weight W, a fact readily observed; or again, V remaining unchanged, any increase in W will produce a corresponding increase in U, as appears at once experimentally.

In order to comprehend clearly how the direction of precession is related to the rotation and torque, suppose the rotation of the gyroscopes appear clockwise to an observer looking from B towards C, then to an observer looking from D to B gravity tends to make the axis B C rotate about C, so that the impulse of T is clockwise also about a horizontal axis E C, which is parallel to the tangent at B to an observer looking from E to C.

This angular impulse of T, generated instant by instant, is continuously compounded with the constant angular momentum M V. Since it acts always at right angles to M V, its effect is not to increase or decrease M V, but solely to change its direction, so that the axis of rotation R is steadily moved forward to successive positions intermediate between B C and E C, and thus at the end of a unit of time it occupies some position C F. It will evidently move to a position between B C and E C whenever both are clockwise, which will therefore also make the precession U clockwise when the observer looks down on C.

Careful attention should be given to the relative directions of rotation just indicated for the three quantities T U V, which are arranged in alphabetical order, are mutually at right angles, and are so situated with respect to each other that they follow each other cyclically clockwise to an observer looking towards C from any point in the solid angle between them, and they each indicate clockwise rotation to an observer looking along either of them towards C. Considered in this way, it is not difficult to analyse gyroscopic effects into clockwise actions, since every rotation is clockwise for one aspect or the other. It further appears that a force applied at right angles to W in an attempt forcibly to increase or decrease the precession U would fail to do so, but would instead produce a precession in a vertical plane, thereby causing W to rise or fall according to the above rule. It would greatly assist the student of the mono-rail car to use a pair of graphical models made of corks, into which three pins of different kinds are stuck at right angles, one along the axis of the cork to represent V or M V, and two others at right angles for T and U respectively, placed in the order mentioned above.

In all this discussion of centrifugal action and gyroscopic action it will be noticed that we have carefully confined our attention to the relaton between the external applied forces and the motions ensuing, and have not considered the equal and opposite internal forces that are developed in the form of reactions in equilibrium with the applied forces. This has been done for the sake of simplicity, and to avoid all possible confusion as to cyclic order, etc. Its correctness as a method can no more be questioned than can its application to the case of motion of a falling body where the external force of gravitation acts and motion ensues, and no regard need be had to the fact that by its inertia the body develops an internal reaction equal and opposed to the force of gravitation.

(*To be continued.*)

HYDRAULIC BRAKE MECHANISM OF CRANES.

The following description and accompanying drawings relate to hydraulic brake mechanism used with cranes and like lifting machinery. A brake for this purpose is frequently formed of a hydraulic cylinder, the piston in which is reciprocated by a crank disc, rotated by the hauling mechanism in such a way that the water passes from one side to the other of the piston through an orifice, the size of which can be adjusted. According to this arrangement, a ratchet or free-wheel mechanism is interposed between the crank and the crane gear in such a way that the brake is operated only when the hauling mechanism is lowering, and not when it is lifting, and therefore the brake offers no resistance to lifting. In the drawings illustrating this device, fig. 1 is a plan and fig. 2 a side elevation of a crane in which the winding drum *a* is driven by the electric motor *b* through the gear wheels, *c*, *d*, *e*, *f*, *g*, *h*. The shaft *i* to which the gear wheel *d* is fixed has also secured to it a gear wheel *j*, through which the braking mechanism is driven as follows:—

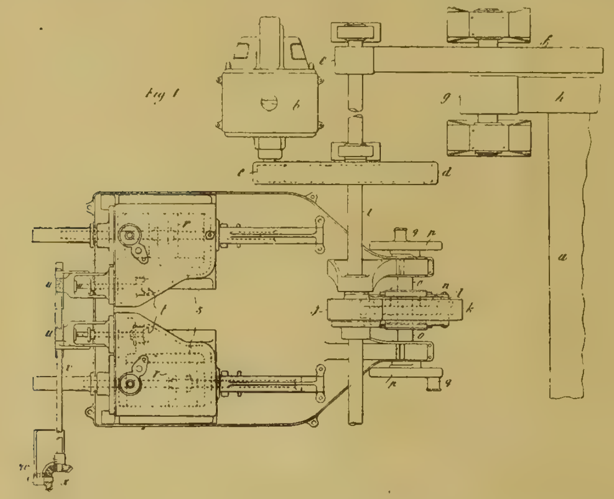


Fig 1

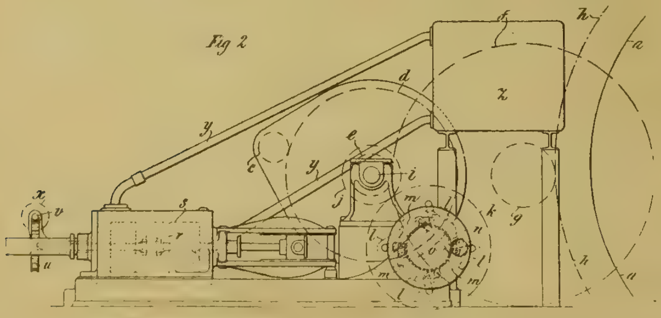


Fig 2

The gear wheel *j* drives the externally-toothed ring *k*, to which are pivoted the pawls *l* adapted to engage the ratchet teeth *m* of the wheel *n* fixed to the shaft *o*, to which two crank discs *p* with their crank pins *q* are also attached.

The crank pins *q* reciprocate the pistons *r* in the cylinders *s*, which pump water past valves *t*, which can be opened to the desired extent by the worm gear *u* on the shaft *v*, actuated by a hand wheel situated in any convenient position on the shaft *w* through the bevel gear *x*.

When the hauling mechanism is lowering, the brake mechanism is driven by the pawls *l* acting on the ratchet teeth *m* of the wheel *n*; but when a load is being lifted, the pawls over-ride the ratchet teeth, so that the brake mechanism is not operated, and consequently no resistance is offered.

In order that the cylinders *s* shall not become unduly hot they are water jacketed, the pipes *y* to the water jackets being connected to the water tank *z*.

The joint patentees of this useful invention are the well-known crane firm of Messrs. Stothert and Pitt Ltd. and Mr. G. T. Peters, of Bath.

NOTES ON THE OPERATION AND TESTING OF POLYPHASE INDUCTION MOTORS.

By J. W. Rogers.

(*Continued from page 14.*)

In the case of three-phase machines, the windings may be connected in either star or mesh fashion. With a mesh connection the resistance between any two terminals is the resultant of one phase in parallel with the other two phases in series. If r represents the resistance of one phase, then

$$R = \frac{r \times 2r}{r + 2r} = \frac{2r^2}{3r} = \frac{2r}{3},$$

so that the resistance between terminals is only two-thirds of the resistance per phase, that is to say, the resistance per phase

$$= \frac{\text{resistance between terminals} \times 3}{2}.$$

In the case of a star-connected winding, the resistance as measured between terminals is that due to two phases in series, so that the resistance per phase will be = resistance between terminals ÷ 2.

The total resistance R of a three-phase winding

$$= \frac{R_1 + R_2 + R_3}{3 \times 2}$$

where R_1, R_2, and R_3 represent the resistance between the different terminals,

$$\therefore R = \frac{\text{mean resistance between terminals}}{2},$$

and this expression is correct for any polyphase winding. A knowledge of the total resistance of the winding enables its copper loss to be calculated.

The copper loss in any polyphase winding

$$= \frac{C^2 R}{2},$$

where R = mean resistance between terminals, and C = total amperes = amperes per phase × 2 for two-phase, and amperes per phase × $\sqrt{3}$ for three-phase machines, and the accuracy of this formula may be proved as follows:—

In the case of a two-phase winding, if C = total current, and R = resistance between terminals, then amperes per phase

$$= \frac{C}{2},$$

and watts lost in each phase

$$= \left(\frac{C}{2}\right)^2 R = \frac{C^2 R}{4};$$

therefore watts lost in both phases

$$= \frac{2 C^2 R}{4} = \frac{C^2 R}{2}.$$

With a three-phase winding, if C = total current, then amperes per phase

$$= \frac{C}{\sqrt{3}},$$

and watts lost in each phase

$$= \left(\frac{C}{\sqrt{3}}\right)^2 \times \frac{R}{2} = \frac{C^2}{3} \times \frac{R}{2};$$

therefore watts lost in the three phases

$$= 3\left(\frac{C^2}{3} \times \frac{R}{2}\right) = \frac{C^2 R}{2}.$$

In practice, it is the custom to allow for the increase in the primary resistance, due to heating, by adding about 10 per cent to the value of resistance as calculated by the formula given above.

Saturation Tests.—These tests are made chiefly to serve as a check on the design of the magnetic circuit.

The running saturation curves are obtained by running the motor light at various voltages, commencing with a voltage 25 per cent above its normal value, and taking readings of amperes per phase, terminal volts, and real watts, this last quantity being measured preferably by the two-watt meter method. From the results of this test, curves are plotted having total amperes and watts as ordinates, and terminal volts as abscissæ. The amperes curve may be compared to the saturation curve of a direct-current machine, and from it the no-load and magnetising current taken at different voltages may be obtained; the watts curve represents the iron loss and friction at different voltages.

An open-circuit test is generally made on motors having wound rotors for the purpose of checking the E.M.F.'s induced in the secondary winding when a given voltage is applied to the primary. It is carried out in a similar manner to the running saturation test, with the exception that the rotor will be stationary, the readings taken being those of amperes per phase, real watts, and slip-ring volts, which are represented by curves having primary volts as abscissæ, and the other quantities as ordinates. As is well known, the ratio of the primary to the secondary current varies inversely as the primary volts, that is to say—

$$\frac{\text{Secondary volts}}{\text{Primary volts}} = \frac{\text{Primary current}}{\text{Secondary current}}$$

also, the resistance of the windings will vary inversely as the square of the currents, that is, directly as the square of the primary voltage. It follows, therefore, that the slip-ring volts may be calculated when the values of the resistances of both windings and the primary volts are known, although the results are only approximately correct.

The slip-ring volts for a three-phase stator and three-phase rotor

$$= \frac{\sqrt{\dfrac{\text{Rotor resistance} \times \text{stator volts}^2}{\text{Stator resistance}}} \times \sqrt{3}}{K}$$

and with a three-phase stator and two-phase rotor

$$= \frac{\sqrt{\dfrac{\text{Rotor resistance} \times \text{stator volts}^2}{\text{Stator resistance} \times 1{\cdot}5}} \times \sqrt{3}}{K}$$

where K a constant having a value about 1·05, being an allowance for the leakage flux, or that portion of the primary flux which does not pass through the secondary winding. The factor 1·5 is used for obtaining the resistance per phase between terminals with a mesh winding, of which the resistance between terminals is two-thirds of the phase resistance,

$$\therefore \text{ phase resistance} = \frac{3}{2}$$

or 1·5 times the resistance between terminals. The locked saturation and torque test is carried out by short circuiting the rotor winding, fixing a brake arm to the motor shaft, and connecting the motor to the supply circuit in the same manner as for a running saturation test, the torque being measured by means of scales. The motor is supplied with a low voltage, which is gradually increased to its normal value if the capacity of the generating plant and the design of the motor permits, the readings taken being those of terminal volts, amperes per phase, real watts, and scales, the results of this test being represented by curves having kilowatts, total amperes, and pounds torque as ordinates, and terminal volts as abscissæ; the value of torque is given by (scales reading − weight of brake arm) × length of arm in feet. The information to be derived from the locked saturation curves enables the inductive component of the volts, and also the effect of magnetic leakage to be calculated; a knowledge of the starting torque at different voltages is also obtained from this test. A test sometimes made at the conclusion of the locked saturation is that known as the pulling-out or maximum torque test, the voltage at which it is desirable to make it depending upon the output and characteristics of the motor. The resistance of the rotor circuit also has an important bearing on this point, due to the fact that the pulling-out torque is very much greater than the starting torque when the rotor resistance is low. It follows, therefore, that the current taken by a large motor is liable to reach an enormous value, and for this reason it is adviable to measure the maximum torque at a voltage below its normal value. The maximum torque is measured by adjusting the terminal voltage to its required value and holding it constant. The brake is then tightened and balance adjusted on the scales until the motor slows down rapidly without increasing the torque, the actual pulling-out point being reached when the motor begins to slow down, at which instant readings of volts and scales are taken.

As practically the same readings are required, an impedance test is generally made in conjunction with the locked saturation, the rotor being short-circuited and held in two different positions with respect to the stator, corresponding to maximum and minimum values of the stator current, which is first adjusted to its normal full-load value. The readings taken are those of terminal volts, amperes per phase, and real watts, the following data being calculated from the results of this test. The impedance of the motor in ohms per phase

$$= \frac{\text{Stator volts per phase}}{\text{Amperes per phase}}$$

and the reactance

$$= \sqrt{(\text{impedance}^2 - \text{resistance}^2)}.$$

The inductance per phase in milli-henries

$$= \frac{\text{reactance} \times 10^3}{2\pi\, n}$$

where n = frequency.

Power and Slip Curves.—These consist of a series of curves representing the complete performance of a motor, and they may be obtained either (1) directly from a brake test, or (2) by calculation from the losses. A brake test is conducted in a similar manner to the locked saturation test, but as the motor will be running, the brake must not be locked on the rotor shaft. The motor is run at various values of torque, representing different loads, its full-load torque being calculated from the brake horse-power output, and the corresponding speed in the following manner: The full-load torque of a motor is obtained from

$$\frac{T \times \pi \times D \times R.P.M.}{33000} = H.P.$$

where T = torque in pounds and D = diameter of pulley in feet,

$$\text{then } T = \frac{H.P. \times 33000}{\pi \times D \times R.P.M.}.$$

The torque exerted at 1 ft. radius is given by

$$\frac{B.H.P. \times \frac{33000}{2\pi}}{R.P.M.} = \frac{B.H.P. \times 5252}{\text{Speed}}.$$

A complete set of readings is taken at different outputs, including a 25 per cent overload, consisting of terminal volts, amperes per phase, real watts, torque, slip, and motor speed. When a slip meter is not available, the "slip" of small motors may be obtained with a fair degree of accuracy by measuring the frequency of the currents in the rotor windings. This is done by connecting a low-resistance ammeter across the slip-rings, or in the absence of these the meter may be connected between the ends of the shaft. If the ammeter has its zero in the middle of the scale, the vibration of its needle from zero to the left, back through zero to the right, and back to zero, will indicate one period. The number of complete vibrations or beats per minute is then measured, the percentage slip being

$$= \frac{\text{beats per minute} \times 100}{\backsim \text{ of supply} \times 60}.$$

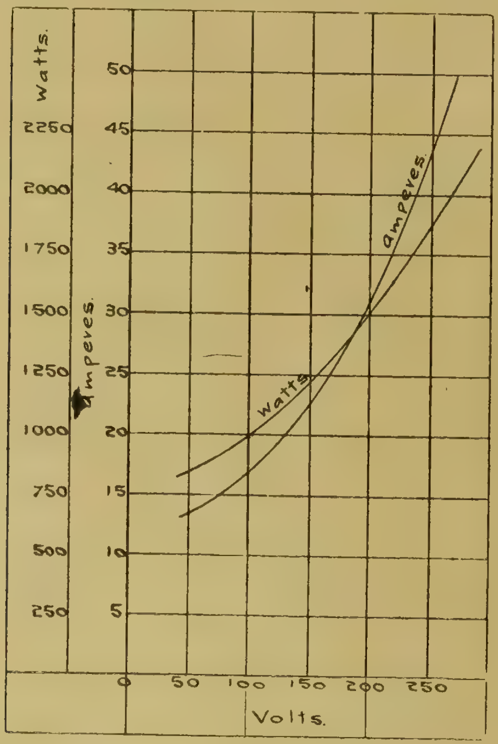


FIG. 4.

The slip may also be calculated from

$$\frac{\text{Synchronous speed} - \text{motor speed}}{\text{Synchronous speed}},$$

but this method is not considered very satisfactory owing to the difficulty in measuring the speed with any degree of accuracy.

When the power curves are to be worked up from the losses a speed curve is also required, having total amperes as abscissæ and speed as ordinates, which shows the relation between the primary current input and the speed at different loads. This completes the series of shop tests, from which are obtained the data required to work out the performance curves of an induction motor, and the following figures may serve as an example of one method of working out these curves.

They represent the results of a test on a 40-H.P. 50-∿ 220-volt three-phrase motor, of which the stator resistance between terminals had the following values:—

Phase 1-2 = ·0501$^{\omega}$, phase 1-3 = ·0496$^{\omega}$, and phase 2-3 = ·0482$^{\omega}$; therefore stator resistance

$$= \frac{\cdot 0501 + \cdot 0496 + \cdot 0482}{3 \times 2} = \cdot 02465^{\omega}.$$

The running saturation or "no-load" curves of this machine are shown in fig. 4, and the power curves of amperes, slip, and kilowatts, etc., in fig. 5. The efficiency of an induction motor

$$= \frac{\text{power in watts converted into horse-power at the pulley}}{\text{watts input}},$$

$$= \frac{\text{watts input} - \left\{ \begin{matrix}\text{stator}\\ \text{copper}\\ \text{loss}\end{matrix} + \left(\begin{matrix}\text{no load}\\ \text{stator}\\ \text{loss}\end{matrix} - \begin{matrix}\text{no load}\\ \text{copper loss}\\ \text{in stator}\end{matrix} \right) \right\} \times 1 - \text{slip}}{\text{watts input}},$$

and by taking any particular value of total amperes on the power curve, and reading off the corresponding values of real kilowatts and percentage of slip, the different quantities may be calculated by means of this formula. The data obtained for one particular value of load on the motor referred to in this example had the following values: Total amperes = 173·2 corresponding to 100 amperes per phase, terminal volts = 220, real kilowatts = 30·6, slip = 2·5 per cent, and speed = 975 revolutions per minute.

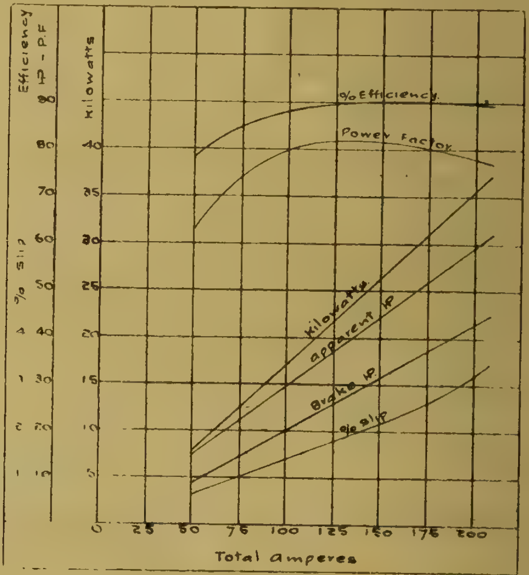


FIG. 5.

The stator copper loss = total amperes² × total resistance = 173·2² × ·02465 = 740 watts, and a reference to the running saturation curves show that the "no-load" current at 220 volts = 35·4 total amperes, and "no-load" watts = 1640, the no-load copper loss being = 35·4² × ·02465 = 31 watts.

Substituting these values in the formula given above,

$$\frac{30600 - \{740 + (1640 - 31)\} \times 1 - \cdot 025}{30600}$$

$$= \frac{(30600 - 2349) + \cdot 975}{30600} = \frac{27570}{30600}$$

= 90·1 per cent efficiency.

Real H.P. = real watts ÷ 746
= 306000 ÷ 716 = 41 H.P.
B.H.P. = real watts – losses ÷ 746
= 27570 ÷ 746 = 36·9 H.P.
Apparent H.P. = apparent watts ÷ 746
= total amperes × terminal volts ÷ 746
= 173·2 × 220 ÷ 746 = 51·1 H.P. ;
therefore apparent efficiency = B.H.P. ÷ apparent H.P.
= 36·9 ÷ 51·1 = 72·3 per cent.

The real efficiency is also given by

$$\frac{\text{B.H.P.}}{\text{Real H.P.}} = \frac{36{\cdot}9}{41} = 90{\cdot}1 \text{ per cent.}$$

The power factor at this particular load

$$= \frac{\text{Real watts}}{\text{Apparent watts}} = \frac{30600}{38100} = {\cdot}805.$$

The torque developed at 1 ft. radius

$$= \frac{\text{B.H.P.} \times 5252}{\text{speed}};$$

therefore torque at 37 B.H.P.

$$= \frac{37 \times 5252}{975} = 199{\cdot}5 \text{ ft.-lbs.}$$

The quantities mentioned above have been calculated for several different loads on the motor, and the resultant performance curves are shown in fig. 5.

(*To be continued.*)

VALVES FOR INTERNAL-COMBUSTION ENGINES.

The use of valves of the poppet type is now being largely superseded by the slide and piston valve types, and amongst other designs of the latter types of valves may be mentioned a construction, recently patented by Messrs. Foster and Hamilton, whereby a quicker opening and closing of the valve ports is obtained.

Referring to the illustration which shows a sectional view of part of the cylinder and the valve, A is the main or working cylinder of which B is the clearance space or combustion chamber. C is the valve cylinder. D is the port between the combustion chamber and the valve cylinder. G is the outer piston valve formed as a sleeve open at the top. The piston sleeve valve G has the second small piston valve H fitted concentrically within it.

T is an annular space or channel formed in the wall of the valve cylinder C, so as to allow the ports R to be cut in the sleeve G all round it, with the intermediate or connecting sleeve portions as shown.

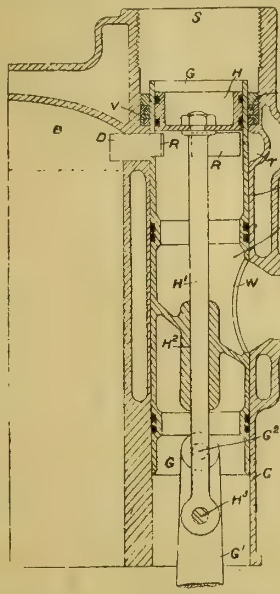
The valve sleeve G is connected with an eccentric on the half-speed shaft by means of the connecting rod G^1, its wrist pin G^2 (shown dotted) being placed on one side for the purpose. The piston rod H^1 of the small valve piston H, slides through the guide H^2 formed integrally with the outer valve sleeve G. The wrist pin H^3 on the end of the rod H^1 is connected by a connecting rod to a centrally-placed eccentric on the half-speed shaft.

The packing rings V which surround the sleeve G are held in position by the screw ring shown.

The sleeve G has cut in it the ports R adapted to register with the port D and space T. The sleeve G also has the port W which is open to the outlet port W^1 formed in the cylinder wall C.

The piston valve sleeve G is connected by its rod G^1 and eccentric in such a manner that ports R register with the space T for half the cycle approximately, that is to say, during both the exhaust and suction strokes of the working piston. The piston valve H is caused by means of its eccentric, piston rod, and connecting rod to move above the ports R and D and the annular space T during the exhaust stroke of the working piston, and to move below these ports during the suction stroke. When the piston H is approaching the bottom of its stroke the ports R and D place the combustion chamber B in communication with the inlet passage S to which the carburetter or induction pipe may be fitted. The exhaust gases, when the piston H is above the ports R and D, pass out through the ports W and W^1 to the exhaust pipe.

The valves operate in the following manner: When the main working piston is on the top dead centre just about to commence the power stroke, the eccentric which drives to outer sleeve of the valve is then about 7 deg. or 8 deg. on its downward stroke, and the eccentric which drives the inner piston of the valve is about 105 deg. behind the first eccentric, or about 98 deg. before the top of its stroke.



Valve for Internal-combustion Engine.

When the main piston has travelled about 135 deg. on its combustion stroke, the eccentric operating outer valve sleeve has travelled about 74 deg., at which point the ports in the sleeve begin to uncover to allow the exhaust to escape to the exhaust pipe. At this period the inner piston has travelled above the ports and keeps the induction pipe sealed. During the exhaust stroke of the main piston, the ports are in communication with the exhaust pipe.

When the piston is at the end of its exhaust stroke the outer valve sleeve is beginning to return on its upward stroke, and the inner piston descending on its downward stroke closes the ports from the exhaust pipe and opens the ports to the induction pipe.

When the main piston has reached the end of its induction stroke, the outer sleeve by means of the ring of packing on the outside of the sleeve makes a gas-tight joint during the compression and combustion strokes.

When the main piston is on the dead point of its firing stroke, the half-speed eccentric driving the outer sleeve valve is 7 deg. or 8 deg. on its downward stroke and the eccentric driving the inner piston is 98 deg. before the end of its upward stroke.

Largest Wire-rod Mill in England.—At the Tinsley works of Messrs. William Cooke and Co., Sheffield, the largest wire-rod mill in the country was formally opened on the 21st June. It is capable of rolling a 3 in. billet into a wire rod of 200 lbs. weight in a minute and a third, and in ordinary work the production is from 25 to 30 tons per shift. Before the mill was completed the late chairman and managing director, Mr. Thomas Wilkinson, secured orders enough to keep the wire-rod plant running night and day for 12 months.

MODERN AUTOMOBILE PRACTICE.

By A.M.I.A.E.

[ALL RIGHTS RESERVED.]

In this series of articles the writer will deal with up-to-date practice of petrol-driven vehicles, with special reference to the transmission, but before so doing will briefly review some of the leading characteristics of the engine. Automobile engines are now almost entirely of the internal-explosion type in one of its several forms, and in consequence these articles will not deal with the other kinds of self-propelled vehicles, such as the steam and the electric car.

By far the simplest and most reliable form of engine, though perhaps the least economical, is that operating on the two-stroke principle, and whilst this type may not yet be much employed here in England, it has a much wider use in America, and has long been recognised as being the most satisfactory for marine work, especially along rocky coasts, where a momentary stoppage would cause instant destruction to the occupants of the boat. As this form of engine may later become more popular, we will not dismiss it without a little consideration.

Two-stroke Engine.

Briefly stated, the simplest form of two-stroke engines, and probably of any form of prime mover, is the three-port, two-cycle engine, in which the only moving parts are the piston, connecting rod, and crankshaft; this engine works on what is called the Day cycle, which will be readily understood by reference to figs. 1 to 6, in which the operations are diagrammatically represented.

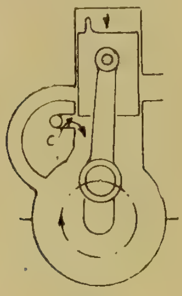


Fig. 1.

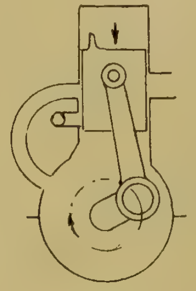


Fig. 2.

Fig. 1 shows the piston at the commencement of its downward stroke, which occurs under the force of the explosion of the previously-compressed charge. At the same time carburetted mixture is rushing in at the port C for the reason explained in connection with fig. 6.

Fig. 2. When the piston has travelled to the position shown in this figure, the communication of the crank chamber with the carburettor is cut off, and the charge which has just been taken in begins to be compressed by the further downward movement of the piston.

Fig. 3. The piston head next uncovers the exhaust port E, allowing the expanded gas above the piston to escape, with an immediate reduction of pressure. The fresh mixture below the piston continues to be compressed in the crank case.

Fig. 4. The inlet port I is next uncovered by the piston head, and the compressed charge in the crank case now rushes up the passage P, and being deflected by the special shape of the top of the piston, rushes up to the top of the cylinder, filling it with the new carburetted mixture, and at the same time assisting in exhausting the burnt gases.

Fig. 5. The piston next begins to move upward, and shuts off first the inlet port I and then the exhaust port E, and at the same time creates a partial vacuum in the crank chamber.

Fig. 6. The piston, on moving further up, next uncovers the carburetter port C, allowing the crank case, whose suction has been still further increased (whilst the charge above the piston had been correspondingly compressed) to draw in a new supply from the carburetter.

Ignition occurs above the piston, and the cycle of operation is again repeated. It will thus be seen that every downward stroke is a working stroke, instead of every alternate one, as in the case of the ordinary Otto or four-stroke cycle, so that in addition to its great simplicity there is also an increased power for a given weight; but although there are twice as many working strokes as in the Otto cycle, there is not twice the power, for the following three reasons:—

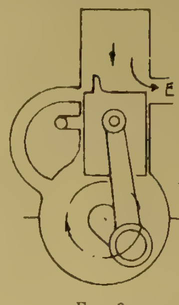


Fig. 3.

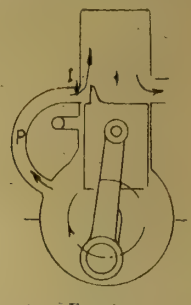


Fig. 4.

(1) Power is lost in compressing the charge in the crank case.

(2) The mixture taken into the cylinder is of a poor quality.

(3) The inlet ports are usually too small to thoroughly fill the cylinder at high speeds.

In consequence of which it requires a well designed and constructed three-port, two-cycle engine to develop more than one and a half times the power of a similarly-dimensioned four-cycle engine. The chief reason is the poorness of quality of the mixture, which is accounted for in two ways, and which is at the bottom of most of the two-cycle troubles. The first cause is that owing to the short time that the exhaust port is open to the cylinder it is very difficult to thoroughly scavenge the burnt gases, so that even a rich incoming mixture would not long remain such. With the Otto cycle the explosion pressure is roughly four times the compression pressure, but in the Day cycle it is more often about two and a half times, whereas if the ignition be arranged to occur every alternate, or, better still, every third stroke, the explosion ratio is thereby increased to about four. Thus the greatest problem before the engineer is to efficiently scavenge the cylinder, which object has been attempted in several ways, but this usually means departing from the simplest type above described, and necessitates the introduction of some form of valve and gear, examples of which we shall describe later. The second course, which is very closely associated with the size of the inlet ports, is the difficulty of enabling the carburetter to work correctly, since most of the mixture has to be drawn in while the piston is near the top of its stroke, or about 43 deg. to 44 deg. of crank movement on either side of the dead centre. With an ordinary mushroom valve, four-cycle engine, the exhaust valve

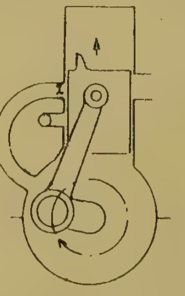


Fig. 5.

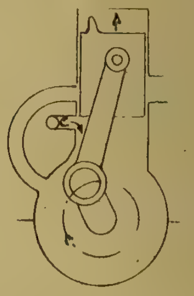


Fig. 6.

opens about 45 deg. before the bottom dead centre of the crankshaft, and closes about 5 deg. after the top dead centre. It will therefore be seen that the valve is open for about 230 deg. Allowing for the difference in the rates of opening and closing and for gas inertia effects, we may consider that the ordinary engine is open to the carburetter nearly three times as long as that of the three-port, two-cycle engine. This trouble, which particularly applies to four-cylinder engines, where no two inlet valves can be open at the same time, can be partially overcome by having the carburetter areas at least twice the size of one for a four-cycle engine of similar dimensions.

The other reason mentioned, namely, the loss due to compression in the crank case, is not entirely avoidable, and may even amount to 15 per cent of the indicated horse power; it can, however, be greatly reduced by giving proper attention to the size and timing of the ports, the size and shape of the pipes and passages, and to the pressure in the crank case.

The author is of the opinion that when the problem of scavenging has been successfully overcome, the fuel economy will closely approach that of the four-cycle type, and that we shall then have almost twice the power for a given size engine, and that the loss due to compression in the crank case will not be a very serious one. The importance of the size and shape of ports and passages, and of the deflector plate, must not be overlooked, and are best obtained by experiment; however, we give in fig. 7 some suitable dimensions for a 4 in. diameter cylinder, showing the proportions of the ports and deflector. Instead of the type of deflector shown in figs. 1 to 7, many designers prefer the type shown in fig. 8 (as an outside view) and in section in fig. 9. This has the great advantage that the deflector surface is much more easily cooled, and that pre-ignition is therefore less likely to occur, and the chances of a cracked piston are not so great; moreover, it is impossible for eddies to form at the back of the deflector, and for exhaust gases to be pocketed and not cleaned out. With a cylinder of the proportions shown in fig. 7, and with a stroke of 4½ in., the compression pressure in the crank chamber should be about 8 lbs. per square inch, and in the cylinder about 70 lbs. to 75 lbs. per square inch. The lowest working crank-chamber compression is about 5 lbs. per square inch, but 8 lbs. will be found most suitable for general conditions. As mentioned above, the port opening from carburetter to crank case cannot be more than 44 deg. on either side of the top dead centre in the case of a four-cylinder engine (that is, for a little less than one-fourth of the crankpin path), but in the case of an engine with a less number of cylinders, this opening can advantageously be increased to, say, 48 deg. The opening from crank case to cylinder should be for a similar length of time, but car should be taken to see that the exhaust port is opened sufficiently in advance of the inlet to ensure the pressure in the cylinder dropping below that in the crank case, and the exhaust passages should permit of the escape of the exhaust gases so readily that they are not liable to rush back to the crank chamber and cause a back fire; the port should be open for about 55 deg. to 58 deg. on either side of the bottom dead centre. When setting down the ports, bear in mind that the opening is one of time and not distance, you should therefore work from the angles on the crank circle, and since the four-cycle valves are open for nearly three times as long as the two-cycle, those of the latter should be nearly three times as large as in the case of the former. The average gas speed at normal engine revolutions should be about 100 ft.-sec. The sparking plug (when this type of ignition is employed) should be fixed to that side of the cylinder wall which is directly above the inlet port from the crank case, and as low down as possible, because when the engine is throttled down and only a small charge is transferred from the crank case, the scavenging effect of the incoming mixture is much reduced, thus leaving a large quantity of burnt gases in the cylinder, and these being hotter than the new charge, will naturally rise to the top. By putting the plug in the position mentioned above, this trouble is remedied to a large extent.

The best position for the engine throttle is at the carburetter; when a good one is employed, this is a very fortunate matter, for the question of throttling in the passage

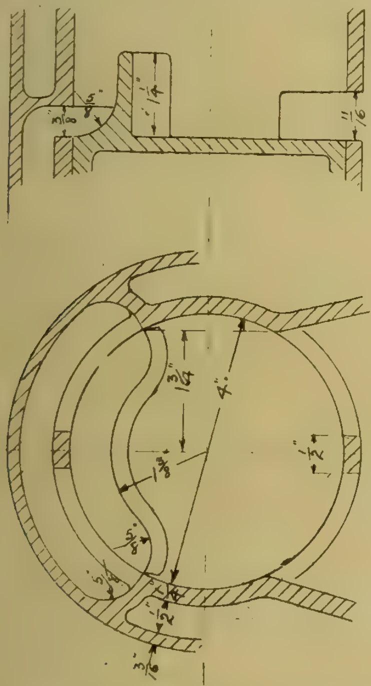


Fig. 7.—Sketch showing Suitable Dimensions for a 4-in. Cylinder.

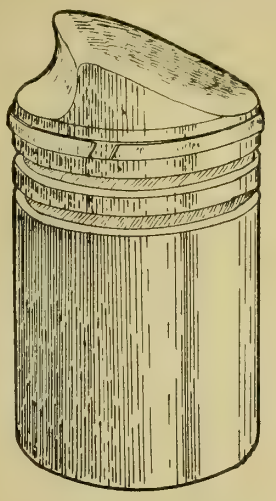


Fig. 8.—Typical Two-cycle Piston.

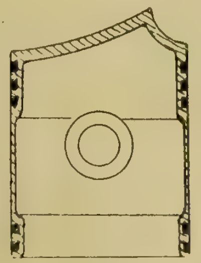


Fig. 9.

P is a very difficult one to satisfactorily overcome. The carburetter should be adjusted to give a richer mixture at low speeds, to ensure steady running and to guard against firing back into the crank chamber; this latter trouble can almost always be overcome by advancing the point of ignition, which has the effect of assisting in the escape of the flame of the exploded mixture, and thus preventing it from igniting the new charge. This assistance is owing to the fact that a given strength of mixture at a given compression pressure always occupies approximately the same fraction of a second for complete combustion, and also to the fact that a weak mixture with low compression occupies a longer time than a richer mixture with higher compression.

The carburetter problem differs considerably from that for the ordinary four-stroke. The vacuum and gas-flow rate are quite different, and in the case of the two-cycle the carburetter range need not be so great. For this cycle, especially with a multi-cylinder engine, the vacuum is much more constant, and in a six-cylinder engine is almost quite so. The inlet should be quite free and the vaporising efficient. The carburation should be entirely accomplished in the carburetter to obtain the greatest economy, and should be complete in order to secure an even quantitative and qualitative distribution of the charge. Probably the best form of inlet pipe for multi-cylinder engines is that shown in fig. 10, which consists of a continuous double return pipe, with the carburetter attached to the centre of the bottom pipe. Incidentally we might mention that the 90 H.P. six-cylinder Napier car which covered two miles a minute was also fitted with an inlet pipe of this description. The crank chamber should be protected from cold air, and may with advantage be warmed by the exhaust pipe or a branch therefrom in order to prevent condensation. The exhaust pipes should be led away in such a manner that the exhaust gases are not likely to in any way be interfered with by those from another cylinder.

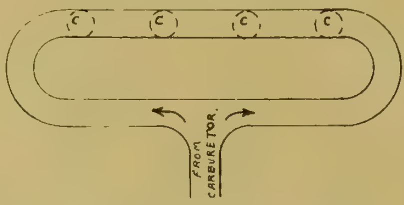


FIG. 10.—Suggested Form of a Four-cylinder Pipe.

(*To be continued.*)

FINISHING WITH THE ROTARY FILE.

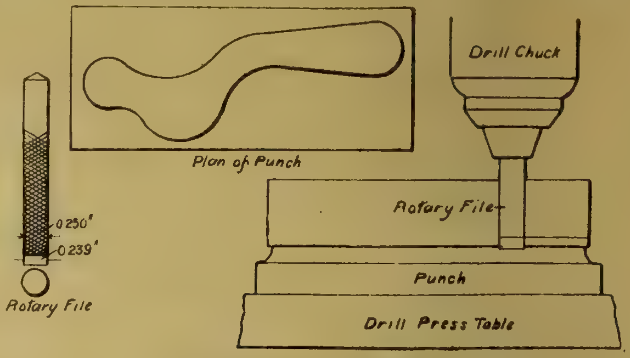
By FRED CEDARLEAF.

THIS die-making kink, though not new, may help some mechanics that read this. The idea is to use a rotary file for removing the stock from the blanking punch for clearance when an even break is required on the finished steel blank.

The general rule for blanking steel is to make the punch six per cent of the thickness of the stock to be punched smaller on each side than the die. Most diemakers, after shearing the punch through the die, remove the rest of the stock by filing by hand, which, at its best, is nothing but pure guesswork, and generally calls for a lot of oil-stoning after the punch is hardened. By using the rotary file shown in the sketch, this stock can be removed faster and easier, and at the same time evenly all around, assuring an even break in the finished blank.

For example, we have a die and punch to make like the sketch. The die is first laid out, finished to size, hardened and stoned to fit the templet. The punch is then machined within a shade of the line, sheared into the die about $^{1}/_{16}$in., and then filed within a couple of thousandths of the sheared portion. It is then sheared through the die and the clearance figured.

Say we are to punch $^{3}/_{32}$in. sheet steel. Six per cent of 0·093 in. = 0·0055, or the amount to be removed from each side of the punch. We next take a rotary file ¼ in. or ⅜ in diameter and hold it in a collet in the bench lathe. After making it run pretty true, we use the grinding attachment, and grind about ⅛ in. at the end of the file as much smaller on the side as there is stock to be removed from the punch, which in this case is 0·0055 in. If the file measured 0·250 in. we would grind the end down to 0·239 in. diameter. The file is then held in the drill press, and run at fast speed, the punch being held on the table and forced into the file, which will cut until the ground surface touches the surface of the work. After going all around the punch, a ridge is left on the bottom, which can be easily removed by bringing the file down ⅛ in. further, and working this ridge down flush with the rest of the punch.



Finishing Punches with Rotary File.

A set of files ground at the end to suit the standard thicknesses of stock is a handy addition to any mechanic's tool kit.

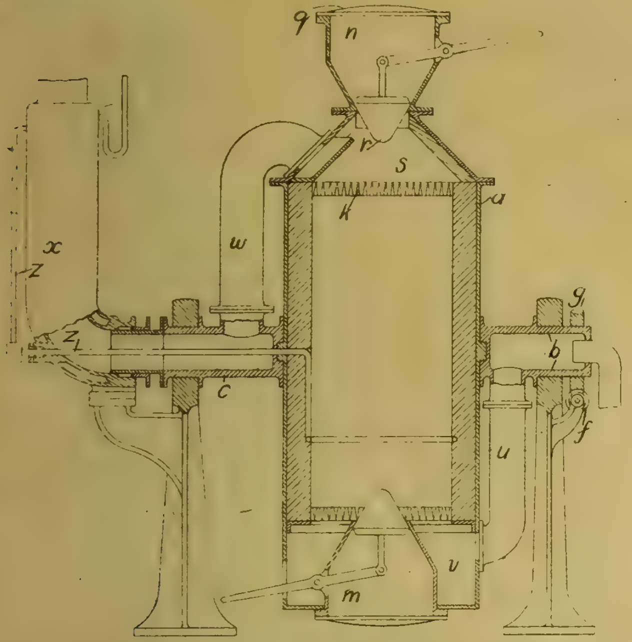
It may be mentioned that a good way to lay off the punch is to tin the face of it and then float a thin film of solder on it. The punch is then squeezed against the face of the die, leaving an accurate imprint on the soft solder film, which is easily followed. This is more accurate than scribing through the die.—*American Machinist.*

AN IMPROVED GAS PRODUCER.

THE following illustration shows an improved gas producer recently patented by Thomas Lumsden. The principal feature consists in arranging the combustion chamber so that it can be inverted, in order that the fuel fed to the same can lie below the fuel previously supplied to the combustion chamber. Referring to the illustration the producer *a* is provided with trunnions *b*, *c* mounted in bearings carried by standards, so that it can be inverted by means of a worm and worm wheel *f*, *g*.

The combustion chamber is provided, in addition to the usual grate, with an upper-grate *k*, and hoppers *m* and *n* (normally closed by valves) are provided at the bottom and top of the producer. The air for combustion is led by a pipe to the interior of the trunnion *b* and passes by conduit *u* to a chamber *v* underneath the lower grate. The gas generated in the combustion chamber passes by a pipe into the interior of the other trunnion *c*, where it is drawn off by a pipe *x*.

To feed or charge the combustion chamber the producer is inverted on its trunnions *b* and *c* by the worm and worm wheel *f* and *g*, when the fuel in the combustion chamber falls on to the upper grate *k*. The charge is then introduced through the hopper *m*, and on the producer being returned to its normal position the charge just inserted lies on the lower grate below the fuel previously in the combustion chamber.



The ashes fall through the upper grate on inversion of the producer into a chamber *s*, and may discharge into the hopper *n* by opening the valve *r*. Water or steam may be introduced into the combustion chamber by a pipe *z* passing through the pipe *c*.

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"Board of Trade Arithmetic for First and Second Class Engineers." By P. Youngson. Glasgow: James Munro and Co. Ltd. Price 5s.

As with most examinations there are certain rules and methods which should be kept in mind by the candidates who intend sitting for the engineers' Board of Trade Examinations. By the observance of these rules much time is saved, and the examiners can judge by the papers those who have been properly coached. The next factor towards success is to know your work, the questions set being generally of a practical nature, in which the thinking power is taxed.

The work before us gives, firstly, some typical examples in arithmetical problems, and these are followed by a series of questions divided into papers, covering the whole ground for first and second class examinations. A complete set of answers are included at the end. It is an excellent test book, and any candidate who can readily work out the examples need have little hesitation concerning his ability to "get through."

"The Telegraphic Transmission of Photographs." By T. Thorne Baker. London: Constable and Co. Ltd. Price 2s. 6d.

The subject of this book is one little known, but to a few experimentalists. Of these workers none have had greater experience than the author, who has been engaged not only in improving and developing the apparatus, but has for a considerable period successfully transmitted pictures between Manchester and London, and other equally distant stations.

Those who understand the principles upon which telegraphic messages are transmitted, the elements of optics and photo engraving, will have little difficulty in following the description of the apparatus employed, and in which all three enter to some extent.

The book essentially refers to the author's instrument known as the telectrograph; but other earlier systems, particularly those with which Prof. Korn is associated, are not omitted. The possibility of transmitting pictures and photographs by wireless telegraphy has doubtless occurred to many. This the author has been able to do, and the results are very encouraging towards further research.

A plainer and more straightforward insight into Mr. Baker's labours it is difficult to imagine, there being nothing extraneous to the subject. The book deserves, and will assuredly attain, early popularity.

Books Received.

"Official Gazette of the United States Patent Office." Vol. CLV., No. 3. Published by Authority of Congress, Washington.

"Electric Trains." By H. M. Hobart, M.Inst.C.E. London: Harper and Brothers. Price 6s.

TRADE NOTES.

The "Fournier" thermo-instruments, which indicate, record, and regulate temperature, humidity, and ventilation at any distance, will be exhibited at the forthcoming Engineering Exhibition at Olympia in September next by **Messrs. F. Mellin and Co.,** of 60, Salisbury Road, Kilburn, London, N.W. The value of these instruments, owing to their accuracy, etc., has, we understand, awakened interest in the various branches of industry, the Admiralty, and War Office.

Superheating.—Although fully aware of the economies that can be derived from a moderate degree of superheat, many engineers and managers hesitate to instal superheaters on account of the structural alterations necessary to their boiler setting, and the time required to shut down, but with care this stoppage can be reduced to a minimum, and during the past few weeks **Mr. John Thompson,** Wolverhampton, under the supervision of Mr. A. L. Tester, his London representative, installed two of his bent tube superheaters at the chemical works of Messrs. Forbes, Abbott, and Lennard, East Greenwich, one of these superheaters being for one of his 30 ft. by 9 ft. 3 in. dish-end Lancashire boilers and the other for an ordinary 30 ft. by 7 ft. flat-end boiler. The contract included the erection of steam pipes giving a by-pass, connecting to their existing mains, and all necessary alterations to the downtakes. These were fairly extensive, including shifting the dampers, raising the side flues of the larger boiler two courses of bricks, and rebuilding the back flues for a width equal to the two boilers. Steam was shut down on Friday evening, and the boilers handed over on the following Wednesday morning at 6 a.m. with full steam up and the superheaters at work, giving 110 deg. Fah. and 100 deg. Fah. of superheat respectively. To save time these contractors had all their materials on the site before stopping, then cleared away the whole of the downtakes and back flue, erecting the piping and superheaters in position, finishing the brickwork when everything was in place.

Shipbuilding Contract for Greenock.—We understand that the two large intermediate steamers for the Lund Line service of the P. and O. Co. are to be built by **Messrs. Caird and Co.,** Greenock.

Messrs. D. and J. Nicol, Dundee, have sold their steel twin-screw steamer Kinfauns Castle for, it is reported, about £5,000. The vessel, which is 184 tons gross and 78 tons net, was built in 1906 by the Dundee Shipbuilders' Co.

The American auxiliary schooner yacht Invincible, which reached the Tail of the Bank a few days ago, is to be overhauled by the **Clyde Shipbuilding and Engineering Co.,** Port Glasgow.

At the exhibition of meat and meat products and refrigerating machinery, held at Moscow in May, the highest award (diploma of honour) was awarded to the **Pulsometer Engineering Co. Ltd.,** of Reading, for their exhibit of ice and refrigerating plant. The exhibition was international in character, and ice-making machines were exhibited by two German companies.

NEW TWIN-SCREW STEAMER PRINCE RUPERT.

There have recently been completed by Messrs. Swan, Hunter, and Wigham Richardson Limited two twin-screw steamers, Prince Rupert and Prince George, an illustration of the former being given on this page. The vessels are to inaugurate a service for the Grand Trunk Pacific Railway extending along 750 miles of the coast of British Columbia between Prince Rupert and Vancouver Island, and from thence to Tacoma or Seattle. The general dimensions of the Prince Rupert and Prince George are: Length overall, 320 ft.; beam, 42 ft.; moulded depth, 26 ft.; gross tonnage, 3,380; deadweight carrying capacity, 1,100 tons. They have been constructed in compliance with the requirements and under the inspection of the British Corporation for Coasting Steamers and in accordance with the British Board of Trade and Canadian regulations for passenger boats of the class named; a cruiser stern has been adopted in order to obtain the best lines for high speed. The vessels have five decks—lower, main, awning, and boat decks. The twin engines are of the triple-expansion type, with two low-pressure cylinders, in order to give four cranks and therefore a better turning moment. They are balanced on the Yarrow-Schlick-Tweedy system and run at a speed of 170 revolutions per minute. The dimensions of the cylinders are—high-pressure cylinder 23½ in. diameter, intermediate cylinder 37 in., each of the low-pressure cylinders being 41 in. diameter, and the stroke, all cases, being 33 in. The condenser, which is situated at the back of the engine, is of the Weir "uniflex" type. Although in reciprocating engines a high vacuum is not essential to economical working, since practical considerations preclude higher vacua than 25 in. to 26 in. being utilised by the engines, this particular type of condenser attains this end under varying conditions as to the temperature of the water with less weight, space, and less surface than ordinary condensers. They are constructed of steel plate, with cast-iron doors and brass tubes and tube plates.

TWIN-SCREW STEAMER PRINCE RUPERT.

There are four boilers, two being double ended and two single ended. The two double-ended boilers are 22 ft. long and the single ended 11 ft. 4 in. long, the diameter in all cases being 13 ft. 8 in. and the total heating surface 13,512 square feet. Howden's system of forced draught is employed, one funnel being used for both single-ended boilers and a second funnel for the forward end of the two double-ended boilers, and a third funnel for the aft end of the same boilers, the idea being to reduce the width of the uptake in order to give a wide corridor inside for promenading. Ash ejectors are provided in the stokehold, The lower deck, abaft the machinery, extends right across the ship, there being no shaft tunnels, and at the far end, between shafts, the fresh water tanks are situated, and for trimming the vessel light, deep water-ballast tanks have been fitted forward. The lower deck forward is to be given up almost entirely to cargo, there being two hatches, each with two winches and two derricks. In the case of the after hatch the winches are provided with chain gear so as to reduce the noise, as they are located near to the passenger cabins. There is an artificial ice and refrigerating plant, in conjunction with cold storage-chambers for provisions, of about 3,000 cubic feet capacity.

Both vessels are equipped with wireless telegraphic installation and the life-saving and fire-extinguishing appliances have received special attention. Accommodation is provided for 220 first-class and 32 second-class passengers, and a promenade space for some 1,500 excursionists. The passenger quarters are of a highly decorative nature, the staterooms being heated by steam.

At the trials the engines developed about 6,000 H.P. when running at 170 revolutions per minute, and at both high and slow speed there was practically no vibration. The Prince Rupert attained a speed averaging over 18½ knots on a six hours' loaded run, the mean draught during the trial being 15 ft., equal to a displacement of 3,138 tons. The sister ship, the Prince George, attained a speed of 19 knots, the mean draught being 13 ft. 3 in., equal to a displacement of 2,622 tons. Both vessels were constructed under the supervision of Mr. R. L. Newman, the naval architect and superintendent of the owners

THE BRUSSELS EXHIBITION.—VI.

(Concluded from page 18.)

The Union Dortmund show large anchors; a good collection of rolls are exhibited by Messrs. Gustav, Gentesmann. A very impressive stand, made up of highly-polished copper pipes and bronze fittings, is shown by Messrs. C. Heckmann, of Duisbury. While alluding to metallurgical exhibits it should be mentioned that there are several coal cutting and rock-drilling machines to be seen. Messrs. John Davis and Son Ltd., of Derby, have an extensive stand of mining and meteorological appliances, under the auspices of the "Ecole des Mines du Hainault," and as far as could be seen were the only firm exhibiting this kind of apparatus, which comprises a selection of gas-testing lamps, including the Stokes, which with alcoholic flame will test gas down to one-half per cent of fire damp. Also anemometers, including Biram's Patent, which is timed by a watch, and the self-timer (fig. 22), which obviates the use of a watch, the instrument being held in the air current, and the velocity in feet per second is read direct on the dial; all these anemometers are contained in the maker's new pressure-resisting aluminium cases, fixed to waist belts to leave the user's hands free. Also hygrometers, for testing the moisture in mines, including a portable type; and water gauges, to ascertain pressure or drag of air.

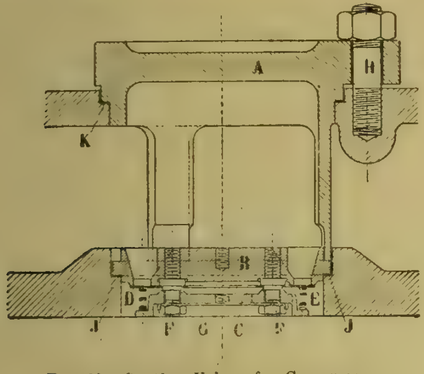


FIG. 23.—Suction Valve of a Compressor.

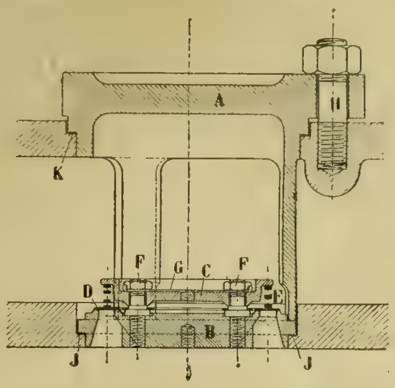


FIG. 24. Discharge Valve of a Compressor.

Any visitor to the Exhibition must come away much impressed by the very fine collection of models; besides those in the British Hall, showing the latest English warships and passenger vessels, the Germans have many more, a noteworthy exhibit being that by the Vulcan Company, of Stretton; also there are complete models of marine machinery, lighthouses, canal locks and gates, floating docks, harbours, ice-breakers, shipbuilding slips, methods of constructing bridges, and the cranes already mentioned. There is a very complete model of a gas-making plant, showing all the mechanical arrangements for charging and discharging the retorts, which are shown in section; methods of handling the coke and of gas collection. Models of several transporting systems are to be seen at work. Messrs. Schmidt have a superheater fitted to a marine boiler. Both in this section and throughout the Exhibition are scores of models of dredgers and excavators of all types. In the French Hall there are models of an electric furnace, as well as of blast furnaces.

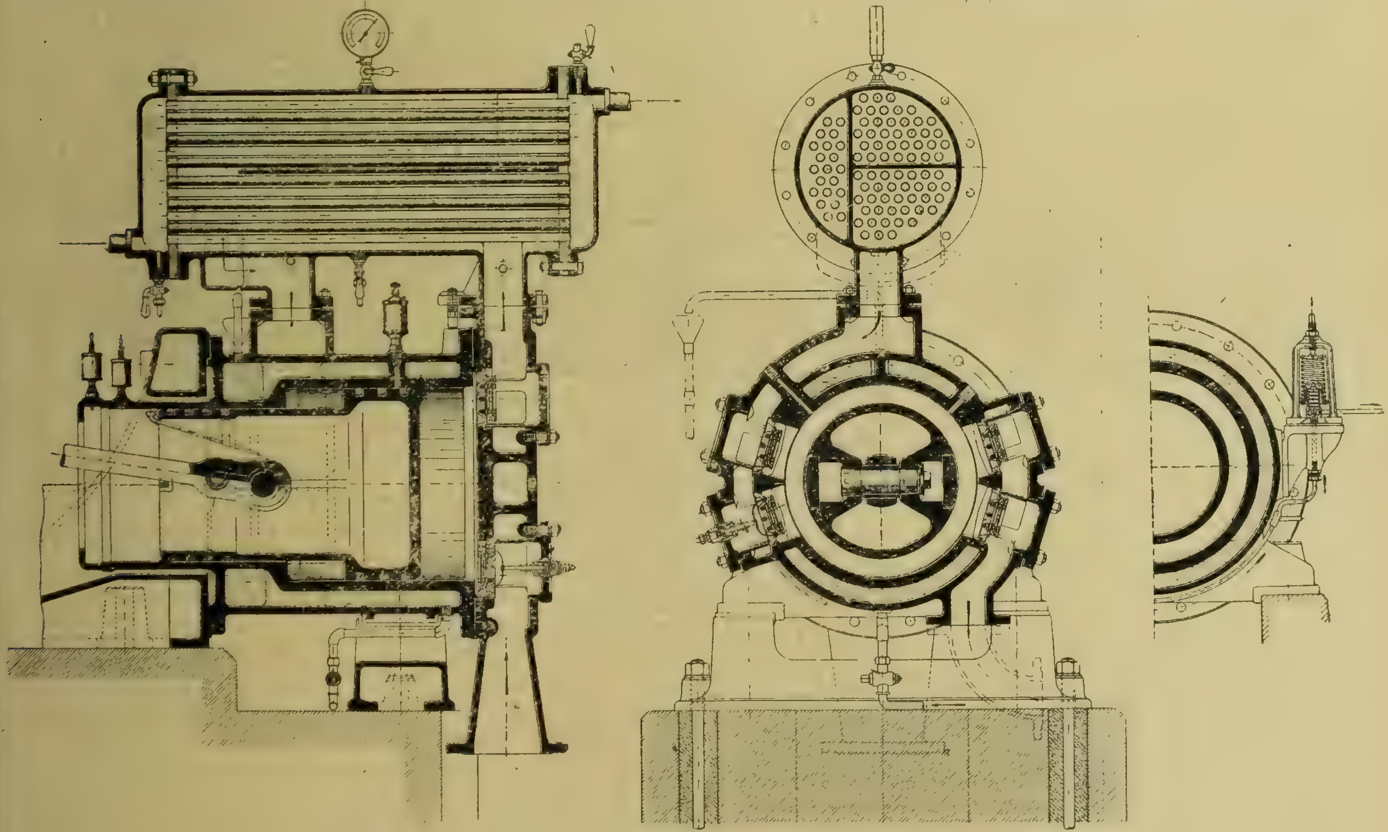


FIG. 25.—AIR COMPRESSOR, BY A. BORSIG.

Sugar machinery is exhibited by three firms. Messrs. Gebr. Stoek, of Hengelo, have a large cane-crushing mill driven by a reversible steam engine of 820 H.P. To those not accustomed to this class of machinery, the crushing rolls and gearing will appear very massive; the crushing is conducted in two operations, the cane leaving quite dry. On the adjoining stand another Dutch firm exhibits a large evaporator heated by steam coils, and complete with condenser, vacuum and water pumps. Messrs. Pott, Cassels and Williamson, of Motherwell, have a number of their water-driven "Weston" type centrifugals fitted with their patent interlocking gear, in which the "Massecuite" is separated.

It has already been mentioned that among the Continental exhibits of air compressors those of Messrs. Porkney and Wittekind, and A. Borsig, are the best. The machines by the first named firm were described in the last article, and those by Messrs. A. Borsig are shown in figs. 23, 24, and 25. The suction and delivery valves are the most important features and are covered by special patents. Referring to fig. 23, which is of the suction valve, the seating is of a separate casting B; C is the valve stop, and is kept away from B by means of studs F, F. The valve D is made of a very light steel plate, and has two small lugs which are guided by studs F, F. To ensure a quick closing of the valve at the end of the piston stroke a light spiral spring E is provided. The valve cover A is fastened by means of studs on the cylinder cover, and presses down on the valve seat B, the apertures of which are alternately opened and closed by the working of the valves. The discharge valve (fig. 24) is similarly constructed, the same nomenclature applying. The chief advantage of this arrangement is the extreme lightness of the valve disc proper, reducing the inertia or resistance, both at opening and closing, to its smallest limits. A further advantage consists in its thorough reliability, its silent working, at even the highest speeds, and the very small amount of clearance in the cylinder which these valves allow.

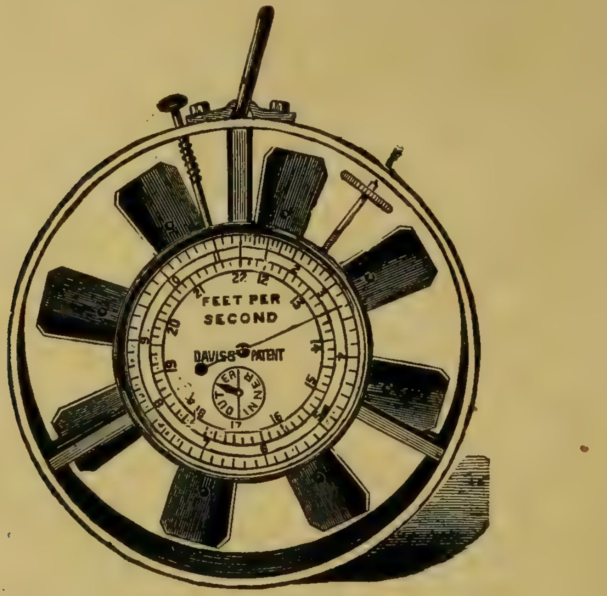


FIG. 22.—Self-timing Anemometer.

On the stand at the Exhibition there were a good many different sizes of machines shown, and as they are all of similar construction, the section in fig. 25 will illustrate their design. The machine is for two-stage compression, and has a single-acting differential piston, the larger part being for the low-pressure cylinder and the reduced portion for the high-pressure. The cylinder proper is a very simple casting, and has the low-pressure valve head bolted on, one half for suction and the other half for delivery, the valve being as already described. The air, after discharge from the low-pressure cylinder through delivery valves, passes through an intercooler, which is of the tubular type having the water passing through the tubes; from the end view it can be seen that the air is passed through three times before reaching the high-pressure suction valves which are disposed around the circumference, an annular passage being formed in the casting. Discharge is through similarly placed valves. The automatic pressure regulator is shown to the right of fig. 25; it is connected both to the air reservoir and the suction valves, and is weighted for the required pressure by means of a spiral spring. If the pressure in the reservoir exceeds the chosen amount, the regulator gets into action and allows some of the air from the reservoir to act on the pistons at the back of suction valves of the high and low-pressure cylinders—this piston can be seen on the valves—and thus puts the same out of action and prevents any further working of the compressor until the air pressure in the reservoir has fallen sufficiently; the regulator then ceases to pass air to the valve pistons, the remaining air gradually escapes and the valves work in their normal manner. In constructional detail these machines are strong and well finished; the bearings are ring-oiled and are provided with both vertical and horizontal adjustment for wear.

Messrs. Wolf's (of Magdeburg) principal exhibit was a 650 H.P. locomobile belt driving a direct-current dynamo. It is to be regretted that there are no drawings of this particular engine available, but that in fig. 26 is of a similar plant and will serve to show the arrangement. The engine is compound and works on two cranks, the valves being of the balanced piston type. There are two superheaters. The boiler steam passes through the first nest of tubes (placed nearest the boiler), is superheated, and

	Belgian State Railways. Class 10, "Pacific" type. Four-cylinder simple, superheated steam. Three-coupled.	Bavarian State Railway, by J. Maffei. "Pacific" type. Four-cylinder compound, superheated steam.	Borsig Engine for Brazilian Railways Consolidation type. Four-coupled Non-superheat.	Borsig Engine for Prussian State Railways. Three-coupled Tank Engine, with bogies in front. Superheated steam.	Borsig two-coupled Tank Engine of 160 H.P. for Contractors. Non-superheat.
Diam. H.P. Cylinder	500 mm.	425 mm.	400 mm.	575 mm.	320 mm.
Diam. L.P. Cylinder	....	650 mm.	....	....	....
Stroke	660 mm.	610 H.P. 670 L.P.	500 mm.	630 mm.	400 mm.
Steam Pressure	14 kg.	15 kg.	12 atmospheres.	12 atmospheres.	12 atmospheres.
Superheater Surface	62 sq. m.	50 sq. m.	....	40·6 sq. m.	....
Heating Surface	215 sq. m.	220 sq. m.	114 sq. m.	132·8 sq. m.	50 sq. m.
Grate Surface	5 sq. m.	4·5 sq. m.	1·62 sq. m.	1·85 sq. m.	0·85 sq. m.
Diam. Driving Wheels	1960 mm.	1870 mm.	950 mm.	1750 mm.	800 mm.
Diam. Bogie Wheels	....	....	735 mm.	1000 mm.	....
Weight empty	98 kg.	....	30·7 kg.	60·52 kg.	16·5 kg.
Weight running	107·5 kg.	....	34·1 kg.	76 kg.	21·5 kg.
Weight on Drivers	....	....	....	48·57 kg.	....
Tank Capacity, Water	....	....	....	7·5 kg.	1·7 kg.
Tank Capacity, Coal	....	....	....	2·5 kg.	0·8 kg.
Gauge	....	....	1000 mm.	1435 mm.	900 mm.

then goes to the high-pressure cylinder, the exhaust from which passes into the second superheater (placed just after the other) and the steam has fresh heat imparted to it, thus materially reducing the condensation in the low-pressure cylinder. This method necessitates making the smoke box rather long, but there is no disadvantage. On some of Messrs. Wolf's engines the cylinders are placed in tandem, the chimney gases passing around the high-pressure cylinder, reducing radiation losses. The furnace and smoke tubes are removable and can be withdrawn in the usual way. The low-pressure exhaust steam passes through a feed-water heater on its way to a jet condenser, the air pump for which is driven by an eccentric worked from the main crankshaft. Two heavy flywheels are fitted, and the engine is made very accessible by the provision of large platforms and ladders.

Messrs. Wolf also show several threshing machines, steam tractors and centrifugal pumps.

Motor cars, except in the British section, are few in number—there are just a few of Italian, French, and German make. The most interesting stand is that of Messrs. Bergmann, who exhibit a 2,000 kg. delivery van, electrically driven by Edison accumulators. The mechanical construction of these accumulators is very strong; the plates are of two pieces of nickel steel pressed together and having iron between them. The solution is caustic potash. The positive is formed by the nickel and the negative by the iron. These cells seem able to withstand any amount of vibration, and do not buckle under heavy discharges. The vehicles are in very successful use in Germany, and those interested in the subject should visit this stand.

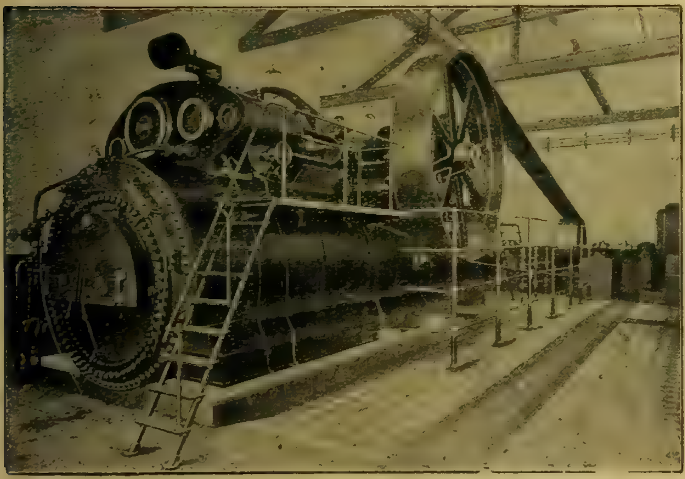


FIG. 26.—Locomobile Belt driving a Direct-current Dynamo.

The locomotives exhibited are probably the most wonderful sight to be seen at Brussels; many mark entirely new departures in design, and are the largest Continental engines yet built. Most of them work on superheated steam, the "Schmidt" system being generally preferred. The majority of the Belgian and German firms are represented, by both engines and rolling stock; the Bergmann Company have a very interesting rail motor.

With the space at the disposal of these articles it is not possible to do justice to this section by means of illustrations, but the accompanying table will give some idea of the leading sizes of the most important engines, the largest of which is that for the Belgian State Railways, built to the design of M. Flaneur by Messrs. Zimmermann-Hansez and Co., it is of the "Pacific" type, and has four simple cylinders using superheated steam. Another large engine of the "Pacific" type is exhibited by Messrs. J. A. Maffei, and Messrs. Borsig, have a "Consolidation" type engine for the Brazilian railways.

SOME TEST FIGURES FROM AN OIL ENGINE.*

By F. J. KEAN, B.Sc. (Lond.).

THE oil engine upon which these tests were carried out has a single cylinder of 8½ in. bore and 14 in. stroke. There is one flywheel 5 ft. 2 in. diameter which is fitted with a rope brake to take up the power. The normal speed of the engine is 250 revolutions per minute, at which speed the governor comes into action, holding open the exhaust valve and preventing the suction of fresh mixture until the speed has fallen to its normal value. The supply of oil to the engine is from a graduated tank to an automatic mushroom type valve. The oil passes through fine holes in the seating of the valve, which simply serves for the admission of air. This valve is mounted at the top of a vaporiser kept hot by means of a paraffin blow lamp; the lower end of the vaporiser contains the ignition tube. There is no timing valve and ignition takes place automatically at a point in the stroke which is governed entirely by the temperature of the ignition tube, the composition of the charge, and the compression in the cylinder. The exact nature of the contents of the cylinder is thus necessarily difficult to estimate, and the problem is still further complicated by the difficulty of maintaining the firing point at any definite fixed period in the stroke for any length of time. Between the vaporiser and the cylinder itself there is a short circular cored passage passing through the water jacket, but not communicating in any way therewith. This passage is fitted with an automatic valve of special design which allows water to be drawn into the cylinder and mixed with the oil vapour on the suction stroke of the engine, the mixture of oil vapour and water vapour being compressed and fired on the return stroke of the engine. The purpose of the water injection is to tone down the violence of the explosion and prevent the harsh metallic knocking within the cylinder which is such an objectionable feature of most paraffin oil engines, and this it does most effectively. The water supply comes from a small tank, especially graduated for the purpose.

Having proved that the injection of water with the oil vapour diminishes the violence of the explosion, the question arises as to what the effect is upon the economy of the engine in working. To ascertain this the author had a series of tests made upon the engine, keeping the brake load constant and all other conditions as nearly as possible so, but varying the amount of water injected. The results of these tests, collected and worked out, are given in Table I.

TABLE I.

Test No.	Pounds of Water injected per pound of oil used.	Indicated horse power.	Brake Horse power.	Oil per I.H.P. per hour in pounds.	Oil per B.H.P. per hour in pounds.	Absolute Thermal Efficiency on the I.H.P. (per cent).	Absolute Thermal Efficiency on the B.H.P. (per cent).
1	0 [illegible]	8·55	6·10	0·86	1·21	14·5	10·4
2	0·174	8·50	6·04	0·91	1·28	13·8	9·8
3	0·198	8·50	6·05	0·99	1·39	12·7	9·1
4	0·232	8·30	5·81	1·03	1·48	12·1	8·5

This shows that the thermal efficiency and the economy of the engine quickly decrease as the amount of water injected increases, but the noise and violence of the explosions get less and less, so that quietness of running is secured at the expense of economy in running costs.

The chemical formula for water being H_2O and for a paraffin $C_nH_{2n-6}H_6$, some interesting speculation was indulged in as to whether any dissociation of the H_2O would occur inside the cylinder during combustion.

It seemed to the author that if an approximate simple analysis was made of the exhaust gases, and if they were found to contain a marked difference of nitrogen (or other unknown commodities such as hydrocarbons), when the water was injected, such evidence would prove whether or not dissociation had taken place and whether it would be advisable to place the gas analysis in the hands of a qualified analyst.

He therefore began a series of experiments tentatively by himself, and, encouraged by the results, proceeded with the full investigation. In running the engine tests the observations were made one minute after each other and timed by a stop-watch; there being five principal observations, it took five minutes to start and stop a test, the intervening period allowing for gas sampling and indicating. Table II. shows the results obtained from a series of experiments which were made under constant conditions. The outlet temperature of the jacket water was kept at 100 deg. Fah., the load on the brake at 50 lbs. net, the oil cock one-eighth turn open and the same tension on the mixture valve spring all through.

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* Paper read before the Institute of Marine Engineers, June, 1910.

TABLE II.

Test No	Pounds of Water injected per pound of oil used.	Indicated horse power	Brake Horse power	Oil per I.H.P. per hour in pounds.	Oil per B.H.P. per hour in pounds.	Absolute Thermal Efficiency	
						on the I.H.P. (per cent).	on the B.H.P. (per cent).
5	0	9·10	6·12	0·77	1·14	16·3	11·0
6	0·274	8·88	6·10	0·84	1·22	15·0	10·3
7	0·400	8·99	6·11	0·95	1·39	13·3	9·0
8	0·463	9·37	6·16	0·91	1·38	13·7	9·1
9	0·560	8·65	6·07	1·11	1·59	11·2	7·9

The blow lamp was kept in a fixed position below the ignition tube and the flame maintained as nearly as possible at one definite intensity. The amount of water injection was varied both by opening the water cock and by releasing the tension on the water valve spring. It will be observed that the results obtained are very similar to those shown in Table I., except perhaps that the amount of water injection is much greater, reaching the extraordinary figure of 56 per cent. With this amount of water injection the running of the engine was very similar to that of a single-acting steam engine (except for the noise made by the governor gear and the automatic inlet valves, the springs of which are not enclosed). The thermal efficiency falls off and the oil consumption rapidly increases with the amount of water injected, showing what an expensive means this is of obtaining a quiet running engine. The knocking does not cease until 30 per cent of water is being injected, though even when 56 per cent of water was being injected the noise of the explosions within the cylinder could still be heard, but they sounded very faint and reminded one of listening to distant long range gun practice at sea.

The exhaust gases were sampled in the usual manner and analysed by the author with the Orsat apparatus. The results of the gas analysis are given in Table III., from which it will be seen how rapidly the total combustion (CO_2 + CO from volumetric analysis) falls off, but it seems to reach a minimum value at about 50 per cent of water injection, which is no doubt due to condensation of the oil and water vapour during compression, the liquid leaking past the piston and leaving less combustible to be burnt with the same air supply. Examining the gas analysis figures, we note that while the sum of CO_2 and CO by volume continually decreases the free O continually increases, so that there is no evidence of any dissociation having taken place. Hence the author concludes that the effect of the water injection is merely to damp down the total combustion, causing the maximum or explosion pressure to occur later in the stroke and lowering its value.

TABLE III.

Test No.	Pounds of Water injected per pound of oil used.	Gas analysis by volume (per cent).				Total Combustion $CO+CO_2$	Pressures from the Indicator Cards.	
		CO_2	CO	O	N, &c. (by difference)		Maximum or Explosion.	Mean Effective.
5	0	9·4	6·2	0·4	84·0	15·6	280	63·1
6	0·244	9·6	4·5	0·6	85·3	14·1	245	58·6
7	0·400	6·9	4·6	6·9	81·6	11·5	190	52·9
8	0·463	6·7	4·1	6·0	83·2	10·8	185	51·3
9	0·560	6·7	3·9	6·4	83·0	10·6	136	45·3

The author thought that perhaps dissociation might take place if the explosions were made more violent and a higher maximum and mean temperature obtained in the cylinder. Accordingly the vaporiser and ignition tube were kept much hotter, the outlet temperature of the jacket water being kept the same (100 deg. Fah.). It was thought advisable, however, to admit more air and put a little more load on the engine so as to improve the running conditions generally. A difficulty now presented itself on account of the vaporiser getting so hot that ignition occurred much too early and the engine slowed down. However, with patience and after several attempts two satisfactory tests were made, the results being given in Table IV.

TABLE IV.

Test No.	Pounds of Water injected per pound of oil used.	Gas analysis by volume (per cent).				Total Combustion $CO+CO_2$	Pressures from the Indicator Cards.	
		CO_2	CO	O	N, &c. (by difference)		Maximum or Explosion.	Mean Effective.
10*a*	0	11·5	2·3	3·0	83·2	13·8	280	60
10*b*	0·271	12·1	2·0	2·0	83·9	14·1	280	59
11*a*	0	10·1	2·6	1·5	85·8	12·7	280	55·5
11*b*	0·284	11·4	1·5	1·6	85·5	12·9	280	62·8

The gas analysis shows slightly improved combustion when the water is being injected, but only the CO_2 is increased, the percentage of nitrogen being almost identical for both conditions, while the free O decreases. The effect of the water injection is to retard the firing point and bring it back nearly to the dead centre, the result being that a higher compression pressure is reached before ignition; this would, of course, slightly increase the efficiency of the combustion process. The author does not, at any rate, consider there is any evidence to show that dissociation has taken place. The last tests were made under similar conditions as regards the vaporiser, but with the mixture valve adjusted as in the first tests, the load being 50 lbs. net, but more water being injected. In this case the total combustion is distinctly decreased, and the test is a very remarkable one in many ways, so that the author gives the working out in full below.

In test No. 12*a* ignition occurred when the compression pressure was as low as 25 lbs. per square inch above atmosphere, whereas in test No. 12*b* ignition did not occur until the full compression pressure was reached, and under these conditions a very marked economy in oil consumption is obtained. This improved economy in oil consumption was also noted on tests No. 10*b* and 11*b* under similar conditions. In 10*a*, 11*a*, and 12*a* it was noted that during certain periods of the test the engine laboured rather heavily and seemed inclined to slow down, whereas in 10*b*, 11*b*, and 12*b* no such result was observed. The author shows the oil consumption figures in Table V. for these tests; but it must be remembered that in 10*a*, *b* and 11*a*, *b* the air supply was greater than in the earlier tests. In test No. 12*a*, *b* the air supply was the same as in tests 1 to 9 inclusive, so that 12*b* shows how by keeping the vaporiser much hotter the oil consumption may be greatly improved, the oil per horse power in test No. 12*b* being much lower than that in test No. 5, for instance.

TABLE V.

Test No.	Total Oil per hour lbs.	Total Water per hour (injection).	Pounds of Water per lbs. of oil.	I.H.P.	B.H.P.	Mechanical Efficiency. Per cent.	Oil per I.H.P. hour. Lbs.	Oil per B.H.P. hour. Lbs.
10*a*	7·31	0	0	12·00	7·57	63·1	0·609	0·966
10*b*	6·93	1·88	0·271	11·12	7·53	67·7	0·623	0·921
11*a*	6·55	0	0	9·84	6·54	66·5	0·666	1·000
11*b*	5·99	1·70	0·284	9·64	6·37	66·1	0·622	0·941
12*a*	8·31	0	0	11·02	6·31	57·3	0·754	1·317
12*b*	6·61	3·1	0·469	11·65	6·29	54·0	0·567	1·051

In summing up the author believes that he is justified in drawing the following conclusions from the results of his tests:—

1. That in an oil engine the economy in oil consumption is greater with a moderately high compression than with a very low compression before ignition.
2. That the economy obtained by working with a very hot vaporiser is greater than that with one only moderately hot.
3. That the true effect of injecting water with the oil vapour is not due to dissociation of the H_2O, but is in reality due to economy—that is to say, the engine becomes less efficient.
4. That if in case (3) a greater economy results such economy is not due to dissociation of the H_2O, but is in reality due to improved conditions, (1) and (2), being realised as the result of injecting water with the charge.

(To be continued.)

METAL MARKETS.

JUNE.

Pig Iron.—The iron and steel trade have been very dull during the month of June, the speculative markets being inactive right through the month. Although no attempt has been made to knock down warrant prices, in consideration of stock increases, yet the prices have come down very gradually. The breaking up of warrants into 50 and 100-ton lots in order to induce the public to speculate still remains only a suggestion, and the public are still conspicuous by their absence as regards the warrant market. The reduction per ton for Cleveland for the month amounts to 9d. cash warrants. The fall in hematite amounts to 1s. 6d. per ton. The highest and lowest daily settlement prices quoted for pig iron during the month are as follows: At Glasgow, Scotch, 56s. 6d. and 54s. 9d.; Cleveland, 49s. 7½d. and 48s. 9d.; hematite, 66s. 1½d. and 64s. 7½d. In London, Cleveland, 49s. 6d. and 48s. 9d. Rubio ore has been quoted at 20s. 6d. ex-ship Tees. Average blast-furnace coke ranged from 16s. to 16s. 6d. delivered at Middlesbrough. At the end of the month Messrs. Connal and Co., the warrant store keepers had in stock at Middlesbrough 435,550 tons of Cleveland pig iron, composed of 397,672 tons of No. 3 Cleveland, 34,408 tons of other kinds of iron deliverable as standard, and 3,470 tons of other kinds of iron not deliverable as standard. Since the beginning of June the stock has been increased by 953 tons. Shipments of pig iron for June amount to 117,957 tons, 102,178 tons of which have gone from Middlesbrough and 15,178 tons from Skinningrove. This is 32,433 tons more than last month and 12,754 tons more than June last year. Of the pig iron despatched from Middlesbrough 24,731 tons went coastwise and 78,048 tons foreign. Italy imported 18,595 tons; Scotland took 15,076 tons; Sweden, 12,238 tons; Canada, 11,000 tons; Germany, 10,946 tons; and Belgium and France, about 4,000 tons each. Of the Skinningrove loadings 14,638 tons went to Scotland and 540 tons to the Continent.

Manufactured Iron and Steel.—The position has remained practically unchanged during June, although activity is reported at works producing shipbuilding material. At the end of the month iron bars were at £7; iron ship plates, £6 10s.; iron ship angles, £7; iron ship rivets, £7 6s.; packing iron, £5 15s.; steel bars, £6 5s.; steel ship plates, £6 10s.; steel ship angles, £6 2s. 6d.; steel strips, £6 10s.; steel hoops, £6 12s. 6d.; steel joists, £6 5s. 6d.—all less 2½ per cent discount. The manufactured iron shipped during June amounted to 15,786 tons. Of this 6,839 tons went coastwise and 8,947 tons to foreign customers. India received 3,679 tons, the next largest importer being the Argentine. The steel despatched amounted to 38,845 tons, of which 27,393 tons went foreign and 9,452 tons coastwise. The largest importer was India, who received 7,663 tons. Canada received 2,766 tons; Russia, 2,743 tons; Japan, 2,375 tons; New South Wales, 2,163 tons; and Ceylon, 2,140 tons.

Copper.—There is still a decline in price of this metal. The highest daily settlement price was £56 17s. 6d. on the 1st and 14th of the month, and the lowest £54 5s. on the 16th. The price at the end of the month was £54 10s.

Tin.—The price for tin has kept fairly steady, the highest and lowest daily settlement prices being £149 12s. 6d. and £148. The 1st and 30th prices were the same, viz., £149 12s. 6d.

Lead.—Lead was very steady, there being a rise in soft foreign towards the end of the month. The highest and lowest daily settlement prices were—soft foreign £12 17s. 6d. and £12 11s. 3d. and English £13 2s. 6d. to £13. The 1st and 30th prices were soft foreign £12 11s. 3d. and £12 13s. 9d. and English £13.

Spelter.—There has been a gradual decline in g.o.b.'s from £22 10s. on the 1st to £22 2s. 6d. on the 30th. The highest and lowest daily settlement prices were £22 10s. and £22. Except for the 1st and 2nd when the price was £23 5s., the price of specials for the month was constant, and at £23.

LAUNCHES AND TRIAL TRIPS.

Kansas.—On Saturday morning, 25th June, Messrs. Workman, Clark, and Co. Ltd., Belfast, launched from their south yard a large steamer, built by them to the order of the Bucknall Steamship Lines Ltd., London. The new vessel, which has been named the Kansas, is 488 ft. in length, with a gross tonnage of over 6,000, and has been built under British Corporation survey for the highest class in their Registry. The propelling machinery consists of a set of triple-expansion engines having all the necessary auxiliary appliances, and supplied with steam from three single-ended multitubular steel boilers working under an approved system of forced draught.

Thistleban.—On Saturday, the 25th June, Messrs. Craig, Taylor, and Co. Ltd. launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a single-deck screw steamer of the following dimensions, viz.: 382 ft. by 51 ft. 4½ in., by 26 ft. 6 in. moulded. She is built of steel to the highest class in Lloyd's Registry. She is equipped with patent direct steam windlass with quick-warping ends, steam steering gear, eight steam winches, and multitubular donkey boiler. Her engines have been constructed by Messrs. Blair and Co. Ltd., Stockton-on-Tees, the cylinders being 26 in., 42½ in., 69½ in., by 45 in., with two large steel boilers working at 180 lbs. pressure. The vessel has been built to the order of the Albyn Line Ltd. (Messrs. Allan, Black, and Co., Sunderland, managers), under the superintendence of Messrs. M. Wawn and Son, Sunderland.

Ladywood.—On Saturday, 25th June, Messrs. Osbourne, Graham, and Co., of Hylton, sent to sea for her official trial the steel screw steamer Ladywood, constructed for Messrs. Wm. France, Fenwick, and Co. Ltd., of Sunderland and London. She carries 3,500 tons on a light draught, and is to Lloyd's highest class. The engines have been supplied by the North-Eastern Marine Engineering Co. Ltd., of Sunderland, and have cylinders 22½ in., 37 in., 61 in., by 42 in. stroke, with two large boilers working at a pressure of 180 lbs. During the trial, which was in every way satisfactory, a speed of 11 knots was easily attained.

Republicana.—On the 27th June Messrs. Murdoch and Murray Co., Port Glasgow, launched a twin-screw steamer for passenger and cargo service for foreign owners. The vessel was towed to Glasgow to be fitted with machinery.

Zeelandia.—This new twin-screw liner, the second vessel which Messrs. Alexander Stephen and Sons Ltd., Linthouse, have built for the Koninglyke Hollandsche Lloyd, of Amsterdam, has completed speed trials on the Firth. The vessel attained a speed, loaded, of 16 knots. The Zeelandia is intended for the mail and passenger service between South America and Amsterdam and other Continental ports, and she will also call at Dover.

Tadorna.—This vessel has just recently been launched from the Neptune Works, Newcastle-on-Tyne, for the Cork Steamship Co.'s services between Manchester, Liverpool, and Dutch and Belgian ports. The length is 275 ft. and beam 36 ft. The propulsion will be by triple-expansion engines, and the vessel is designed to carry 2,450 tons dead weight on a moderate draught of water.

Camerata.—On Saturday, 25th June, the steel screw steamer Camerata, built by Messrs. Wm. Gray and Co. Ltd., to the order of Messrs. Frank C. Strick and Co. Ltd., of London and Swansea, for La Tunisienne Steam Navigation Co., of Paris, had her trial trip. The vessel has been built to Lloyd's highest class, and is of the fellowing dimensions, viz.: Length overall, 362 ft.; breadth, 50 ft.; and depth, 25 ft. 11½ in. Triple-expansion engines have been supplied by the Central Marine Engine Works of the builders, having cylinders 24in., 38 in., and 64 in. diameter, by 42 in. stroke, and two large steel boilers adapted for a pressure of 180 lbs. per square inch worked under Howden's system of forced draught. The trial was a very satisfactory one, the speed being 11½ knots.

Anna.—This new screw steamer, of about 2,200 tons dead weight, built by the Campbeltown Shipbuilding Co. for German owners, ran trials at Wemyss Bay on July 1st. The vessel is specially designed for the owners' timber and general trades. On the trial a mean speed of 11½ knots was attained.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 30th June, 1910.

ABERDEEN.—*First class :* A. R. Reid, W. S. Ritchie. *Second class :* J. W. Adam, C. Cadger, J. W. Masson.

BRISTOL.—*Second class :* H. Beszant, S. P. Ross, A. E. Turner.

GREENOCK.—*First class :* A. McPhail, J. Weir, D. M. B. Morrice, R. Millar, A. Currie. *Second class :* A. Cousins, J. Crawford, T. Gallie.

HULL.—*First class :* G. J. Gresswell, V. Hadland, G. J. Stuart, F. Cook, P. F. Winsor. *Second class :* R. D. Bartlett, G. W. Giles.

LIVERPOOL.—*First class :* J. L. Walker, W. A. Hannah, W. J. McDonald, P. H. Wilson, M. Mackay. *Second class :* D. Pimblett, A. London, G. A. Hunt, D. J. Owens, R. B. Griffiths.

LONDON.—*First class :* L. T. Tomlinson, J. L. Mitchell, E. P. Bamford, J. S. Gray. *Second class :* A. Patrick, J. F. Jackson.

SUNDERLAND.—*First class :* P. Christie. *Second class :* J. C. Metcalf, G. E. H. Campbell, F. Greenlees, A. H. Burlinson, H. Taylor, P. H. Smith.

NOTICES OF MEETINGS, &c.

July 9th.—The North of England Institute of Mining and Mechanical Engineers. Excursion to Blyth.

July 16th.—The Junior Institution of Engineers. The commencement of the Summer Meeting, which is to take place at Dublin and Belfast, from July 16th to July 23rd. A visit will be paid in the afternoon to the Power House of the Dublin United Tramways Company.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2254. **Composition of Alloy for Compressor Valves.**—Will some reader give the composition of a gun-metal alloy suitable for a discharge compressor valve for a ship's refrigerator, such as Haslam's? I have only copper, tin, spelter, and lead to work from.—Alloy.

Answer No. 1.—In answer to above query, the best mixing for this class of work is copper 100, tin 13, spelter 2 per cent.—H. H.

Answer No. 2.—A good tough gun-metal alloy is 90 per cent copper, 10 per cent tin, spelter or lead, but not both, and may be used in place of a small percentage of the other metals, this giving a very good, but cheaper, alloy. As much as 10 per cent spelter may be used; this gives fluidity to the alloy, and is an excellent deoxidising agent for the copper. Lead and copper, having but little affinity for each other, give trouble if more than 3 per cent of lead be used. So "Alloy" would do well to try 82 per cent copper + 10 per cent tin + 8 per cent spelter, or 84 per cent copper + 13 per cent tin + 3 per cent lead, the spelter to be added to the molten copper, and the tin last, the whole to be well stirred with an iron rod heavily coated with graphite, and the crucible to be kept covered as much as possible. There is a little phosphorus in the Haslam alloy I think, perhaps 0·5 per cent; but this need not trouble "Alloy."—A. M.

2263. **Oil Engine Feed Pumps.**—I am anxious to know of a good brass mixture suitable for oil engine feed pumps, as I have had considerable trouble with leakage from the pumps already installed. Information on this point would oblige.—A. H.-T.

Answer.—A good practical mixing for above is copper 87 lbs., tin 8 lbs., spelter 4½ lbs.—H. H.

2265. **Cast-iron Mixture.**—Will some reader favour me with the best mixture of cast iron, viz., one that will cast a test bar (2 in. deep by 1 in. thick) capable of withstanding a load of 28 cwts. applied in centre and supported 3 ft. centres.—R. A. B.

Answer.—I beg to submit the following mixtures, which have been actually tested, and which I think will be likely to meet R. A. B.'s requirements. It however, would have been better had he stated for what purpose the castings were required.

The following tests were taken from a series of bars cast in a crucible. Bars 1 in. square, 3 ft. 3 in. long. Centres of testing machines 3 ft.

	Cwt.		
Stanton No. 4 ……	5½		
,, ,, 2 ……	5½		
Scrap …………	6		
	—		
	17 cwt.		
	Cwt.	qrs.	lbs.
Average breaking of 130 bars …	7	2	15
	In.	In.	
Deflection …… …	$\frac{3}{4}$ ×	$\frac{1}{32}$	

	Cwt.		
Stanton No. 4…………	6		
,, ,, 2…………	4		
Star ,, 1…………	1		
Scrap …………	6		
	—		
	17 cwt.		
	Cwt.	qrs.	lbs.
Breaking …………	8	0	0
	In.		
Deflection……… …	$\frac{7}{8}$		

W. S.

2267. **Leaking Hydraulic Ram.**—Will any reader kindly say whether it is possible for an unturned hydraulic ram, about 8 in. diameter, to be kept from leaking under a pressure of 1,000 lbs. per square inch, and if so, what kind of packing should be used?—An Old Subscriber.

MISCELLANEA.

World's Largest Dock.—The Mersey Dock Board are arranging the construction of a new dock, which will probably be the largest in the world. It is to accommodate vessels 1,000 ft. long and 60,000 tonnage.

Outing.—The staff of Messrs. W. P. Butterfield Ltd., Shipley, numbering about 100, spent their annual outing at Morecambe on June 25th last, when a most enjoyable day was spent. The party left the resort at 8-30 p.m. for Shipley.

Steel at Skinningrove.—The first cast of steel was made at the Skinningrove Iron Co.'s Works near Whitby recently. The steel plant has been in course of construction for about the past two years. It is intended, we understand, to turn out sectional steel at Skinningrove.

Scottish Shipbuilding.—The Scottish shipbuilding industry during June has been in a very satisfactory state. The total output was 36,300 tons, as against 19,000 tons in June last year. The prospects of the industry are very good, and during the month many notable orders were secured.

Shrinkage and Contraction.—Technically, shrinkage refers to the gradual lessening in volume of fluid metal as it approaches the solidification point at which shrinkage ceases and contraction commences, contraction being understood to refer to the lessening in length or in volume of the solid metal.

The "I.C.S. Student," No. 7, Vol. 2, as usual with this monthly, contains many unique matters of interest. The first article on "Airmanship" contains a £100 prize for the first British student who is a graduate of the I.C.S. aviation course and who flies one mile. "Ideals" is a continued article of encouragement, and there are many others of equal merit. We would draw attention to the £24 in cash prizes offered in a new drawing competition.

With reference to the notice on page 570 of the *Board of Trade Journal* of 23rd June relative to the representation of British firms by an engineer at Toronto, the Imperial Trade Correspondent at Toronto (Mr. F. W. Field) now reports that the engineer in question sails in July for Great Britain, in order to discuss with British firms who may be interested the question of their representation in Canada. He desires to obtain agencies for engineering and contractors' supplies, including sanitary equipment for sewage purification, filtering plants for pure water supplies, dock cranes, road rollers and scrapers, wire cable, etc. This London address may be obtained by British firms on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Northampton Polytechnic Institute.—The silver medal offered by the Women's Aerial League to the best student in the pioneer courses in aeronautics, held during the session 1909-10, has been awarded to Mr. Duncan George, Mr. E. R. Moffat being *proxime accessit.* In continuation of the above successful evening courses, extended courses of a more complete and practical nature are being arranged for next session, and Mr. F. Handley Page, of the firm of Messrs. Handley Page Ltd., the well-known aeronautical engineers, has been appointed to take charge of these courses. Full details will be announced shortly. In addition, there is under consideration the establishment of full-time day courses in aeronautical engineering extending over four years, and similar to the well-known day courses in electrical and mechanical engineering established some years ago. A preliminary announcement has already been made in connection with these day courses, and fuller particulars will be ready shortly.

The Institution of Mechanical Engineers and the American Society of Mechanical Engineers: Joint Summer Meetings.—The meetings are to be held in Birmingham, July 25th-28th, and in London, July 28th-30th. The following papers are down for reading and discussion in Birmingham: "English Running-shed Practice," by Mr. C. W. Paget; "Engine-house Practice, or the Handling of Locomotives at Terminals to Secure Continuous Operation," by Mr. F. H. Clark; "Handling Locomotives," by Mr. Henry H. Vaughan; American Locomotive Terminals," by Mr. William Forsyth; "High-speed Tools and Machines to Fit Them," by Mr. H. J. Brockenbury; "Tooth Gearing," by Mr. J. D. Steven; "Interchangeable Involute Gearing," joint paper, by members of the committee of the A.S.M.E. on "Standards for Involute Gears." In London: "Electrification of Suburban Railways," by Mr. F. W. Carter; "Cost of Electrically-propelled Suburban Trains," by Mr. H. M. Hobart; "Economies of Railway Electrification," by Mr. William B. Potter; "Electrification of Trunk Lines," by Mr. L. B. Pomeroy; "Electrification of Railways," by Mr. George Westinghouse.

PATENTEES' CHRONICLE

OF

Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus,**

JUNE 27th, 1910.

15326 Door protector. Kupper.
15327 Cleaning brush. Alesbury.
15328 Steam engine. Davidson.
15329 Coal conveyor screens. Barker.
15330 Pneumatic tyres. Edlin.
15331 Studs, etc. Young.
15332 Mops, etc. Lester.
15333 Lamp fittings. Hall.
15334 Fireproof magazine. Chalmers.
15335 Cycle lock. Toon.
15336 Looms. Pilkinton.
15337 Locks. Slack.
15338 Non-skid tyre. Coulson.
15339 Steam pump. Pickstone.
15340 Saucepans. Bagnall.
15341 Golf bags. Thomas.
15342 Dye manf. Levinstein.
15343 *Electric controller. Smith.
15344 Fire lighter manf. Newton.
15345 Valve gear. Dobbin.
15346 *Tachiometers. Wetzel.
15347 *Photographers. Duchenne.
15348 Roller skates. Reitbauer.
15349 Heat radiators. Breeden.
15350 Cycle saddle. Yoxall.
15351 Charging gas retorts. Guest.
15352 Braces, etc. Taylor.
15353 *Steam engine. Stumff.
15354 Toy gun, etc. Strapnel.
15355 Cycle spring forks, etc. Corah.
15356 Merry-go-round. Herzog.
15357 Flycatcher. Plöttner.
15358 Nut locks. Harris.
15359 Knitted necktie manf. Tatton.
15360 Ladies' hat fastenings. Bailey.
15361 Trawl nets. Frusher.
15362 Blind cord holder. Heelds.
15363 Digging, etc., Device. Brown.
15364 Rubber over-shoes, etc. Roberts.
15365 Electric switches. Garforth.
15366 Mattresses. Klemantaski.
15367 Motor tyres. Reeves.
15368 Hydrometers. Graf.
15369 *Fat reducing device. Loughney.
15370 *Thrust bearing. Brown-Boveri and Co.
15371 *Marine turbine. Brown-Boveri and Co.
15372 Type casting machine. Nicholas.
15373 Rifle sight. Grandi.
15374 Fountains, etc. Needham.
15375 *Wrenches. Kiser.
15376 *Filter beds, etc. Ames.
15377 Hats. Aylott.
15378 *Aeration of liquids. Billows.
15379 Automobile wheels. Goodyear.
15380 Nail guide. Fry.
15381 Wedge stone. Heine.
15382 Sick-bed. Bohnenkam.
15383 *Railways. Streeter.
15384 Generating combustible vapour. Pace.
15385 *Handcuff locks. Caveney.
15386 Motor engine. Watkins.
15387 Brushes. Payne.
15388 Dynamo control. Thomas.
15389 Wearing apparel fastenings. Bouvier.
15390 Dye manf. Bloxam.
15391 *Dye manf. Bloxam.
15392 *Dye manf. Bloxam.
15393 *Relating to printing rolls. Preschlin.
15394 Firing practice. Doyne.
15395 *Back pedalling brake. Marx.
15396 *Collapsible bath. Müller.
15397 Printing machine feed. Jones.
15398 *Opening, etc., valves, etc. Howlin.
15399 *Type casting machines. Degener.
15400 *Stamping pads. Bofinger.
15401 Wrenches, etc. O'Grady.
15402 *Slack adjusting devices. McCabe.
15403 *Railway vehicles. Almond.
15404 *Derricks. McVeigh.
15405 *Ticket register. Wright.
15406 *Small arms. Lake.
15407 *Dyeing fabrics. Bulteau.
15408 Photometers. Trezise.
15409 *Eyeglass mountings. Bader.
15410 *Ammunition primers. Lake.
15411 Utilising waste heat. Wilde.
15412 Motor car brakes. Trier.
15413 Gas supply governing. Hind.
15414 *Trolley poles. Richmond.
15415 Dynamos, etc. Brown-Boveri and Co.
15416 Billiard tables. Alcock.
15417 *Alternating current solenoids. Kohler.
15418 Tobacco pipe. Schroeder.
15419 *Polish tins, etc. Wilsch.
15420 Knitting machines. Aldridge.
15421 *Boot soling, etc. Borden.
15422 Power transmission device. Money.
15423 Constant voltage generator. Newton.
15424 Electric lamps. Harrison.
15425 *Accumulator boxes. Pritchett.
15426 *Dynamo control.
15427 *Automobile brake. Nelson.
15428 *Fluid pressure engine. Cassady.
15429 *Corn mills. Rubow.
15430 Steam heating apparatus. Clair.
15431 Steam traps. Clair.
15432 Electrical alarm. Lane.
15433 Rock drill holder. Capel.
15434 Superheaters. Long.
15435 Gas burners. Schuchardt.
15436 Shaft sinking device. Thomas.

JUNE 28th, 1910.

15437 Electrical device. Brown.
15438 Cycle pedals, etc. Koche.
15439 Internal-combustion engine. Strives.
15440 Clogs. Foxall.
15441 Internal-combustion engine. Wrench.
15442 Spinning machines. Antoine.
15443 Bromine derivatives of indigo. Wyler.
15444 Temperature indicator. Clarke.
15445 Spinning machines. Cuttill.
15446 Ambulance. Burkett.
15447 Gas controlling device. Bell.
15448 *Telephone mouthpiece. O'Hara.
15449 Sweeping, etc., apparatus. Seddon.
15450 Dredgers. Brown.
15451 Flower binder, etc. Wheatley.
15452 Internal-combustion engine. Henderson.
15453 Internal-combustion engine. King.
15454 Kneeling hassock. Francis.
15455 Kitchen rugs. Lonsdale.
15456 Electric burglar alarm. Prevette.
15457 Bath chambers. Sellars.
15458 *Rod operating mechanism. Morgan.
15459 *Safety valve. Royce.
15460 Furnace firebars. Dalgliesh.
15461 Ammunition transporter. Dundas.
15462 Colour manf. Fazi.
15463 Drying photo prints. MacCallum.
15464 Ice manf. Barr.
15465 Umbrellas. Lame.
15466 Railroad vehicles. Whiteley.
15467 Beer barrel corks. Edwards.
15468 Brush. Gerhold.
15469 Pillow slip. Macmillan.
15470 Looms. Ward.
15471 Paint cleaner, etc. Lambert.
15472 Clothes drainer. Saunders.
15473 Locknuts. Lench.
15474 Pneumatic tyres. Barker.
15475 Suspension device. Salomon.
15476 Ladies' hatpins. Haynes.
15477 *Mortice panic bolts. Tonks.
15478 Felt manf. Clegg.
15479 Bottling machine. Williams.
15480 Control for firing, etc. Barr.
15481 Curve drawing. Tyler.
15482 *Electric cut-out. Winterhalder.
15483 *Hatpin guard. French.
15484 Floating norfolk jacket. Read.
15485 Water closets. Barron.
15486 Ink supply to pens. Wainford.
15487 *Music sheets. Davis.
15488 *Gas stoves. Grosser.
15489 *Curtain suspending. Bölke.
15490 Preserving perishable goods. Allen.
15491 Golf ball painting. Doidge.
15492 Non-skid wheel. Nunan.
15493 Propulsion of boats, etc. Valda.
15494 Boot, etc., stand. Bailey.
15495 *Rotary shears. Slick.
15496 *Flushing apparatus. Moise.
15497 *Production of continuous wave trains, etc. Galletti.
15498 Light-proof envelope. Niell.
15499 Photo developing. Niell.
15500 Tobacco pipe. Niell.
15501 Envelope seal. Rigby.
15502 Aeronautical machines. King.
15503 Distillation, etc., device. Epstein.
15504 Wine manf. Stuckrad.
15505 Internal-combustion engine. Barr.
15506 Nail construction. Reiner.
15507 *Metal alloys. Beck.
15508 *Dredgers. Boistel.
15509 *Mixing machine. Owens.
15510 *Cycle carrier. Thornton.
15511 Rock drill. Daw.
15512 Gas production. Constantine.
15513 Music, etc., cases. Ferris.
15514 Projectiles. Coles.
15515 *Windows. Alexander.
15516 Fan. Powis.
15517 *Cartridges. Loeble.
15518 Brakes. Wright.
15519 Equalising the pull on draft animals. Willis.
15520 *Window frames. Monberg.

15521 Pruning vines, etc. Willis.
15522 Railway coupling. Coles.
15523 *Dye manf. Lucius.
15524 *Heating apparatus. Lindemann.
15525 *Manf. of alkali nitrates, etc. Guye.
15526 Type casting machines. Druitt.
15527 Amusement apparatus. Meinhardt.
15528 Sliding doors. Norman.
15529 *Brick manf. Vinsant.
15530 *Lamp burners. Fender.
15531 *Controller lever lock. Miller.
15532 Motor car headlights. Rolph.
15533 Cooking stoves. Liddall.
15534 Smoke consumer. Hargreaves.
15535 Hydraulic clutches. Jones.
15536 Cycle mudguards. Grace.
15537 *Track channeller. Lake.
15538 *Embossing apparatus. Orr.
15539 *Transmission gear. Renault.
15540 *Boot heels, etc. Yberty.
15541 *Solution of triangles. Goertz.
15542 *Line casting machines. Degener.
15543 *Looms. Regal.
15544 *Oxygen blowers. Knapp.
15545 *Spittoons. Zabranski.
15546 *Fish sorting machine. Vüg.
15547 *Prism polyscope. Nicolai.
15548 *Electric motors. Phillips.
15549 Vices. Moffatt.
15550 *Cameras, etc. Klaiber.
15551 *Chairs. Aslor.
15552 *Safety razors.
15553 Non-refillable bottles. Corfield.
15554 Pencil sharpener. Lyle.
15555 *Crushing cans. Pickett.
15556 Bottles, stoppers, etc. Hurst.
15557 Reducing crude rubber to liquid state. Oswald.
15558 Purifying rubber. Oswald.
15559 Applying bands, etc., to boxes, etc. Rose.
15560 Acid production. Johnson.
15561 Games. Bax.
15562 Wind screen. Strachan.
15563 Self-propelled vehicles. Collier.
15564 Electrical switch. Moore.
15565 *Blacking device. Hannah.
15566 *Flying machine. Jensen.
15567 *Knock-down barrel. Robinson.
15568 Artificial bait. Geen.

JUNE 29th, 1910.

15569 Railway switch. Johnson.
15570 Time measures. Vipond.
15571 Tyre inflator. Law.
15572 Lock nut. Barry.
15573 Rail chairs. Beynon.
15574 Telegraph poles. Bishop.
15575 Bakers' loaf tins. Cressey.
15576 Flying machine. Meden.
15577 Dress fastener. Loevenich.
15578 *Paper bag manf. Denman.
15579 Brushes. Shaw.
15580 *Washing machine. Vierling.
15581 Looms. Sidebotham.
15582 Roller, etc., skates. Willmoth.
15583 Steam boiler. Jory.
15584 Internal-combustion engine. Murry.
15585 Gas lighter, etc. Young.
15586 Wind screen. Dee.
15587 Dynamo. Holbech.
15588 Steam engine. Davidson.
15589 Cycle wheel rim tape. Smith.
15590 Air-tight teat. Woolf.
15591 Door catch. Henry.
15592 Air-tight canisters. McEwen.
15593 Fire lighting device. Hutton.
15594 Relating to ships. Spence.
15595 Cycle lamp lighting. Brain.
15596 Internal-combustion engine. Meadows.
15597 Single track vehicles. Brennan.
15598 Casement windows. Bedingfield.
15599 *Butter holder, etc. McGregor.
15600 Wheels. Komatsu.
15601 Sand toy moulds. Washbourne.
15602 Aeroplanes. Wrench.
15603 *Cane harvesters. Hurrey.
15604 Lubricating axles. Rodd.
15605 Tobacco case. Oliver.
15606 *Internal-combustion engine. Cadett.
15607 Thrashing machine. Moore.
15608 Penholder. Waterman.
15609 Liquid straining device. Torrance.
15610 Shirt cuff suspenders. Ellis.
15611 Motor car wheels. Richardson.
15612 *Guns. Krupp.
15613 Malt beverage. Howell.
15614 Firewood splitting tool. Veal.
15615 Wooden boxes. Penny.
15616 *Cartridge holders. Ross.
15617 Chiming clocks. Moore.
15618 *Distributing electrical energy. Anderson.
15619 *Electric recording device. Lambot.
15620 Taps. Eliott.
15621 *Electric lamp. Skampy.
15622 *Delivering granular material. Wetter.
15623 Internal-combustion engine. Lamplough.
15624 Milk cans. Mears.
15625 Dynamo. Vandervell.
15626 *Type setting device. Drewell.
15627 *Mine shafts. Klöune.
15628 Relating to guns.
15629 *Sewing machine. Marks.
15630 *Sewing machine. Marks.
15631 *Sewing machine. Marks.
15632 Wheels. Putz.
15633 *Flying machines. Raclot.
15634 *Electrifying device. Aub.
15635 Moulding presses. Decauville.
15636 *Basins. Henrich.
15637 Closet seat. Vaupel.
15638 Magneto-electric sparking machine, Brand.
15639 Corn binders. Orbell.
15640 *Motors. Lambert.
15641 Ventilating strong rooms. Lee.
15642 *Screening device. Boult.
15643 *Screening device. Boult.
15644 Vacuum cleaner. Lake.
15645 *Turbine. Procner.
15646 Dye manf. Ransford.
15647 Phono optical illusions. Craig.
15648 *Knitted web manf. Scott.
15649 Colouring matter manf. Johnson.
15650 *Doors, etc., hinges. Tarján.
15651 Lock nut. Peterson.
15652 Aerial ropeway. Vickers.
15653 Luggage label. Thomson.
54 Collar, etc., adjustments. Anderson.
15655 *Boots, etc. Wagner.
15656 Cinematographs. Bolan.
15657 Pneumatic tyres. Smith.
15658 Motor car wind screen. Russell.
15659 *Time recorders. Foggin.
15660 *Perambulators, etc. Kürsten.
15661 *Screen. Büchner.
15662 *Internal-combustion engine. Fouchet.
15663 Pneumatic tyres. Mote.
15664 Electrolytic copper process. Jones.
15665 Ships' propellers. Paulson.
15666 Ovens. Lunt.
15667 *Shears. Searight.
15668 Railway couplings. King.
15669 Window fern cases. Roberts.
15670 Fishing winches. Forlow.
15671 *Wire netting. Schmid.
15672 Engraving printing rollers. Reckard.
15673 *Printing upon rollers. Rechard.
15674 Blast furnace. Zohrab.
15675 Gramophone sound box. Lyons.
15676 Fishing reels. Curtis.
15677 Game. Long.

JUNE 30th, 1910.

15678 Shift key lever. Bedford.
15679 Fastening ladies' boas. Johnson.
15680 Brick manf. Whittaker.
15681 Dress fastening. Clayton.
15682 Weaving shuttle. Storey.
15683 Winding yarn, etc. Drennan.
15684 Electric switches, etc. Dean.
15685 Toilet pins. Johnson.
15686 Sandals. Fingerhut.
15687 *Water, etc., mains. Huguenin.
15688 Screw propellers. Quick.
15689 Nursery chairs. Norfolk.
15690 Spinning machines. Ashworth.
15691 Railway carriage door. Roberts.
15692 Wireless telegraphy. Lenz.
15693 Door holder. Davies.
15694 Grass mower. Ludlow.
15695 Vacuum cleaner. White.
15696 *Compound of tannin, etc. Weil.
15697 Knife cleaner. Hall.
15698 *Door fastener. Johnson.
15699 Manf. of pickers. Dean.
15700 *Artificial silk manf.
15701 Liquid soap distributor. Allen.
15702 Erecting bench. Stone.
15703 *Spinning machine. Vleek.
15704 Skylight ventilator. Greenwood.
15705 Sheet metal boats. Richardson.
15706 *Artillery vehicles. Krupp.
15707 Recovery of sulphur. Teed.
15708 *Tree climbing device. Hardenne.
15709 Sole sewing machines. Richards.
15710 Electric lamps. Quint.
15711 *Tar coatings. Raschig.
15712 Photo apparatus. Walker.
15713 *Hardening, etc., wood. Sucher.
15714 *Dredgers. Boistel.
15715 Fibre cleaner. Wright.
15716 Vehicle brakes. Parker.
15717 Centrifugal pumps. Scheurmann.
15718 Road cleaning, etc. Wildsmith.
15719 *Constructional members. Tönjes.
15720 *Mercury vapour rectifiers. Schäfer.
15721 *Typewriter. Fell.
15722 Compound manf. Johnson.
15723 Rubber boot soles, etc. Cooke.
15724 *Surgical appliance. Wiegard.
15725 Torpedoes. Shoesmith.
15726 Disinfecting device. Reynolds.
15727 Sanitary closets. Reynolds.
15728 *Bottle filling, etc. Dörschel.
15729 Food manf. Woosnam.
15730 *Umbrellas, etc. Kroker.
15731 Electric junction box. Champion.
15732 Stamp affixing machine. Green.
15733 *Folding cameras. Mckmak.
15734 *Telegraphic device. Montogra.
15735 *Vacuum cleaner. Schumacher.
15736 Grooved pulley. Ryland.
15737 *Cycle wheels. Roze.
15738 *Concrete mixery. Brackenburg.
15739 Ornamental fountain. Corbin.
15740 *Automatic machine. Harhorn.
15741 Gas burners. Robson.
15742 *Counting appliance. Camescasse.
15743 *Feather plume manf. Metzger.
15744 *Energy relay. Garnmont.
15745 *Pneumatic tyres. Ascheri.
15746 Miners' tool. Banyon.
15747 *Temperature recorder. Cherretot.
15748 *Brush manf. Burger.
15749 Torpedo boats. Elix.
15750 *Rammer for ordnance. Bohn.
15751 *Blind cord. Gibb.
15752 Solutions of cellulose. Pellerin.
15753 *Dynamo. Allgemeine.
15754 *Evacuating system. Allgemeine.
15755 *Glass enclosures. Mygatt.

JULY 1st, 1910.

15756 Casting reels. Mawson.
15757 Pianos. Carryer.
15758 Safety device for fires. Friezer.
15759 *Hydraulic pumps. Roberts.
15760 Fire control apparatus. Barr.
15761 Safety device for aerial motors. Jane.
15762 Cardboard boxes. Hutton.
15763 Brick manf. Fawcett.
15764 Road vehicles. Pratt.
15765 Flue cleaner. Havercroft.
15766 Paper manf. Barber.
15767 Water purifying. Candy.
15768 Luggage carrier for cycles. York.
15769 Egg handling device. Knowles.
15770 Dynamo. Carter.
15771 Talking machine. Baker.
15772 Kettle. Stiller.
15773 Looms. Taylor.
15774 Railway wagons. Goode.
15775 Submarines. Macnamara.
15776 Wheels. Board.
15777 Tobacco pipe filler. Allen.
15778 Tipping wagons. Wild.
15779 Aeroplanes. Pope.
15780 Letter sheets. McLennan.
15781 Pipe cleaner. Walker.
15782 Spinning machine. Seeley.
15783 Bedstead. Albright.
15788 Castors. Cole.
15789 *Arc lamps. Pechin.
15790 *Expansion of steam device. Gaudin.
15791 *Rotary motion transmission. Leppitz.
15792 Electric conductor. Bowyer.
15793 Van shaft suspending. Browning.
15794 Aluminium solder. Adamson.
15795 Photo developing. Hodgson.
15796 Walls. Ferguson.
15797 *Lubricant for waterproofing leather. Fölsch.
15799 Valves. Robinson.
15800 *Air compressor. Gemmill.
15801 Cape carts. Hewer.
15802 Calculator. Mackle.
15803 *Driving belt. Pollin.
15804 Billiard cue tip. Broomfield.
15805 Bayonets. Ashton.
15806 *Priming band manf. Prenzie.
15807 Arc lamp. Jones.
15808 *Administering anaesthetics. Poole.
15809 Ship's log apparatus. Walker.
15810 Air filters. Sayers.
15811 *Scribing blocks. Worsdell.
15812 *Internal-combustion engine. Goodhart.
15813 Tea mills. Banks.
15814 Food preparation. Hawkins.
15815 *Race game. Trepagner.
15816 Pants. King.
15817 Ammonium sulphate manf. Christie.
15818 *Coating paper with fibres. Claviez.
15819 *Coloured woven goods. Becke.
15820 Liquid raising device. Humphrey.
15821 Washing, etc., machines. Spivey.
15822 Distributing material upon roads, etc. Hines.
15823 Non-slip horseshoe. Lowry.
15824 Counting machines. Wentworth.
15825 *Hairpins. Tucker.
15826 *Locks. Ziron.
15827 *Refuse treatment.
15828 *Danger signal. Stokes.
15829 *Treatment of glycerine. Boult.
15830 *Cycle frame. Hopper.
15831 Railway signalling. Pearce.
15832 *Tyres. Hugon.
15833 *Spooling machine for yarn, etc. Schweiter.
15834 *Label applying device. Maynes.
15835 Fluid pressure braking apparatus. Cloud.
15836 *Braking device. Mahoney.
15837 *Submarine telegraphy, etc. Rosenthal.
15838 Tile floors. Juman.
15839 *Internal-combustion engine. Eason.
15840 Internal-combustion engine. Dunscombe.
15841 *Heating apparatus. Vermylen.

15842 Fixing stops in tubes. Cutler.
15843 *Weighing machines. Benis.
15844 Child's level crossing. Haswell.

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15845 Emergency tube for mines. Fraser.
15846 Pencil compasses. Bayly.
15847 *Welding blow pipe. Demeur.
15848 Distance finder. Martin.
15849 Aeroplanes. Booth.
15850 Motorists' cap. Wilson.
15851 Brake mechanism. Lancaster.
15852 Horseshoe. Smith.
15853 *Lubricating device. Waigh.
15854 *Valve. Sonek.
15855 *Meat slicer. Berkel.
15856 *Meat slicer. Berkel.
15857 Rotary engine. McCullock.
15858 Tyre inflator. Irving.
15859 Whitewashing device. Ward.
15860 Sprinklers. Boeininger.
15861 Gas producer. Stobie.
15862 Electric cut-outs. Hope.
15863 *Casting metal. Enomoto.
15864 Pie moulds. Coppin.
15865 *Rolling stock of railways, etc. Bellecourt.
15866 Safety envelope. O'Callaghan.
15867 Motor car whels. Symes.
15868 Garments. Bacon.
15869 Sheet gālvanising device. Minnis.
15870 Paper bags. Greenwood.
15871 Washing, etc., machines. Gibbins.
15872 Wind resisters. Chilcott.
15873 Electrical condenser. Bullmore.
15874 *Dredgers. Wienen.
15875 Advertising device. Rhodes.
15876 Advertising device. Rhodes.
15877 *Ammonium sulphate preparation. Burkheiser.
15878 Tube manf. Powell.
15879 *Electric lamp. Schröter.
15880 *Potato digger. Brettschneider.
15881 Gymnastic apparatus. Cox.
15882 Train warning signals. Moore.
15883 Half-tone process screens. Smiles.
15884 Motors, etc. Currall.
15885 Toy. Logan.
15886 Cap manf. Norton.
15887 Sewing machine. Salter.
15888 Games. Tatian.
15889 *Tyres. Stichelen.
15890 Physiologically active base. Wellcome.
15891 *Leather tyres. Spiegel.
15892 Alloys. Parsons.
15893 *Briquette manf. Lepoutre.
15894 *Advertising device. Sperber.
15895 *Reproducing configuration of objects. Selmersheim.
15896 *Vending apparatus. Vilbonnet.
15897 Fireproof wood, etc. Carron.
15898 Advertising device. Leonard.
15899 Bacon slicer. Robinson.
15900 Valve actuating mechanism. Burr.
15901 Tobacco cartridges. Tattershall.
15902 Ambulance stretchers. Cox.
15903 Treatment of fatty acids, etc. Markel.
15904 Pincer lasting machines. Bates.
15905 Railway vehicles. Uriburn.
15906 *Cooking apparatus. Rotzov.
15907 *Rotary engine. Stercq.
15908 Boot supports, etc. Coblentz.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to August 8th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

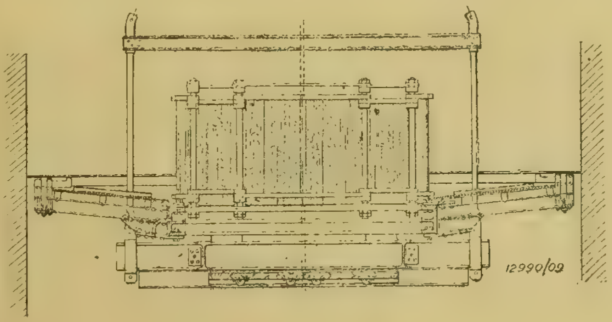
Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

1184 **Wilmot**: Ranges and the like. [Post-dated July 24th, 1909.] 5270 **Davies and Rowell**: Process for manf. of a composition to be used in lieu of wood and other substances and materials. [Post-dated September 2nd, 1909.] 9906 **Angus**: Devices for preventing collisions between railway trains. [Date applied for under International Convention, May 8th, 1908.] 10235 **Evans**: Machinery for the manf. of feeding cake. 10400 **Bohm**: Incandescence bodies for gas lighting. 12386 **Ure**: Pneumatic tyres for motor cars and other vehicles. [Cognate Application. 13401, 1909.] 12411 **Durrant**: Expander or stretching machine for cotton, woollen, and similar cloths. 12426 **Heide (Murray and Jacobs Manufacturing Co.)**: Non-slipping tread and wearing surfaces for floors, stairs, and the like. 12450 **Herzfeld**: Hot-water and electric supply systems. 12463 **Lennox**: Revolving drying machines. 12465 **Lennox**: Machine or apparatus for drying bricks, briquettes of peat, coal, or other materials, salt chemicals, sand, and other analogous wet or moist materials. 12516 **Burt**: Measuring and calculating rule. 12563 **Gunner**: Screws and the method of applying same. 12584 **Button**: Under-feed mechanism for furnaces, fireplaces, stoves, ranges, and the like. 12606 **Solon**: Regenerative gas stoves. 12614 **Moore**: Phonographs and talking machines. 12659 **Foster and Hamilton**: Valves for internal-combustion engines. 12668 **Cartwright**: Printing presses. 12712 **Jarvis**: Sand papering, grinding, and analogous abrading machinery. 12719 **Riley**: Smithy hearths and the utilisation of waste heat therefrom. 12757 **Sands**: Frames for stretching and drying garments upon. 12807 **Newell and Mitchell**: Advertising device. 12808 **Wardle**: Lanterns for electric lamps. 12865 **Ronchetti**: Typewriting machines. [Date applied for under International Convention, June 5th, 1908.] 12867 **Plant**: Heeling machines. 12885 **Bohm**: Cash-delivering machines. 12893 **Lake (Ingersoll Rand Co.)**: Hammer drills. 12926 **Strachan and Strachan**: Pneumatic tyres for motor vehicles. 12937 **Houghton, Allman, and Gray**: Electric power traction systems. 12943 **Bardsley**: Slubbing, intermediate, roving, and like frames. 12980 **Huffman**: Printing machines.

12990 **Walker**: Scaffolds or stagings particularly adapted for mining purposes.

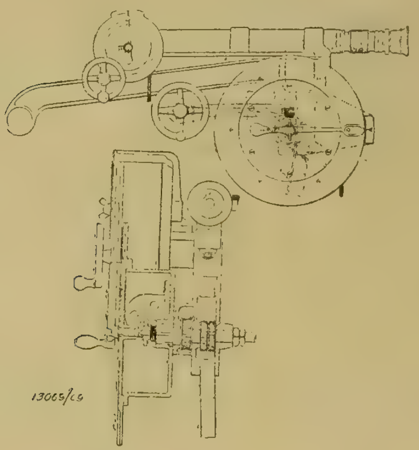
The apparatus comprises a main framing fitted with suitable devices for suspending it by, and to this framing are hinged a number of preferably radial arms adapted to support the flooring upon which the workmen are to stand while employed, for instance, in lining a pit with tubbing. The framing is constructed with a central opening for the passage of the buckets employed for the removal of the excavated material. The workmen at the bottom of the pit are protected from any debris which may be dislodged from the platform by having the flooring sections lying between the radial arms outwardly extensible. Thus while the staging may be normally of such a diameter as to pass easily up and down the pit it is possible, after the staging has been placed in the desired position, for the plates to be extended outwardly until they come into close contact with the walls of the pit and so prevent any article or debris from passing between the periphery of the staging and the interior of the pit. Radially slidable bolts may be mounted upon the staging, and when the staging is in the desired position may be projected so as to take into apertures in the interior surface of the pit and constitute supports for the staging, thus relieving the suspension gear of the dead weight of the staging.



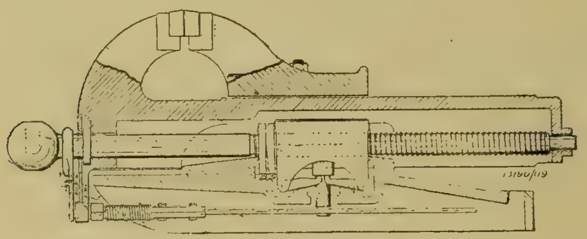
13000 **Light**: Liquid fuel burners. 13009 **William Beardmore and Co., and Bremberg**: Range-indicating and sighting apparatus for ordnance. 13017 **Thomlinson**: Flexible shafting. 13061 **Pollen (Mergenthaler Setzmaschinfabrik Ges.)**: Devices for levelling multiple-face matrices between the casting and distributing mechanisms of a typographical composing machine.

13069 **Dawson and Buckham**: Sighting apparatus for ordnance.

This invention relates to sighting apparatus of the kind in which a travelling range pointer is actuated through worm gearing by an electric motor controlled from a distant station whence the information relating to the sighting is transmitted, the movements of the pointer being followed by angularly displacing a graduated range dial or an index operated by the movement of the sighting apparatus during its elevation or adjustment by hand through the intervention of the usual rack and pinion arrangement. The pointer is angularly displaced by the motor to any desired extent, and is brought back to the zero or starting position of the sight by a corresponding angular displacement of the range dial and so setting the sight. For this purpose the casing of the motor is attached to the dial, so that when the dial is moved by the hand-actuated gearing in setting the sight movement will be imparted to the pointer in a direction opposite to that which it receives from the motor in order to return the pointer to its zero or starting position. Thus the act of setting the sight to accord with the indications of the motor-actuated pointer, instead of causing the dial to follow the movements of the pointer as in previous arrangements, causes the pointer to return to the zero or starting position after each angular displacement it receives from the motor.



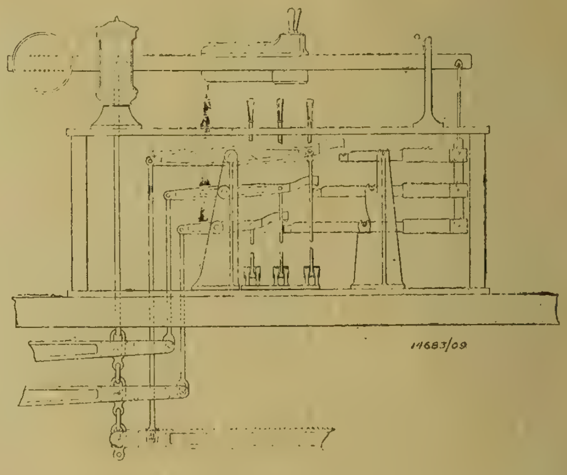
13070 Boult (United Shoe Machinery Co.): Tack-extracting machines for use in the manf. of boots and shoes. 13074 Von Koppen: Ships' hulls. 13083 Lorenz: Key actions for typewriting machines. [Date applied for under International Convention, June 5th, 1908.] 13084 Ronchetti: Typewriting machines. [Date applied for under International Convention, June 5th, 1908.] 13085 Anderson: Margin and like stop mechanism for typewriting machines. [Date applied for under International Convention, June 5th, 1908.] 13086 Anderson: Typewriting machines. [Date applied for under International Convention, June 5th, 1908.] 13087 Anderson: Ribbon-feeding mechanism for typewriting machines. [Date applied for under International Convention, June 5th, 1908.] 13100 Daniel and Daniel: Adding machine attachments for typewriters. 13144 H. and M. Southwell Ltd., and Head: Apparatus for winding yarns of different colours on spools, more especially intended for winding pile yarns on spools for use in looms for weaving tufted fabrics. 13163 Ronchetti: Typewriting machines. [Date applied for under International Convention, June 5th, 1908.] 13164 Lorenz: Back-spacing mechanism for typewriters. [Date applied for under International Convention, June 5th, 1908.] 13165 Ronchetti: Line-spacing mechanism for typewriting machines. [Date applied for under International Convention, June 5th, 1906.] 13166 Ronchetti: Platen-shifting mechanism for typewriting machines. [Date applied for under International Convention, June 5th, 1908.] 13167 Ronchetti: Platen-shifting mechanism for typewriting machines. [Date applied for under International Convention, June 5th, 1908.] 13168 Anderson: Escapement mechanism for typewriting machines. [Date applied for under International Convention, June 5th, 1908.]



13190 Bateman: Parallel vices.

This relates to improvements in parallel vices of the class in which a divided nut is employed engaging with the operating screw when the work is to be gripped and disengaged therefrom when the movable jaw is being slid to or from the work in the vice. According to the present arrangement, one portion of the divided nut is in the form of a bridge with lugs depending on either side of the screw and furnished with pivoted rocking levers, on the inner ends of which rest the other portion of the nut. As the lower portion of the nut is operated by the trigger or releasing device, the two portions of the nut are simultaneously operated and opened or closed, releasing or gripping the operating screw as desired. Rocking or self-adjusting washers are employed to equalise the pressure on the divided nut.

13201 Pollen (Mergenthaler Setzmaschinen-Fabrik Ges.): Method of and means for levelling multiple-face matrices in typographical composing machines, preparatory to distributing them. 13205 Johnston: Feed regulators for steam boilers. 13209 Pierpont, and Lanston Monotype Corporation: Type-casting machines. 13220 Siemens Bros. and Co., Handcock, Dykes, and Rawlings: Sheathing of insulated electrical conductors. [Cognate Application. 24683, 1909.] 13223 Dairy Outfit Co., and Summers: Milk churn tops, and lids for use therewith. 13230 Hewitt, and Hewitt Engines Ltd.: Cooling device for internal-combustion engines. 13238 Laurie-Walker and Niblett: Ploughs for electric tramcars. 13243 Dawson and Buckham: Elevating and loading gear for ordnance. 13248 Martin and Rippingille: Locking devices for nuts or washers. [Post-dated December 7th, 1909.] 13249 Chaplin and Millington: Padlocks. 13281 Butterworth: Friction clutch. 13291 Ruthenberg: Smelting of sulphide ores and the like. 13294 Perrot and Goris: Process for rendering inactive the ferments in vegetable and animal organisms, and means for effecting the same. 13295 Nathusius and Westdeusche Thomasphosphat-Werke Ges.: Electric furnaces. [Application for Patent of Addition to No. 7188, 1908.] 13313 Plant: Shoe-sewing machines. 13314 Plant: Machines for sewing boots and shoes. 13317 Moss: Shirts and collars. 13400 Denham: Gentlemen's cabinet. 13401. *See* 12386, 1909. 13416 Schooling and Wykeham-Fiennes: Adding and subtracting machines. 13422 Napierala: Hame fasteners. 13441 Law: Machines for the manf. of cleaning waste. 13442 Berry: Electric switches and switch fuses. 13461 Howden: Circulators for water-tube steam generators. 13520 Fedotoff: Carding engines. 13525 Jenner: Ice chests or safes, cooling chambers, refrigerators, and the like. 13674 Ravigneaux: Spring-driven clockwork mechanism. 13810 Heywood, and Fine Cotton Spinners' and Doublers' Association Ltd.: Spinning mules. 14001 Boult (Goldthwait): Automatic fire extinguishers. 14029 Bowley: Elastic-fluid turbines. 14100 Weekes and Ashdown: Spraying nozzles. [Post-dated December 2nd, 1909.] 14210 Lock and Pearce: Bed motions of printing machines. 14311 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of dyestuffs. [Samples furnished under Section 2.] 14321 Peters: Connections for inflating pumps, hoses, steam pipes, and the like. 14350 Binyon: Pneumatic tyres. 14599 Bebbington: Snifting valves applicable to air pumps. 14621 Ayton: Ignition apparatus of internal-combustion engines. 14657 Pearman: Construction of apparatus for stove-enamelling baths. 14662 Howorth (Millspaugh): Suction rolls suitable for use in paper and pulp-making machines and for other purposes.



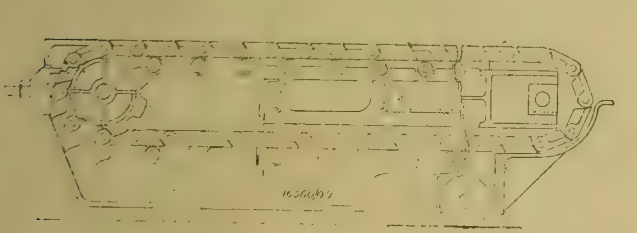
14683 Hipkins: Weighbridges.

The present invention relates to that class of combined weighbridges employing three or more weighbridges or platforms connected to one steelyard, and has for its object the application of automatic compensating levers to this class of weighbridge for the purpose of compensating for disturbance of equilibrium whatever the number of the weighbridges or platforms employed, and, further, the construction allows of each or every weighbridge or platform or any combination thereof being in or out of connection to the steelyard as desired. The compensating levers depend from the steelyard, and each of the levers and the weighbridge in combination therewith are operated by an independent or separate hand lever; this allows of every weighbridge and its compensating lever being independently and separately controlled irrelative to the operation of any other of the weighbridges and connections.

14785 Grogan: Supports for memorial crosses and wreaths on graves and vaults. 14820 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new acid wool dyestuffs. [Samples furnished under Section 2.] 14879 Tonks and Sparks: Manf. of ball bearing door and other hinges. 14988 Prosser: Tooth and other such brushes. 15079 Hogermann and Wellensick: Process for purifying municipal and industrial waters, more particularly waste waters. 15136 Petch: Hydraulic power transmission apparatus. 15155 James: Drawer pulls and the like. 15185 Custer: Mode of casting metal structures in permanent moulds having permanent cores. 15252 Lealan and Wardle: Lock nuts. 15282 Felten and Guilleaume Lahmeyerwerke Akt.-Ges.: Driving mechanism for petrol electric apparatus. [Date applied for under International Convention, July 1st, 1908.] 15388 Hindley, Hindley, Stanford, and Taylor: Cylinders of vertical internal-combustion engines. 15396 Horrell and Bowman: Domestic fireplaces. 15438 Hookham: Electricity meters. 15660 Gendron: Shuttle motions for looms. 15664 Howell: Vermin traps. 15759 E. A. White Ltd., and Jennison: Nozzles for syringes. [Post-dated December 31st, 1909.] 15858 Lake (Mathews Gravity Carrier Co.): Gravity roller conveyers. 15903 Ageron and De Charpin: Mechanism for starting explosion motors. 15935 Finney: Automatic weighing and price-computing instruments in combination. 15971 Bindel and Joest: Process and machines for automatically making chains. 16204 Hillyard and Simon: Vacuum cleaning apparatus for use in cleaning carpets and the like. 16397 Stock: Self-contained and easily portable apparatus for the constant supply of water or other liquids at fixed temperatures. 16549 Hopkins: Apparatus for use in the construction of circular concrete structures.

16560 Miller and Bennett: Revolving chain grates.

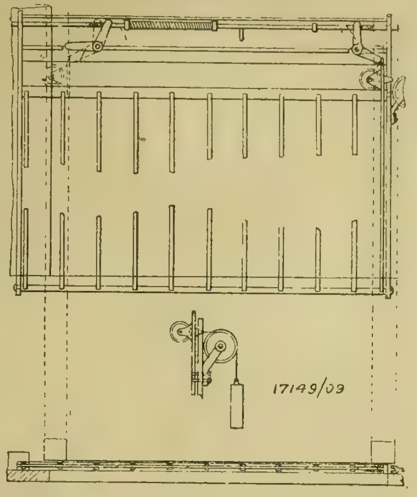
A series of supporting members is provided mounted under the bottom portion of the chain grate and adapted to control the position in which the pivoted links or firebars open the spaces between their supports. Experience has shown that owing to the green nature of the coal in the front of the furnace considerably more air is required for combustion at that end than at the back of the furnace. Very satisfactory results have been obtained with a stoker or chain grate in which the supporting members were arranged in such a manner that the pivoted links or firebars only opened at about a point 2 ft. away from the front end of the stoker. It is found that there is no advantage in practice in allowing the pivoted links or firebars to open at the rear end of the stoker since at this point it is often desirable to even restrict the admission of air.



16595 Luhrs and Hyslop: Coupling for flexible pipes. 16646 Dibben: Collapsible vans. 16688 Rostron: Automatic stop motion and take-up control devices for use with loom re-shuttling mechanism. 16700 Materne: Spring pin for fastening ladies' veils. [Date applied for under International Convention, January 19th, 1909.] 16757 Rollason: Conditioning or improving the quality and colour of flour. 16983 Harrison (Stacey): Stop cocks. 17029 Princess Lowenstein Wertheim: Gun mountings for use on ships.

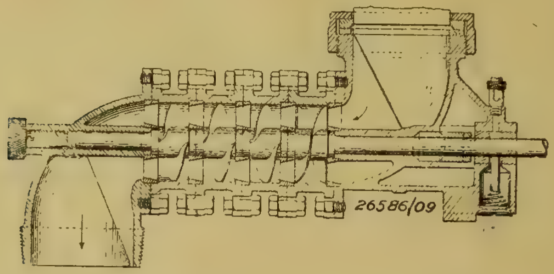
17149 Fox: Apparatus for automatically closing and locking hoist and lift gates.

The arrangement shown is the horizontal sliding action. The gate is of the collapsible type, and is enclosed or surrounded in a wrought-iron frame which carries in its upper portion a rail for the gate to slide upon by means of a pulley carried by and pivoted on a bracket, forming part of or supported by an extension of the end bar which at this part is made longer than the rest of the gate bars. The pulley, castor, or runner slides on the rail which is situated below a bar on which are pivotally mounted locking and releasing catches or levers which are controlled by a sliding shaft which are operated by the motion of the sliding shaft through that of the hoist or lift, and, further, by a spring or the balance weight of hoist cage not shown in drawing, but which will be readily understood.



17172 Marchant: Hair brush drying horses. 17409 Thomas: Solution for cleaning and polishing plate. 17563 Hartridge: Resilient tyres for the wheels of road vehicles. 17644 Bohlig: Bobsleighs. 17837 Lentz-Getriebe Ges. and Lentz: Rear axles of motor vehicles. 17920 Yates: Gas fires and the like. 17933 Meinzolt: Method of and appliances for stringing pianofortes. 18056 Allman: Mechanism for controlling the movement of curtain rod rings. 18061 Balg: Process and apparatus for the manf. of hollow building blocks. [Date applied for under International Convention, September 2nd, 1908.] 18136 Williams, Williams, and Williams: Facing point bars on railways. [Application for Patent of Addition to No. 19424, 1908.] 18147 Shipton: Advertising and displaying devices. 18275 Smithurst: Means and apparatus for opening and closing the window sashes or blinds of carriages and the like. 18432 Hudson: Surgical instruments known as trephines. 18437 Keen: Sound-reproducing machines. 18598 Crewe: Means for transmitting power to light machinery requiring high speeds, such as sewing machines and the like. 18604 Smith, Mitchell, Askam, and Hey: Tables or slabs for use with dry cleaning and other processes entailing the use of volatile liquids and solvents. 18610 Hoff: Process and apparatus for heating, melting, refining, and extracting metals and other substances. 18625 Wienecke and Bohm: Protector for pointed objects such as hat pins, tie pins, and the like. 18812 Nicholson, Nicholson, and Hardy: Swath turners and collectors. 18955 Pearson and Cox: Liquid fuel burners. 19099 Porter: Catch devices for use with reversing levers of steam winch engines and the like. 19184 Gibson and Palmer: Coin-freed fluid meters. 19244 Searle: Cushions of billiard tables and the like. 19324 Hardacre: Door holders. 19461 Mead: Fountain pens. 19486 Combe: Flag post for use in connection with golf and like games. 19657 Boyd: Appliance for facilitating the playing of poker patience. 19707 Wiking and Bengtsson: Mechanical vibrational massage apparatus. [Date applied for under International Convention, August 27th, 1908.] 19844 Charles Walmsley and Co., and Walmsley: Potching, beating, or disintegrating machines. 19907 Morgan and Reader: Eye for sails, carriage and cart hoods, garments, and the like. 19924 Lumsden: Gas producers. 19968 Knight: Packings for rotating shafts and the like. 19985 Cochrane: Safety lamps for indicating fire damp. 19991 Smith: Adjustable spring seat pillars for cycles, motor cycles, and the like. 20038 Simson: Luminous paints or compositions. 20105 Beaver and Claremont: Filling electric joint boxes.

20159 Hull: Billiard table or board. 20202 Szam: Tube scraper. 20239 Blatz: Cash check tills. [Date applied for under International Convention, September 3rd, 1908.] 20300 Newell: Boards for holding advertisements, newspaper contents, notices, and the like. [Post-dated March 4th, 1910.] 20404 Lutze: Machines for treating and moulding plastic material. 20480 Von Vass and Geszti: Apparatus for plastering and making walls, partitions, and the like. [Date applied for under International Convention, September 21st, 1908.] 20481 Lironi: Edge runner mill for treating plastic or clay for the manf. of bricks or the like. 20606 Challis, Chipperfield, and Stephens: Roller skates. 20698 Hughes: Garden reels. 21208 Lacroix: Turbines. 21293 Held: Manf. of iron vats and casks and the like vessels for brewers' use. 21393 Rosenthal: Travelling trunks. 21420 Watson: Tool for use in grooving casks. 21546 Snee: Screw wheels for use as wind, water current, and like motors. 21605 Harrison: Mowing and reaping machines. 21613 Smith: Form of parallel ruler and spacer. 21912 Lean (Firm Wolf, Sayer, and Heller): Machine for removing the fat and mucus from intestines. 21931 Johnson (Chemische Fabrik Griesheim Elektron): Igniting compositions for matches. 22224 Hodges: Flower holders. 22318 Kinnear: Annealing or like processes and apparatus therefor. 22937 Diener: Domestic washing appliances. 23086 Beresford: Folding lavatories. 23203 Newton (Spalckhaver): Inking mechanism. 23318 Santin: Street-sweeping machines. 23572 Ward, Robinson, and Ward Bros. (Blackburn) Ltd.: Shedding mechanism of dobbies of looms for weaving. 23717 Rossel: Mechanism for controlling propellers. [Date applied for under International Convention, October 17th, 1908.] 23763 Fearnside and Fearnside: Rubber heels for footwear. [Application for Patent of Addition to No. 8327, 1909.] 23938 Fortescue: Electrical transformers. [Date applied for under International Convention, November 19th, 1908.] 23950 Schreiber and Mannes: Kneading and mixing machines. 23988 Wakefield: Acetylene gas apparatus. 24095 Bland: Inverted incandescent gas burners. 24299 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manufacture and production of tetranitro-methane. 24443 Muller and Bonnet: Manf. of incandescent mantles. [Date applied for under International Convention, November 3rd, 1908. Application for Patent of Addition to No. 6556, 1909.] 24608 Conrad: Bottle seals. 24620 Soc. Anon. des Ciments Francais: Rotary furnaces for treating cements. [Date applied for under International Convention, November 5th, 1908.] 24683. *See* 13220, 1909. 24707 Boivin: Actuating mechanisms. 24787 Westebbe: Roller skates. 24904 Linnette Blinds Ltd., and Cox: Paper blinds. 25140 Boivin: Machine for distributing bars of sugar. 25156 Evered, and Evered and Co.: Electrical switches. 25201 Purdie: Bag for administering anæsthetics. 25222 Textil-Maschinenfabrik B. Cohnen: Dyeing apparatus. [Date applied for under International Convention, November 2nd, 1908.] 25251 Brenner and Hoffmann: Self-acting valve for pumps and similar devices. [Date applied for under International Convention, December 31st, 1908.] 25480 Pressey: Aeroplanes. [Date applied for under International Convention, November 19th, 1908.] 25589 Bohn: Devices for purifying and sorting clay or the like. [Request under Section 19 not granted. 25652 Allyn, Partridge, and Ward: India-rubber tyre treads, horseshoe pads, stair treads, or similar friction members. 25867 Morris: Gas meter. 26188 Franks: Appliance for supporting and securing together skirts and bodices, and retaining them in their proper position. 26247 Day and Oswald: Railway ties and rail fastenings. 26350 Kinney: Animal traps. 26373 Wainwright: Sash fastenings. 26374 Schmelzer: Transmission of power. 26476 Rey, and Chance Bros. and Co.: Lanterns of lighthouses and the like. 26558 Seward: Mechanical movements.



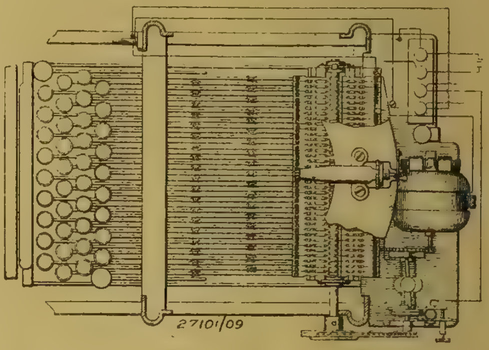
26586 Bennett and Burlingame: Screw pumps.

The invention is a pump of the screw form, and is characterised by the employment within the pump of a diaphragm or diaphragms having openings for the passage of the water tapering from the inlet to the outlet sides of the same, presenting shoulders or flat surfaces on the outlet sides to form back stops for the water to prevent back pressure, the diaphragms being formed of inner and outer rings connected by spokes which present knife edges on the inlet sides, the blades of the screw working closely against the diaphragms, and the diaphragms being held preferably in recesses formed between sections of the cylinder. The invention is also characterised by a double form of screw-bladed piston working in conjunction with a plurality of inlets and outlets.

26624 Robillot: Contrivance for automatically actuating an alarm signal in cases of fire, theft from rooms, escape of gas, and the like. 26929 Korber: Electric resistances. [Date applied for under International Convention, November 20th, 1908.]

27101 Goddard, Grover, and Thrall: Telegraph transmitters.

Means are provided for mounting and operating the cams carrying the telegraphic code characters, whereby the cams may be actuated by the depression of an operating lever and motion transmitted from the cam to a telegraphic key lever adapted to produce a hit or hammer action whereby a clear, distinct, and accurate transmission of the cam character is secured upon the telegraphic line. The clutch shaft is adapted to contain a plurality of character cams, each provided with a clutch normally held out of engagement with the shaft by a cam lever adapted when that lever is released to engage the shaft and rotate the cam for the purpose of actuating the telegraphic key lever. A switch connection is provided by which the driving motor circuit may be opened and the motor made inoperative, and the telegraphic circuit through the key lever may be closed when the operator desires to receive a message from the line previously used for transmission.

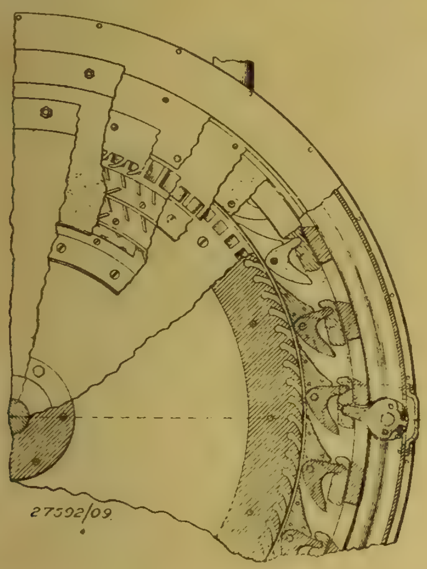


27121 Mannesmannrohren-Werke: Torpedoes. [Date applied for under International Convention, November 23rd, 1908.] 27262 Fell (Brown Hoisting Machinery Co.): Spreaders for coke ovens. 27278 Ofenbau-Ges.: Gas holder or gasometer. [Date applied for under International Convention, December 7th, 1908.] 27553 Bichel: Submarine mines. [Date applied for under International Convention, December 8th, 1908.]

27592 Thompson (Holly Turbine Engine Co.): Steam turbines.

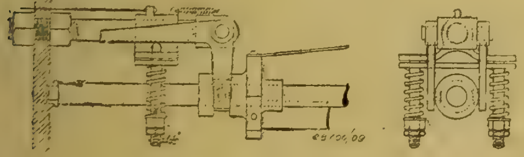
This invention relates to turbines of the class in which steam is admitted at the centre of the rotor and flows out from the centre in both directions. The object is to provide improved valve mechanism and governing apparatus therefor. Pivotal valve members are employed which can be rotated by means of rings arranged in the steam chest in order to vary the nozzle apertures between the valve members and the valve rests and so control the supply of steam. The valve-controlling rings are operated either by hand or by suitable automatic governing means. Further, means are provided whereby one set of valves may be moved ahead of the other so as to deliver more steam to one set of blades than to the other. The object of this is to provide that where necessary only one-half of the turbine may be used, and also to equalise any end thrusts resulting from an inclined or vertical arrangement of the turbine.

27814 Bollweber: Collars for draught animals. [Date applied for under International Convention, December 28th, 1908.] 27947 Farrell, Mead, and Mead: Amusement devices. 28037 Hurst: Reservoir pens. 28062 Patterson: Means for protecting roll bearings of textile machinery. [Date applied for under International Convention, February 6th, 1909.] 28170 Farbwerke vorm. Meister, Lucius, and Bruning: Process of making new vat dyestuffs. [Date applied for under International Convention, December 24th, 1908. Application for Patent of Addition to No. 16584, 1907.] 28257 Dawson: Combined abdominal belts and hose supporters. 28476 Wilkinson and Lambert: Motor starters. 28485 Maddocks and McNair: Pneumatic treads for boots and shoes. 28502 Schafer: Manf. of polishes for leather and the like. [Date applied for under International Convention, December 7th, 1908.] 28551 De Vilbiss and De Vilbiss: Closures for fluid receptacles. [Date applied for under International Convention, February 23rd, 1909.] 28625 Justice (Binney): Filters for metallurgical and other uses. 28662 Bridgman: Detachable rim flanges for the wheels of motor cars and other vehicles.



28706 Hamilton, and J. B. Hamilton and Co.: Governors.

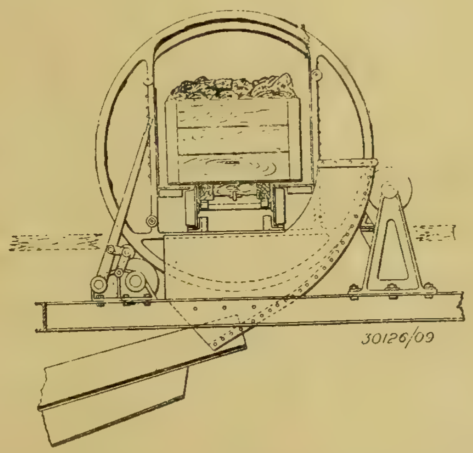
The governor has a part that is connected with and operates the member to be controlled when the speed or the number of rotations of the body exceeds a pre-determined limit or number and moves in one direction or the other as the governor weights move outward or inward under the influence of centrifugal force or of the spring provided to oppose the forces set up by the centrifugal action of the governor weight or weights, whichever is at the moment the stronger. This part is arranged to act upon or to actuate either directly or indirectly a lever, the effective length of which or the position of whose fulcrum is variable, the lever being also acted upon by the spring provided to oppose the forces set up by the centrifugal action of the governor weights, the arrangement being such that according as the effective length of the lever or the position of its fulcrum is altered so will the number of rotations at which the governor is to come into action be altered. The alteration of the effective length of the lever or the position of its fulcrum is accomplished without alteration or variation of the stress on the spring provided to oppose the forces set up by the centrifugal action of the governor weight or weights.



28707 Mauser: Automatic pistol. [Date applied for under International Convention, December 24th, 1908.] 28946 Newbury: Trivets or firegrate attachments. 29198 Kuch: Device for tightening up floor boards. 29249 Farmer: Refrigerating apparatus. [Application for Patent of Addition to No. 24180, 1907.] 29568 Ziegler: Treatment of domestic and street refuse and sludge for the production of gas therefrom. 29573 Herzog: Process of manufacturing material or stuff of open non-woven fibre. 29612 Stahn: Cardboard and like boxes and packages. 29683 Baker: Machines for use in depositing grease on supports or goods in the manf. of biscuits, sweetmeats, and the like. 29988 Vogtlandische Maschinen-Fabrik (vorm. J. C. and H. Dietrich) Akt.-Ges.: Automatic embroidering machines. [Date applied for under International Convention, December 28th, 1908.] 29994 Emge: Surgical apparatus for setting fractured legs. 30012 Lambert and Black: Wire ropes.

30126 Barker: Automatic rotary coal tipplers.

The invention has reference to that type of tippler having a shute arranged with its top back edge level with or higher than the horizontal centre line of the tippler body and with its ends partly enclosing the ends of the tippler frame rings. The object is to provide in combination with such a shute a pair of guide pulleys or runners arranged in contact with the tippler rings at a point substantially level with the back edge of the shute or above such edge. Such a combined arrangement prevents the coal getting over the sides of the shute during the action of tippling and so interfering with the runners which support the tippler body, a further object being to enable a more gentle delivery of the coal to be obtained as it leaves the coal tub into the shute.



30280 Boult (Sutherland Rifle Sight Co.): Sights for firearms. 30286 Strawson: Apparatus for developing or otherwise treating and manipulating photographic plates or films. 30302 Hoke: Penholders. 30564 British Incandescent Mantle Works Ltd. (Deutsche Gasgluchlicht Akt.-Ges. Auer Ges.): Box for packing incandescent mantles.

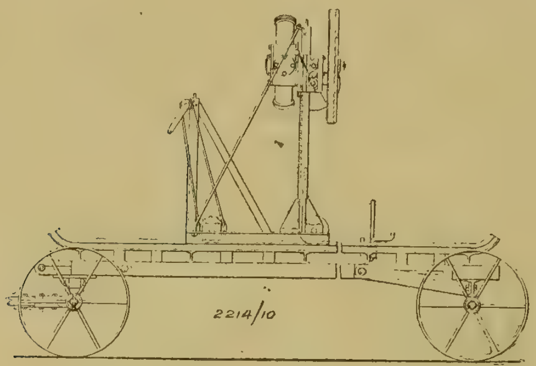
1910.

428 Jackson: Valves for pneumatic tyres and the like. 544 Ullmann: Manf. of chlorimated anthraquinone sulphonic acids. [Date applied for under International Convention, May 10th, 1909.] 943 Michel: Mechanism for controlling the lateral displacement of the work after each cut in machines for sawing wood. [Date applied for under International Convention, January 22nd, 1909.] 1083 Feery and Feery: Neckties. 1399 Van Oyen: Grinding or bruising rollers. 1409 Fulford and Howe: Side carriages for cycles and motor cycles. 1435 Hourioux: Driving mechanism for tractor tricycles and the like. [Date applied for under International Convention, January 27th, 1909.] 1607 Lambert: Cartridge and the like

pipe-filling tobacco holders. 1639 Fabrik Chemischer Gravuren Luppe and Heilbronner Ges.: Process for imparting black coatings to metals. [Date applied for under International Convention, June 1st, 1909.] 1723 Stewart: Construction of tracking iron for the use of boy scouts and the like. 1783 Firm Kemper and Lonsberg: Mechanism for operating the turning forks of potato-harvesting machines. [Date applied for under International Convention, January 25th, 1909.] 1790 Benedictus: Glass. [Date applied for under International Convention, August 10th, 1909.] 1796 Mygatt: Glass enclosures. 1823 Jackson and Jackson: Pocket handkerchiefs or the like for curative purposes. 2023 Dowell: Valves for feeding bottles.

2214 Marks (Watkins): Portable sawmill.

The sawmill may readily be transported upon carrying wheels of standard wagon gauge. Lightness attended by adequate strength and rigidity is attained by the employment of a light, strong, non-reciprocating log bed having ways longitudinally thereof upon which the saw carriage reciprocates, combined carrying wheels and means whereby the log bed may be held elevated for transportation or be lowered to the ground for work. When lowered the ground affords the most stable of foundations for the log bed which may, therefore, be made as light as is consistent with the work to be done. The motor may be mounted on the saw carriage or be otherwise disposed.

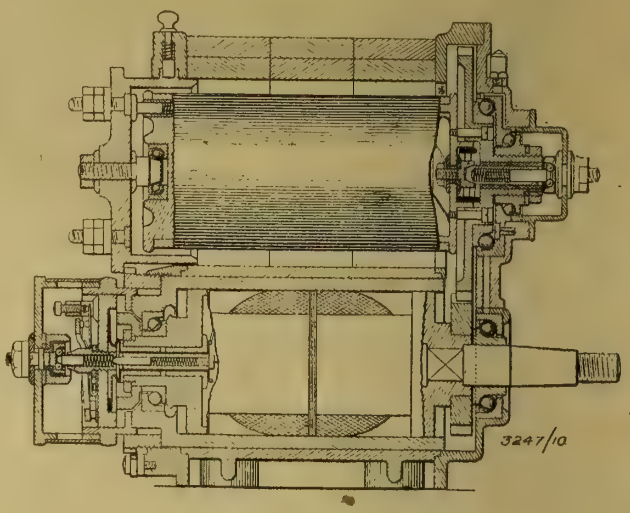

2214/10

2225 John: Girder-cutting devices. 2322 Waigh: Detachable mud guard for motor cycle or like vehicle. 2502 Cawley: Attachable appliance for holding reels or balls of cotton and the like. 2547 Hetherington: Clothes line props. [Date applied for under International Convention, February 4th, 1909.] 2551 Altmann: Engine frames. 2606 Bumpus: Panelling. 2628 Rhodin: Manf. of slag cement. 2878 Breitkreuz: Automatic valves for water pipes. 2938 Vicars, Vicars, and Vicars: Chains for travelling ovens. 3008 Veber: Receptacles for materials for the treatment of hair. 3111 Gorton: Garment supporters. [Date applied for under International Convention, March 10th, 1907, originally included in No. 16810, 1909.]

3247 Brooks and Alston: Contacts of electric ignition apparatus for internal-combustion engines. [Date applied for under Rule 13, July 7th, 1909.]

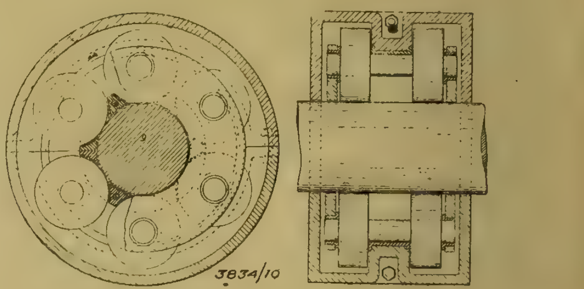
Upon the one part to or from which the current is to be conveyed a spring-pressed plunger or other terminal is carried, whilst the contact member upon the other part consists of a hollow body part within whose interior is arranged a ring of balls running upon suitable races. The outer end of the body is open so as to receive the end of the spring plunger which bears and runs upon the balls, thus reducing friction and wear to a minimum. The contact device may be carried by or formed at the end of a screwed shank which may extend through the part upon which the contact is mounted so as to project from the outside, where it may be provided with suitable binding or terminal nuts for connecting up the contact with the circuit in which it is situated.

3363 Richardson: Hatch cleats. [Request under Section 19 not granted.] 3431 Marks (Hager and Weidmann Ges.): Concrete or the like mixing machine. 3574 Justice (Schneible Co.): Manf. of fermented liquors. 3627 Edwards (Johnston and Finley): Rod packing. 3641 Fahrenheim: Method of obtaining constant emissions of gas and apparatus therefor. 3684 Forbes and Rothwell: Boot or the like polishing outfits. 3740 Hartmann and Schwerdtner: Method of preserving wood. 3748 Philip: Cupboards. [Date applied for under International Convention, October 15th, 1909.]


3247/10

3834 Brewer: Roller bearing.

The invention relates particularly to car axle journals, which as ordinarily used are periodically subjected to excessive loads due to shock or vibration caused by the unevenness of the track or road bed. The bearing shown is adapted to operatively receive the normal working loads, and auxiliary supporting means are provided acting through the axle and rollers for receiving the incidental stresses due to shock or abnormal loading to avoid excessive pressure upon the working parts. Means are provided to effectively lubricate these working parts.


3834/10

4094 Peto, and Peto and Radford Ltd.: Driving pulleys or sheaves. 4408 Mulliner (Long Acre London and Northampton) Ltd., and Mussellwhite: Hoods for motor cars or like vehicles. 4493 Henton: Feeding bottle. 4949 Lean: Domestic firegrates. 5041 Potter: Automatic turret lathes. [Date applied for undr Rule 13, June 7th, 1909.] 5068 Reed: Apparatus for mixing or combining various substances. 5282 Rendle and Churchill: Means for holding submarine cables. 5504 Lefebvre: Lubricating devices. [Date applied for under International

Convention, March 5th, 1909.] 5646 Short, Short, and Short: Valves for gas containers employed in balloons or in airships. 6342 Lourdel: Incubators. [Date applied for under International Convention, March 30th, 1909.] 6438 Mathys (A. J. Deer Co.): Coffee mills and the like. 6656 Schnabel: Pianos. 7092 Imray (Society of Chemical Industry in Basle): Method of precipitating alkaline earth oxalates. 7194 Wiegel: Tie clips. 7856 Renault: Means for lubricating the transmission gear of motor vehicles. [Date applied for under International Convention, April 27th, 1909.] 7893 Lean: Domestic firegrates. [Application for Patent of Addition to No. 4949, 1910.] 8426 Kaiser: Ball bearings for hand trucks and the like. 9034 Bohm: Locomotives and the like suitable for work in mines. [Date applied for under International Convention, April 17th, 1909.] 9476 Rosencrantz: Tuning pins of pianos and the like. 9848 Ges. fur Chemische Industrie in Basel: Manf. of anhydrous hydrosulphites. [Date applied for under International Convention, November 26th, 1909.]

Complete Specifications Open to Public Inspection before Acceptance, under the Patents Act, 1907.

1909.

25472 Chemische Fabrik Ladenburg Ges.: Disinfecting process. 28755 Von Schlippenbach: Method of and means for recovering gases rich in sulphur dioxide separately from gases poor therein in roasting and oxidising processes.

1910.

3754 Flersheim: Clutches. 3760 Carlson: Motor vehicles. 5917 Siemens and Halske Akt.-Ges.: Rectifier for high-tension alternating currents. 6462 Richardson: Tyre protectors. 7550 Bollee: Presses for testing or other purposes. 8095 Kratz: Surgical and other needles. 8200 Rheinische Metallwaaren-und Maschinenfabrik: Keys for setting timing rings of fuses for shells or the like. 8724 Siemens: Rotary cement kilns calcining or roasting furnaces or the like. 9499 Aktieselskabet E. C. Dahls Bryggeri: Closing means for boxes or cases. 10700 Godfree: Electro-mechanical separator. 10780 Etablissements de Dion-Bouton (Soc. Anon.): Attachment device for the distributors of magneto ignition machines. 11065 Kuttner and Lubecius: Toys. 11226 Rogers: Typographical composing machines. 11366 Haselbauer: Machines for cutting out wrappers for cigars or the like from tobacco leaves. 11669 Hogan and Meinecke: Adjustable beds. 11922 Brihaye: Method and means for consolidating or strengthening sewn seams of leather or other material. 11930 D'Espujols: Device for connecting the tubes with the headers in water-tube steam generators. 12052 Hugo: Machines for making paper envelopes. 12108 Hart: Knives. 12130 Farbwerke vorm. Meister, Lucius, and Bruning: Manf. of violet-to-blue dyestuffs of the triphenylmethane series. 12170 Hick: Filing appliances. 12214 Hiorth: Electric induction smelting furnaces. 12234 Livingston: Percolators. 12293 Becker: Tubular and collapsible keys. 12417 Von Kando: Systems of marine propulsion. 12425 Geb. Siemens and Co.: Protective coating for bodies consisting of carbon. 12426 Farbwerke vorm. Meister, Lucius, and Bruning: Manf. of a red monoazo dyestuff and colour lakes therefrom. 12483 Siemens Schuckert Werke Ges.: Electric arc lamps. 12491 Peckham: Hand-cart supports. 12500 Quentin: Kneading machines. 12510 Valentin: Process for the preparation and dissolving of the silicates of sodium and potassium. 12521 Jones: Doorways or gates. 12525 Ernst and Trachsler: Furnace for burning of cement and the like. 12559 Brzesina and Walther et Cie. Akt.-Ges.: Device for removing residues with chain-stoking devices. 12594 Blathy: Dynamo electric machines. 12595 Dennison: Sound boxes for talking machines. 12656 Carlson: Steering mechanism for motor cars. 12661 Lardy: Lining shafts with concrete. 12692 Maniere: Safety razor. 12715 Kubicek: Method of and means for analysing the

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composition of colours. 12734 Disdier y Crooke: Product applicable as a food for cattle. 12736 Guillaume: Heating of the rectifying column of distilling and rectifying apparatus. 12768 Bomborn: Centrifugal blowers or pumps. 12821 Internationale Rotations Maschinen Ges.: Apparatus for the transmission of motive power by means of liquid pressure. 12835 Buisson: Wind screens. 12838 White and Richards: Apparatus for preparing paving material. 13016 Lucas: Incandescent gas lamps. 13017 Lucas: Inverted incandescent gas lamps.

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THE NEXT STEP IN TRAMWAY TRACTION.

THE most recent developments in electric tramway engineering reflect that continuous pursuit of economy in which all have to engage if they strive after efficiency and profit-making. The tendency continues to spread in favour of the overhead trolley principle, because economy and efficiency have been found to go hand in hand. The opposition to the system that we all became accustomed to years ago, opposition based on the idea that we were preparing the way for great street slaughterings, and that every decent street view that we enjoyed was to be mutilated, never seems to show itself to-day, for accidents have been few and far between in English practice; few good street views have been disfigured and some have been improved, and the cost of construction and equipment per mile of track is low, while working expenses have been kept down well in most places.

Notwithstanding this, however, there are indications nowadays which pretty definitely tell us that we have arrived at a stage of the journey where we require to closely examine the sign-posts, observing the lessons from events that are, and have been for several years past, happening around us. Judging from opinions expressed by some of our leading authorities at the recent Tramway Congress in Dublin, "the economic limit of tramways has been almost reached in the provinces," and if we are to meet the demands of suburban and interurban public for transportation facilities, some method must be found which will be less costly both to construct and to operate than our electric tramways. When tramways were confined to the more congested parts of a borough they could earn far better profits per car mile than they can now when networks have been pushed out in all directions. In places where a new neighbourhood is developing, facilities for getting into and out of town are needed, but a tramway with costly track construction is not justified. Traffic does not always obey us as quickly as we would desire when we lay a new section of such line from the city outwards, in the hope of both developing the neighbourhood and bringing a bigger revenue to the tramway undertaking.

It seems that motor omnibuses have been tried as feeders for serving such districts only to be abandoned after exhaustive trials, for Mr. Harry England tells us that the profit on the traffic brought in this way to the tramways was more than counterbalanced by the loss on the omnibuses.

Where then does a careful consideration of such a position lead us? It does not lead us to any of the other electrical systems of which we have had experience in this country. Self-contained battery cars do not come; surface-contact traction is again at this moment passing through a period of tribulation down at Torquay, where it is feared it may yet be superseded by the trolley; and of conduit working, well, perhaps we shall be thought absurd to even breathe the word where we are searching for a system which shall be low in point of construction, and, as a matter of fact, we only do so to record as being of interest in this article that Bournemouth Corporation is minded to convert its conduit section in the centre of the town, between the several trolley lines, to overhead trolley. If Christchurch Road can bear the latter system, certainly other parts of Bournemouth should be able to do so, though probably the sharp curves and gradients will require special attention. The capital cost of making the change will be insignificant, but the annual economy in working expenses, if one uniform system be adopted, is put at a very high figure.

We are led, then, to the conclusion that a system we have not tried very much, even experimentally, and not at all practically, in this country, is the most promising direction in which to look for a solution. We chaff municipalities for sending deputations abroad to see new things, but until recently they had to go to the Continent if they were to understand what a trackless trolley system was, how it worked, its cost, and so forth. We have now a short experimental line of a system adapted to English conditions laid for demonstration purposes at Hendon, but municipal authorities, when the matter has come before them, have decided to see something more than the experimental track. So it comes about that there have gone to Germany, to Austria, or to Italy, deputations from Dundee, Manchester, Bradford, Liverpool, Leeds, Sheffield, and Newcastle. In all cases they have returned favourably impressed and recommending the adoption of the principle for linking up outlying districts and the existing tramway services. This year Parliament has authorised Leeds and Bradford Corporations to adopt the system in conjunction with their tramway departments. Mr. England has drawn attention to the heavy cost of obtaining parliamentary powers for running railless cars, and he says it is a serious stumbling block in the path of the progress of this system. His view is that, as the Board of Trade is understood to regard the new principle somewhat sympathetically, Parliament should authorise it to grant licences, but he does not appear to be hopeful of that coming to pass in a hurry. Readers who desire to understand the possible economies of railless traction, and to briefly compare the technical merits of the several systems in vogue on the Continent, will find sufficient material in the paper read by Mr. England at Dublin.

Bursting Speeds of Pulleys.—At a recent meeting of the American Society of Mechanical Engineers, Professor C. H. Benjamin described some interesting experiments on the bursting of various kinds of pulleys. The pulleys tested were about 2 ft. in diameter. The linear bursting speeds of the pulley were as follows: Solid wooden pulleys, 275 ft. per second; split wooden pulleys, 220 ft. to 260 ft. per second; paper pulleys with a solid web, 300 ft. per second; built steel pulleys, 235 ft. per second. Thus apparently the solid paper pulley has the greatest strength and the steel pulley the least. This steel pulley breaks at the joints in the rim. Solid cast-iron pulleys burst at from 350 ft. to 390 ft. per second, thus giving better results than any of the others. These results show that ordinary pulleys are amply strong enough under commercial conditions, as rim speeds seldom exceed 80 ft. per second, and more commonly average less than half this figure. As the stress due to centrifugal force increases with the square of the speed, it is clear that the usual factor of safety is very high.

First Telewriter Exchange.—The first telewriter exchange was opened recently, and a brief outline of its operation may be of interest to some of our readers. A telewriter requires only two wires, but there are really two circuits, each wire and the earth forming one. The pencil which writes the messages is guided by or controls when transmitting two links, the other ends of which are connected to the ends of two arms fixed to the ends of two spindles. Hence if the pen is moved over the paper its motion produces corresponding rotation in each of the two spindles. At the transmitter the crank arms on these spindles each carry a roller which makes contact with a resistance, cutting more or less out according to the amount of rotation. Each of these resistances is in one of the two lines or circuits, and hence the current flowing varies with the position of the transmitting pencil. At the receiving end of each line is a coil pivoted between the poles of a magnet and having an arm and link connection to the receiving pen just like that at the transmitter. The coil is deflected by the current flowing, and hence the receiving pen takes up a position dependent upon this current, and this again is controlled by the writing at the transmitter, so that the receiver writes a true copy. In order to leave blanks corresponding to when the transmitter pencil is off the paper the pressure of the pencil is made to depress the writing-board and complete a circuit, which superimposes on the main-line current a small alternating current which does not affect the main writing current, but which causes the receiving pen to be pressed on to the paper. When the transmitting pencil is lifted from the paper this secondary current is cut out by the writing-board breaking circuit, and the receiving pen is then held off the paper.

Mineral Production of Canada.—The annual report of the Canada Department of Mines on the mineral production of Canada for the years 1907-8 shows total output of 86,865,202 dols. and 85,927,802 dols. respectively, these totals comparing with 10,221,255 for the year 1886, the first year for which complete statistics are available for the whole of Canada. The decrease of 937,400 dols. in 1908 as against 1907 is accounted for by a diminution of 650,000 dols. in metallic production, and by 1,150,000 dols. decrease in clay manufactures; other non-metallic products increased by 860,000 dols. In spite of the reduced value of production during 1908, the mining industry was more active in that year than in the former one, and the actual output of metals, from the point of view of tonnage, was greater. Had copper, silver, lead, and nickel maintained the average prices of 1907, the total production would have been worth about 8,000,000 dols. more than was actually the case. The actual output of copper increased in 1908 by 11·8 per cent, as compared with 1907; silver increased by 72·98 per cent, and gold by 17·4 per cent; while on the other side decreases are shown in pig iron, 7·78 per cent; lead, 9·52 per cent; nickel, 10·35 per cent; zinc, 71·27 per cent; and antimony, 92·6 per cent. In the list of non-metallic products, coal increased by 3·38 per cent and asbestos by 7·1 per cent. The output of petroleum decreased by 33 per cent.

STEAM ENGINE DESIGN.—XXIV.

(Continued from page 582, vol. xli.)

Surface Condenser Air Pumps.

For crosshead-worked pumps, instead of having double-linked levers, as in fig. 126, the bucket is sometimes made of trunk form like that shown in fig. 130. The pump is a modification of the triple-valve type; in this case the suction valves are left out, as it is the opinion of many engineers that a better vacuum is obtained by this arrangement. Water flows in at C, and through port F. The discharge valves are contained in the head E.

Direct-acting pumps are almost invariably used for marine purposes; among the best known are those by Messrs. Weir, of Glasgow, one of which is illustrated in fig. 128. The makers' special type of steam valve is well adapted for economically working these pumps, and recently improvements have been made so that a regular discharge can be obtained by a single cylinder for main engines up to 6,000 I.H.P.; above this, the twin-beam type is recommended.

An instance of using a direct-acting pump and the compact arrangement thereby obtained is given in fig. 127.

The best and safest way of proportioning the air pump size is on the quantity of steam condensed per hour.

For a vacuum of 26 in., a capacity of ·6 of cubic foot of effective plunger displacement (single-acting pump) per pound of steam per hour gives good results. The capacity at about 28 in. will largely depend on whether dry or wet pumps are fitted, if not, ·88 to 1·0 cubic feet may be necessary, especially if a high hotwell temperature is required. For a vacuum of 24 in., the above capacity may be about ·5 to ·54, and for 27 in. about ·7 to ·75 cubic foot.

Sometimes the air-pump capacity is made a proportion of the low-pressure cylinder capacity; this method is wrong, since it takes no account of steam economy. In marine practice, for triple-expansion engines, the value for single-acting pumps:—

$$\frac{(\text{diameter of pump})^2 \times \text{stroke}}{(\text{diameter of cylinder})^2 \times \text{stroke}} = \frac{1}{12} \text{ to } \frac{1}{24}$$

$$= \frac{1}{17} \text{average.}$$

On a horse-power basis, useful for pumps driven from the main engine crosshead, capacity of single-acting pumps in cubic inches

$$= \text{plunger area} \times \text{stroke}$$

$$= \frac{\text{I.H.P.}}{N} \times C.$$

N = revolutions per minute.

C = 220 to 300.

Plunger speed = 200 ft. to 300 ft. per minute on Edwards' pumps for land work, and = 320 ft. to 400 ft. for all kinds of pumps for marine work, and as high as 450 ft. per minute in the Navy.

Stroke = ·5 × plunger diameter, independent direct-acting triple-valve pumps.

Stroke = ·6 to ·7 × plunger diameter, Edwards' crank-driven pump.

For crosshead-worked pumps, since the number of strokes is fixed by the main engine, the diameter can at once be found from the allowable bucket speed. In some cases it may be necessary to fit two pumps—on a four-cylinder engine, one for each low-pressure crosshead.

The velocity in the suction pipe may be taken as 800 ft. to 1,100 ft. per minute when based on the effective pump capacity; for discharge, up to 3,000 ft. per minute. The velocity through valves may be from 350 ft. to 600 ft. per minute.

Horse power required by a single-acting air pump

$$= \frac{S\,A}{7800 \text{ to } 8800}.$$

S = plunger speed in feet per minute.

A = plunger area in square inches.

The strength of parts should be proportioned on a load of 30 lbs. per square inch.

Stress in plunger rod (usually of some bronze), 1,800 lbs to 2,100 lbs. per square inch.

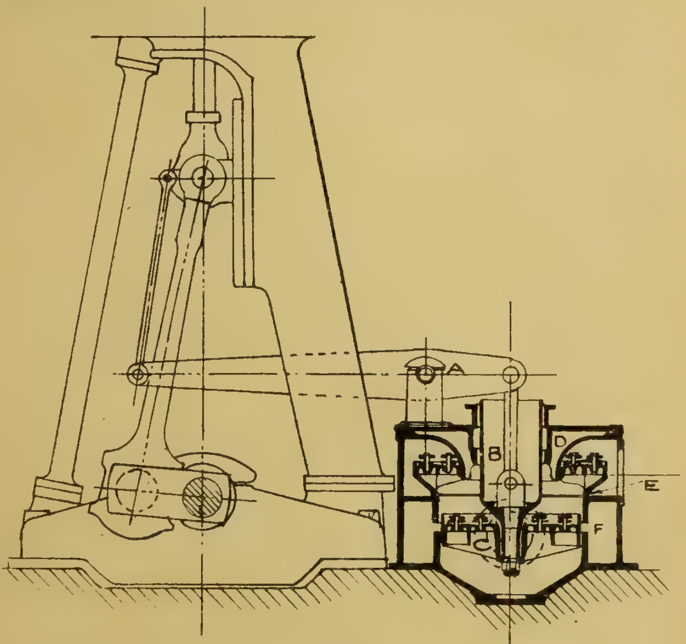

Fig. 130.

The pump cylinder is usually of gunmetal, or of cast iron with a liner; for naval work all parts are of bronze. The bucket or plunger of gunmetal and valves of indiarubber discs, "Kinghorn" or "Beldam" pattern. "Kinghorn" valves are most favoured for land installation.

Thickness of pump barrel

$$= \frac{\text{diameter}}{60} + \tfrac{1}{4} \text{ in. gunmetal}$$

$$= \frac{\text{diameter}}{60} + \tfrac{3}{8} \text{ in. cast iron.}$$

Thickness of bucket

$$= \frac{\text{diameter}}{50} + \tfrac{1}{4} \text{ in. gunmetal.}$$

The water should flow down into the pump from the condenser. All valves should be water sealed after the manner of that shown in fig. 126.

Air pumps must never discharge against a head—18 in. to 24 in. must be regarded as the maximum. If the hotwell or feed tank is at a high level, then a special pump must be used to elevate the water.

On the pump discharge an air separator should be fitted, and a special air pipe provided to take away the air.

Jet Condensers.

The jet condenser, always popular on account of its simplicity and low initial cost, has in recent years been greatly improved and further simplified. As the water mixes intimately with the steam, this condenser is obviously unsuited when the condensing water cannot be used for boiler feeding.

The jet condenser in its simplest form consists of a chamber in which the exhaust steam meets a spray of cold water, is condensed, and removed together with the air, by means of an air pump.

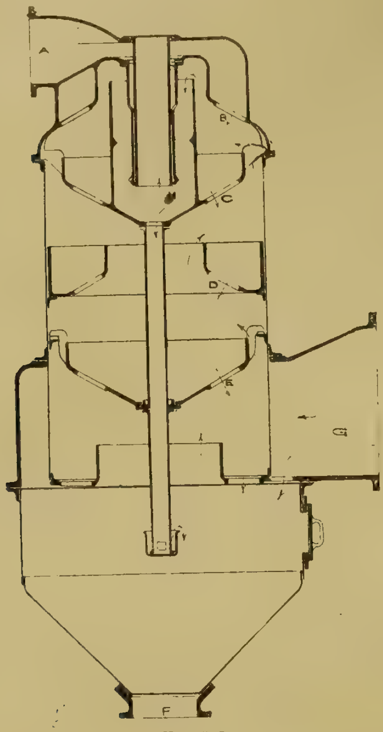

Fig. 131.

The condenser may be either of the "parallel or counter-current" type; in the former, the water and steam pass through together; in the latter, the water is usually arranged to pass downwards and the steam upwards. In this arrangement, as the hottest water meets the hottest steam, the condensed water (which is removed from the bottom) will be the hottest possible.

A good example of a counter-current jet condenser, as made by the Worthington Pump Co., is shown in fig. 131. The injection water enters at the top through A, and passing downwards through a number of trays B D C E, is split up into a great number of circular or long oval jets, thus exposing to the exhaust steam an enormous cooling surface, being repeatedly thoroughly mixed and broken up until it leaves the cone at the bottom F. The exhaust steam (entering at G) travels in the opposite direction, entering the cone near the bottom, and on its way upward is thoroughly condensed until a mixture of air and uncondensed vapour is left, which, before leaving the cone, passes through an air cooler H, into which a portion of the injection water is diverted from the injection chamber. In this cooler the temperature of the air and uncondensed vapours is reduced to a minimum, so as to allow the maximum efficiency of the air pump to be obtained. The counter-current principle will be clearly seen; the water sprays are indicated by dotted arrows, and the opposing steam directions by full lines. With this condenser, when situated on a low level, a hot-water pump must be arranged to suck out the water at F; as a rule no injection pump will be required if the level is sufficiently low, especially as the vacuum will assist in drawing the water. The air may be removed by any type of dry pump. Special provision must be made to prevent the condenser being flooded and the water drawn back into the cylinder, should the hot-water pump break down.

The so-called "Barometric Condenser" is merely an ordinary jet condenser elevated in such a way that the cold water can discharge itself against the vacuum. Now if it is remembered that the pull due to a perfect vacuum is equal to a head of 34½ ft. of water, it will be seen that the condenser is self-draining if raised high enough.

The Mirrlees-Watson Co. have largely developed the counter-current principle, and an arrangement of a barometric jet condenser made on these lines is shown in fig. 132. The condenser C is carried on a mild-steel structure outside the engine house, a set of steam-driven air and circulating pumps, separately driven, being fixed inside the engine house. The circulating pump A is of the centrifugal type, driven by an enclosed high-speed engine, fitted with forced lubrication, the water being delivered to the top part of the condenser, falls over a series of trays in the form of thin sheets or cascades, and the steam entering at the bottom rises through these several cascades, thus becoming thoroughly intermixed with the cooling water. The condensed and cooling water falling to the bottom of the condenser is drained away to a sump through the barometric pipe B, the air and incondensible vapours are drawn off from the top of the condenser close to the water inlet, and are therefore at the minimum temperature and volume. The air pump is of the dry slide valve type; the exhaust from its steam cylinder, and also from that of the circulating pump, enters the main exhaust pipe at E.

An arrangement of condenser and air pump for a large slow-speed engine is shown in fig. 133. It is common practice on this type of engine, when there are two low-pressure cylinders, to provide a separate condenser to each cylinder. The exhaust steam K passes to chamber A, into which is fitted a perforated injection pipe B; the arrangement forming a parallel flow jet condenser. Both air and water are removed by air pump C. There are many methods of driving this pump; that shown consists of attaching a connecting rod to the main crank pin. On some engines working at low piston speeds (up to 500 ft. per minute) the air pump is attached to the tail of the main piston rod; in this case, and also in many others, the condenser is formed in the upper part of the pump chamber F, in fig. 133, its size being enlarged for the purpose, and an injection pipe fitted.

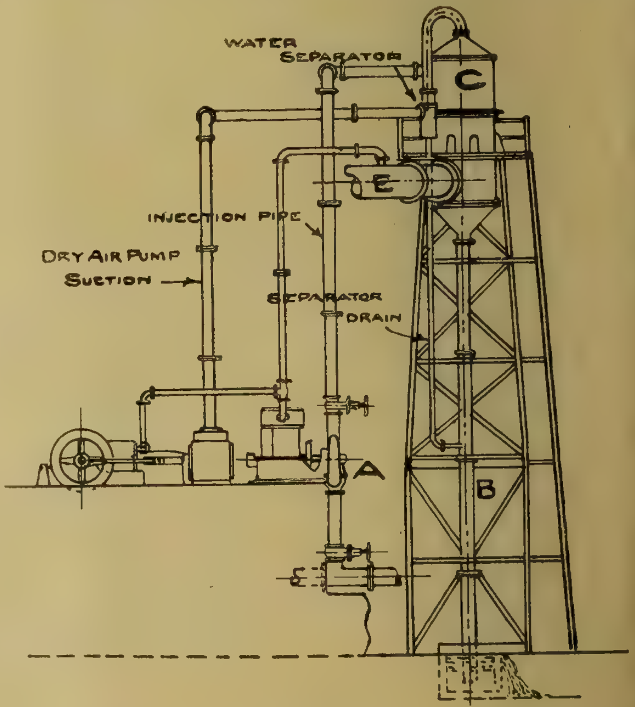

Fig. 132.

The size of a jet condenser will vary considerably with the design, but there should be a minimum capacity of a quarter low-pressure cylinder volume, and usually the maximum will be three-quarters of the low-pressure volume.

The speed of injection water into a condenser may be obtained from:—

$$H = H_1 + (15 - p_0)\ 2{\cdot}3 \text{ ft.},$$

where H_1 = head, in feet, of injection water above the condenser,

p_0 = pressure, in pounds per square inch, in the condenser.

Velocity of water in feet per second = $8\sqrt{H}$.

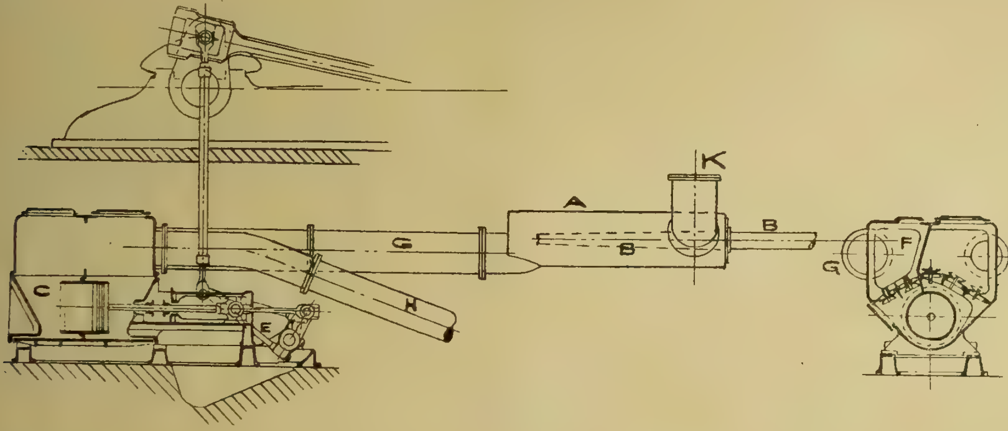

Fig. 133.

This formula must be used with caution, and has only approximate application; also in any case the actual velocity will be only a fraction of the theoretical velocity given.

Low-level condensers will not require an injection pump, provided the difference in level between inlet and supply does not exceed about 12 ft.

Barometric pipes depend for length on the vacuum required; if W = pounds of vacuum, the length to overcome the vacuum can be found from:—

Length of barometric pipe = $2{\cdot}3 \times W$.

The quantity of injection water required can be obtained from the formula given in the last article. In the case of jet condensers $T_2 = T_3$, in practice, the air pump discharge temperature is always below the temperature corresponding to the vacuum; 5 deg. for a good counter-current condenser to 15 deg. and 20 deg. for parallel flow. The water required per pound of steam for a 5 deg. difference is given in Table XXXIV.

TABLE XXXIV.—Injection Water for Jet Condensers.

Temperature of injection water at condenser inlet.	Vacuum (with barometer at 30 in.).				
	24 in.	25 in.	26 in.	27 in.	28 in.
	Pounds of water required per pound of steam condensed.				
60 deg. Fah.	13	15	17	21	30
65 ,,	14	17	19	24	35
70 ,,	15	18	21	27	42
75 ,,	16	20	24	31	53
80 ,,	18	22	26	36	70
85 ,,	21	25	30	45	105

Air Pumps for Jet Condensers.

The duty of a jet condenser air pump is very heavy; in addition to the condensed and condensing water, the air received with the injection must be removed.

The capacity of pump depends much on circumstances, and the following formula for parallel flow condensers give good results:—

Referring to the formula for surface condenser pumps for vacua of 28 in.,

C = 850 to 900 quadruple expansion
= 900 to 1100 triple expansion
= 1100 to 1200 compound and simple engines.

For vacua of 26 in., allow about 20 per cent less than above values. For a double-acting pump worked from tail rod, single cylinder and compound engines, vacua about 25 in.

Plunger area = $\frac{1}{6}$ to $\frac{1}{10}$ × cylinder area.

The speeds through inlet and discharge pipes should not exceed one-half those given for surface-condenser pumps.

For removing the water from a low-level condenser, the vacuum pull must be allowed for in the pump power.

Other types of air pump are dealt with in the section on "Vacuum Intensifiers" in the next article.

(*To be continued.*)

THE HIRTH MINIMETER FOR ACCURATE MEASUREMENTS.

The accompanying illustrations show a measuring apparatus devised by Mr. Albert Hirth, of the Fortuna Works, Cannstatt-Stuttgart, Germany, and, according to *Machinery*, is intended for a comparator to indicate differences of fractions of millimeters existing between the piece measured and a standard guage block, or between the piece measured and a sample piece of arbitrary dimensions. The general construction of the minimeter is shown in figs. 1 and 2, and the principle of its action in fig. 3, this principle being the introduction of a long lever arm, which at the same time serves as an indicating needle, and a short arm, the length of which is determined by the distance between two knife edges. The bearing points of these two knife edges may be varied in order to provide adjustment for the apparatus. One of the advantages of the device is that it eliminates the necessity for lubrication and overcomes the disadvantages of play on dead centres. As indicated in fig. 1, a springs holds the lever against the knife edges and returns it to its normal position after measuring. The whole mechanism is enclosed in a tube, the upper part of which is provided with an opening, which permits a graduated scale to be seen, and the indications of the pointer to be read off. The scale is provided with graduations corresponding to hundredths of a millimeter (about 0·0004 in.). The measuring instrument proper can be mounted in different holders, so that it can be used with equal facility for measuring flat and round pieces, as well as inside diameters of holes.

When measuring, or rather comparing, dimensions of flat pieces, the instrument proper is mounted on a standard or upright, carrying at its upper end a clamp for holding the minimeter, and at its lower end a small circular table placed on a bracket adjustable for height. In the case of comparing cylindrical pieces, the location of the measuring instrument proper is adjusted by means of adjusting mechanism on the side of the holder, so that the indicator points to zero when the sample or standard gauge is placed in the holder. Then the differences in dimensions of the various pieces are noted by inserting them in the instrument in place of the sample or gauge. For measuring inside diameters the minimeter is held in a bracket having a two-point support, provided with means for adjustment, so that it can be easily applied to the required diameter.

It is evident from this brief description that the apparatus is a very convenient one for machine shop use. It permits of a comparison of different measuring instruments and gauges at given intervals, without the employment of a relatively costly standard measuring machine. When standard gauges are at hand it indicates exactly the size that the piece of work must have in order to obtain the desired degree of accuracy. It is so simple in its application that it may be employed by the ordinary mechanic as easily as any of the ordinary measuring instruments with which he is familiar. It is evident that this instrument can be applied to many special uses not directly referred to in this description.

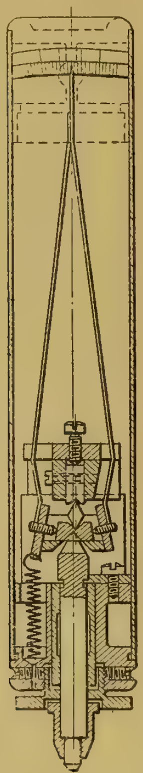
FIG. 1.

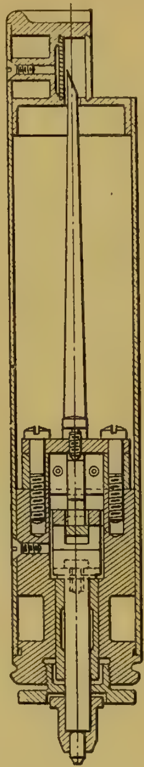
FIG. 2.

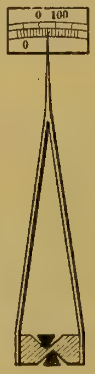

FIG. 3.

The strides which the telephone has made since the present century began are strikingly shown in a paper which Sir John Gavey has read before the Institution of Civil Engineers. In 1902 there were 7,467,417 miles of telephone wires in the country, and in 1907 there were 19,839,537 miles, an increase of 12,372,120 miles, while the subscribers' stations increased from 3,534,036 to 8,406,336, an advance of 4,873,330 stations. For the same period the mileage of telegraph land wires and submarine cables also indicates a considerable increase, but much less than in respect of the telephone.

THE MECHANICAL PRINCIPLES OF THE GYROSCOPIC MONO-RAIL SYSTEM.

(Continued from page 40.)

A VERTICAL transverse section of the gyroscopic equilibrating part of Brennan's mono-rail car may be represented in diagram, as in fig. 3, and in horizontal section or ground plan in fig. 4, in which the same letters refer, so far as possible, to corresponding parts in both figures at once.

The arrangement consists of a pair of gyroscopes revolving on horizontal axes $B_1 C_1$, $B_2 C_2$ at the same speed $V_1 = V_2$ in opposite directions, so that a spectator, looking along either axis from B_1 to C_1 or B_2 to C_2, will see the wheels rotating clockwise.

This speed is to be maintained by applying so much power as may be necessary to overcome friction, preferably by synchronous motors upon the axes B C. The axes B B are carried in bearings in the vertical frames which are shown in fig. 3 in the form of circular rings. These rings swing about vertical axes $D_1 D'_1$, $D_2 D'_2$, which in turn are carried in bearings in a vertical framework E F rigidly fixed to an axle T T. The axle T T which lies lengthwise of the car, which is represented in cross section by G K L, is solidly supported by bearings in the car, vertically above the rail J and the car wheel, which last revolves about the horizontal axis $I_1 I_2$.

In fig. 4 the gyroscopes are represented in a position which they would assume after having suffered a small deviation from their mean normal position (in which B B and T T are mutually at right angles) such as would occur after a small precessional rotation had taken place.

The gyroscopes are kept in step with each other in their motion about their vertical axes D D' as well as in their motion about their horizontal axes B B, so that their rate and amount of precession about D D is always equal and opposite. This first result is effected by means of two toothed sectors A_1 A_2, which engage each other, and which are rigidly attached to D_1 and D_2 respectively by arms A D, which may be regarded as right-angled prolongations of D_1 and D_2. Thus the arms A D turn with the rings about the vertical axes D D, and we thus have $U_1 = - U_2$, as well as $V_1 = - V_2$, so that the rates of precession are equal and opposite as well as the rotary velocities.

The fact that both gyroscopes are carried by the rigid frame E F requires, however, that any turning of the gyroscopes about the axis $T_1 T_2$, which is perpendicular to both B B and D D, shall be same for both gyroscopes and in the same direction, not in opposite directions. Let this condition be expressed by the equation $U'_1 = U'_2$, in which U'_1 and U'_2 are precessions about $T_1 T_2$.

In fig. 3 the car is represented as in perfect balance in a horizontal position, but this is not the case in fig. 4. Suppose an unbalanced load be placed upon the right side of the car between L_1 and K_1. That would tip the car and bring the plate at G_2 into contact with the rotating prolongation of the axis $B_2 C_2$ at B_2.

This plate consists of two parts, a rough part G_2 intended to act as a friction brake on B_2 and a smooth part H_2, on which the axis B_2 can rotate without friction. As soon as this plate exerts an upward pressure upon the axis at B_2 the unbalanced load is transmitted to the gyroscopes in the form of a torque about $T_1 T_2$, and the action is the same as though a pair of equal weights were hung upon the right-hand half of each gyroscopic axis whose combined torque is the same as that of the unbalanced load. As already explained, the effect produced upon the gyroscopes is not to cause any revolution about the axes about which T acts, but instead to produce precession about the vertical axes D D.

The right-hand gyroscope then has its three clockwise actions T U V situated as already described in our treatment of the gyroscope, fig. 2, and its precession is clockwise as we look upon it from above as represented in fig. 4, while the left-hand gyroscope, having a clockwise rotation V_2 observed from B_2 and a clockwise T looking at T_1 to A_2, must have a clockwise precession U_2 viewed from below, thus producing the precession represented in the left gyroscope, fig. 4.

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* Abstract of paper by H. T. Eddy in *Journal of the Franklin Institute.*

The sectors A_1 A_2 are therefore unnecessary, so far as this action is concerned. But it is otherwise with respect to the action of the friction plate G_2, for, as the axis at B_2 rolls upon G_2, a horizontal force is exerted on B_2 which exerts a torque T'_2, say, about the vertical axis D'_2 D_2, clockwise when viewed from below, in its effort to increase the rate of precession U_1. This it is unable to change. Instead of causing an increase in the precession U, the torque T'_2 will cause a precession U'_2 about an axis at right angles both to $M V_2$ and U'_2, *i.e.*, about T_1 T_2.

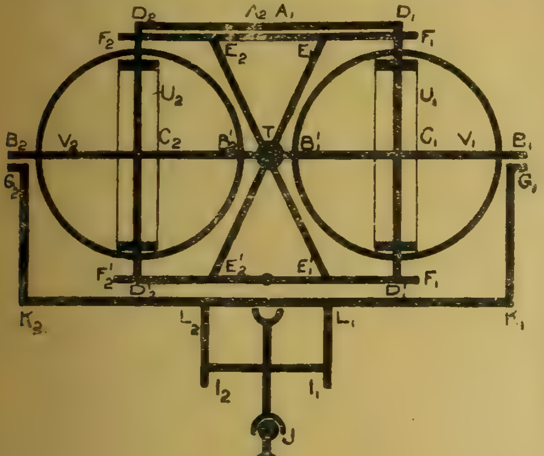

Fig. 3.

Let T' designate the torque of any couple produced by friction tending to turn either gyroscope or both about a vertical axis in a clockwise direction, then by equation (4),

$$T' = M V U' \qquad (6)$$

gives the value of U', the precessional angular velocity produced about the horizontal axis T_1 T_2, to right the car and bring its centre of gravity to a position vertically over the rail. That this statement is correct is evident upon considering the necessary relative position of T'_2 U'_2 V_2 for the left gyroscope, since they may be regarded as acting independently of T U V previously treated. The graphical model will show that the precession U'_2 is such as to right the car by giving it a precession opposite to the torque T of the unbalanced load, which precession will diminish and cease as the car is righted.

We have here considered the left gyroscope as if it alone were effective in righting the car. In fact both gyroscopes conspire to produce the same effect, for one half of the torque T' is transmitted by the toothed sectors A A to the right gyroscope in which T' is, therefore, clockwise seen from above and U', is clockwise looking from T_2 to A_1. This action therefore brings a mechanical stress on the toothed sectors to transmit part of T' from one gyroscope to the other, and in equation (6) M is the sum of the moments of inertia of both gyroscopes.

It is evident, since the car, as shown in fig. 3, is in unstable equilibrium, that left to itself it must immediately incline to the one side or the other. We have just shown how the gyroscopes act in case of an unbalanced load to return the car to the position of unstable equilibrium for car and load together.

Suppose now that the car tips still further in the direction in which the gyroscopes have been operating to right it, so that from unstable equilibrium it begins to tip over and down to the left, while the axes of the gyroscopes have stopped in the position shown in fig. 4, as they would, since there is no unbalanced load to maintain precession. The first effect of this initial inclination to the left would be to bring the smooth plate H_1 into contact with the right axis at B_1. Whatever might be the force which H_1 exerted to press B_1 upward, its only effect would be to produce a precession about the vertical vertical axes D D in the opposite direction from that which was produced when G_2 pressed B_2 upward. This precession about D D will serve to restore the axes B B of both gyroscopes to their normal positions transverse to T_1 T_2, but it will not be accompanied by any precession about T_1 T_2 until B_1 reaches G_1.

The effect of the plates G and H combined with the very small clearance between them and the axes is ordinarily to limit the deviations of the axes B B from their normal transverse position to very small amounts, for any tipping is almost instantaneously corrected and relatively large unbalanced loads may be applied suddenly without large disturbance of the gyroscopes. We shall return to this matter later.

The discussion thus far has considered what occurs while the car stands still or moves upon a straight track or cable. A single gyroscope would have been sufficient to produce all the results reached so far. The two have, however, been shown to act in unison so far, and the two become necessary only by reason of the forces brought into play in rounding a curve in the track.

So far as the centrifugal force which is developed in running the car around a curve is concerned, it acts precisely like an unbalanced load in applying an angular impulse about T_1 T_2 to tip the car off the track. We have already explained in detail how the gyroscopes operate to balance the car on the rail in such circumstances. It should be remembered that in rounding a curve the car is in balance not when its centre of gravity is vertically over the rail, but, instead, when it lies in the line of the resultant of the centrifugal force and gravity, just as it must also stand inclined in case of sidewise wind-pressure.

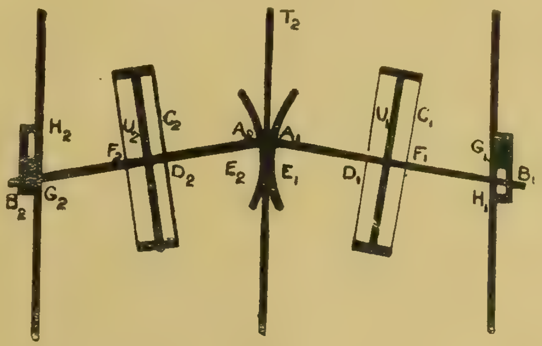

Fig. 4.

The one thing, however, which we have not yet considered is the torque developed in each gyroscope about the longitudinal axis T_1 T_2 by reason of the common precession of both gyroscopes in the same sense with the car itself about a vertical axis in rounding a curve in the track. Were it not for the toothed sectors A_1 A_2, the axes B_1 B_2 would both maintain their original direction in space while the car turned the curve, but, unable to do this by reason of A_1 A_2, they are both forced to precess with the car. Suppose the car moves in the direction T_1 T_2 around a curve that turns to the right as A_1 does, then the precession is clockwise viewed from above, and the torque developed in the right gyroscope is formed by placing our cork model T U V with V to the right, U vertical, and T horizontal, so that T acts about T_1 T_2 and clockwise looking from T_1 to T_2, while the torque in the left gyroscope is about $T_1 T_2$, but clockwise looking from T_2 to T_1, as will be readily perceived by comparing the cork model before mentioned with U upward in the two while V in one case is opposite to that in the other.

The two gyroscopes, therefore, develop equal and opposite torques about $T_1 T_2$, which are transmitted to the rigid frame E F through the bearings D D and they hold each other in equilibrium by means of internal stresses induced in the frame. While running around a curve to the right a tension is caused in $F_1 F_2$ and an equal compression in $F'_1 F'_2$.

The gyroscopes are both needed in this case in order that each may equilibrate and neutralise the torque of the other, which would otherwise infallibly overturn the car on attempting to run it round a curve. Furthermore, it is evident that in order to secure the existence of this dynamic equilibrium it is necessary that the two axial velocities V be at all times equal and opposite.

It is not, however, necessary that V remain at all times constantly of the same value. The high speed of 3,000 revolutions per minute proposed by the inventor is for the purpose of ensuring that the product MV, on which the stability of the car depends, shall be large without making the size and weight of the gyroscopes large. He estimates that for ample stability their weight may then be only 4 per cent of the weight of the car, or less.

Under those conditions the gyroscopes would store so large an amount of rotary energy (which is measured by $\frac{1}{2} MV^2$) that the fluctuations of velocity V, due to the expenditure by friction on $G_1 G_2$ and otherwise, would be practically imperceptible in case the power applied by the synchronous motors to maintain V is sufficient in the long run to make good all losses by friction. In any case the power needed by the gyroscopes would be inconsiderable compared with that required for the propulsion of the car.

(To be continued.)

NOTES ON THE OPERATION AND TESTING OF POLYPHASE INDUCTION MOTORS.

By J. W. Rogers.

(Concluded from page 43.)

There is another method of working up the performance curves from the data obtained from the "shop tests" described above, which is particularly applicable to motors of large capacity when it is not possible to obtain accurate wattmeter readings of the motor input, the apparent watts only being measured. As it is absolutely necessary to know the power factor at which a motor is working, in cases where it cannot be obtained from the ratio

$$\frac{\text{True watts}}{\text{Apparent watts}},$$

its value may be calculated from the total iron loss in the following manner. It is first necessary to find the value of the inductive or wattless component of the volts per ampere of current input, and this may be calculated from the data given by the locked saturation curves.

If any current C be taken on the amperes curve, and also its corresponding value of V volts, then apparent kilowatts = C × V ÷ 1000.

The real kilowatts are then read off the watts curve for the same value of V volts, and the inductive component of the apparent input will be

$$= \sqrt{\text{apparent k.w.}^2 - \text{real k.w.}^2},$$

also inductive volts

$$= \frac{\sqrt{\text{apparent k.w.}^2 - \text{real k.w.}^2}}{C};$$

therefore the inductive volts per ampere of current input

$$= \frac{\sqrt{\text{apparent k.w.}^2 - \text{real k.w.}^2}}{C^2},$$

and the total value of inductive volts for any particular value of load current input

$$I = \frac{\sqrt{\text{apparent k.w.}^2 - \text{real k.w.}^2}}{C^2} \times I.$$

The value of the inductive volts expressed as a percentage of the normal voltage

$$= \frac{\frac{\sqrt{\text{apparent k.w.}^2 - \text{real k.w.}^2}}{C^2} \times I}{\text{normal voltage}} \times 100,$$

and this quantity represents one part of the iron loss. As the power factor is generally expressed as a percentage, it will be convenient to express the iron loss in a similar manner, then total percentage iron loss = percentage inductive volts + percentage magnetising current, and the value of the magnetising current expressed as a percentage of the total primary current

$$= \frac{\text{magnetising current}}{\text{total load current}} \times 100,$$

this quantity being obtained in the following manner:—

The no-load current C_1, which may be taken as the magnetising current, is read off the running saturation curve at normal voltage, and its value expressed as a percentage of the current input.

$$I = \frac{C_1}{I} \times 100.$$

The total percentage iron loss will then be

$$= \left(\frac{\frac{\sqrt{\text{apparent k.w.}^2 - \text{real k.w.}^2}}{C^2} \times I}{\text{normal voltage}} \times 100 \right) + \left(\frac{C_1}{I} \times 100 \right)$$

The power factor is found from the right-angle relation, existing in a triangle, of which the base represents the power factor, and the vertical side the wattless component or total inductive loss expressed as a percentage; the power factor is also obtained from

$$\sqrt{100^2 - \text{total per cent inductive loss}}.$$

For the purpose of illustrating this method of working up the performance curves of an induction motor, perhaps the following example, which has reference to a 40-H.P. three-phase 550-volt machine, may be of interest. In this example the losses and efficiency for 45 B.H.P. will be worked out, corresponding to 80 total amperes and a speed of 730 revolutions per minute, the synchronous speed being 800 revolutions per minute.

The first quantity to be calculated is the power factor, which is obtained from the inductive component of the total apparent input in the manner already described. A reference to the locked saturation curves of this machine gave 377·5 total amperes and 101 real kilowatts, corresponding to 550 terminal volts, then

$$\text{Apparent k.w.} = 377{\cdot}5 \times 550 = 207{\cdot}6, \text{ and}$$

$$\text{Inductive k.w.} = \sqrt{207{\cdot}6^2 - 101^2} = 181{\cdot}2.$$

$$\text{Inductive volts} = \frac{181200}{377{\cdot}5} = 480{\cdot}5;$$

therefore inductive volts per ampere of primary current input

$$= \frac{480{\cdot}5}{377{\cdot}5} = 1{\cdot}274.$$

This quantity was also calculated for 350 and 500 volts, and its mean value found = 1·28 volts per ampere.

The total percentage inductive volts

$$= \frac{\text{inductive volts per ampere} \times \text{total primary amperes}}{\text{normal voltage}} \times 100$$

$$= \frac{1{\cdot}28 \times 80}{550} \times 100 = 18{\cdot}6 \text{ per cent.}$$

The value of the magnetising current as read off the running saturation curve = 22 total amperes at 550 volts; therefore magnetising current

$$= \frac{22 \times 100}{80} = 27{\cdot}5 \text{ per cent.}$$

The total percentage iron loss

$$= 18{\cdot}6 + 27{\cdot}5 = 46{\cdot}1 \text{ per cent.,}$$

and power factor

$$= \sqrt{100^2 - 46{\cdot}1^2} = 88{\cdot}75 \text{ per cent.}$$

The value of the iron, friction, and windage losses is represented by the input to the motor at normal voltage when running light, and is read off the watts curve of the running saturation. This quantity represents the no-load loss, and its value in this example was 1,317 watts at 550 volts.

The mean value of the primary resistance between terminals = ·447$^\omega$ after having been increased by 10 per cent to allow for an increase in resistance due to heating.

The apparent H.P. corresponding to 80 total amperes = 80 × 550 ÷ 746 = 59 H.P.

Real H.P. = apparent H.P. × P F = 59 × ·8875 = 52·4 H.P., and real watts = 52·4 × 746 = 39050.

The total losses consist of C^2R loss in primary winding + no-load loss, and primary C^2R loss

$$= \frac{C^2R}{2} = \frac{80^2 \times {\cdot}447}{2} = 1432;$$

therefore total losses = 1432 + 1317 = 2749 watts.

The true watts available for conversion into mechanical power = real watts − losses = 39050 − 2749 = 36300 watts. As the synchronous speed represents the rate at which energy is supplied to the motor, and the actual speed at which it runs, the rate at which energy is delivered, the slip of the motor must be taken into account when calculating the actual value of the watts converted into mechanical power, which is given by

$$\frac{\text{Real watts} - \text{losses} \times (100 - \text{percentage slip})}{100}.$$

The slip

$$= \frac{800 - 730}{800} \times 100 = 8{\cdot}75 \text{ per cent,}$$

and substituting known values in the above formula we get

$$\frac{36300 \times (100 - 8{\cdot}75)}{100} = 33100 \text{ watts output.}$$

$$\text{B.H.P.} = 33100 \div 746 = 44{\cdot}5.$$

$$\text{Apparent efficiency} = \frac{44{\cdot}5}{59} \times 100 = 75{\cdot}2 \text{ per cent.}$$

$$\text{Real efficiency} = \frac{44{\cdot}5}{52{\cdot}4} \times 100 = 84{\cdot}75 \text{ per cent.}$$

The torque developed at 1 ft. radius

$$= \frac{44{\cdot}5 \times 5250}{730} = 320 \text{ lbs.}$$

The data for different loads on the motor have been calculated in the same manner, and the performance curves are shown in fig. 6.

Commercial Testing.—As already stated, the commercial tests made on induction motors are those for (1) iron loss and friction, (2) temperature run on full load, and (3) insulation.

The iron loss and friction are obtained from the "no-load" readings at normal voltage, but before these readings are taken it is the custom to run the machine for a short period until the friction losses have reached a stationary value, which is indicated by the no-load current remaining constant, and during this test it is necessary to note the following mechanical points, viz., (1) balance, (2) magnetic centre, (3) oil throwing. These are of great importance so far as the operation of the motor is concerned, and they may be considered as follows. When the rotor is balanced there should be a complete absence of vibration when the machine is supported on level ground, such as the test plate.

When the rotor is magnetically centred there should be end play on both sides of the machine; that is to say, the rotor should float between the bearings when running. If this is not the case, and the rotor is found to pull hard on one side, the remedy consists in shifting the rotor core along the shaft from the side at which the tendency to "hug" exists.

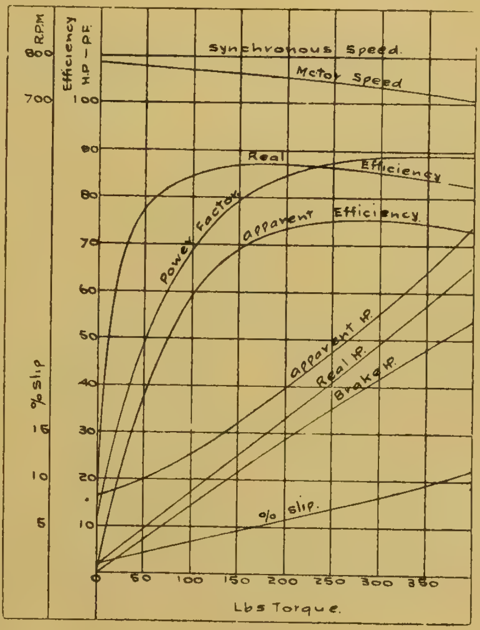

Fig. 6.

As regards the temperature test, a motor is generally run at full load for several hours, followed by one hour's run at 25 per cent overload in the case of large machines. The duration of a temperature run and the rise in temperature allowed varies slightly with different makers, but it is the custom to run a machine at full load until the temperature rise of its various parts becomes stationary.

Surface temperatures are taken with mercury thermometers, their readings being checked by calculating the mean temperature rise from the increase in the resistance of the windings. As the resistance of a copper conductor increases by ·428 per cent per degree Cen. rise in temperature, the mean temperature rise of the windings is given by

$$\frac{\text{Hot resistance} - \text{cold resistance}}{\text{Cold resistance} \times {\cdot}00428}.$$

Insulation.—As the insulation of a machine is more liable to break down when hot, this test is always made at the conclusion of the temperature run. It consists in applying a high alternating current voltage between the windings and frame, the ratio of the testing to the working voltage depending upon the normal voltage of the machine.

BORING AN INJECTOR BODY ON THE DRILL PRESS.

The injector body shown at fig. 1 is of gunmetal, and quantities to be produced enabled them to be machine moulded in the foundry, so that the castings came out fairly close. It was found that with a suitable jig the boring and drilling could be done more economically on the one machine than by having each piece set up twice, as was the case when boring on a suitable turret lathe, because the advantage gained by the latter method was more than counterbalanced in handling time. The jig used is shown at fig. 2, and consists of a grey iron body A, carrying machined facings B for clearance, etc., and internal facings C, D, E, F. Of these, E forms a locating base, suited to the large flange of injector body, and also gives suitable proportions to the necessary drill guide bushings. F forms the second locating face, against which a flange is clamped by two bolts G.

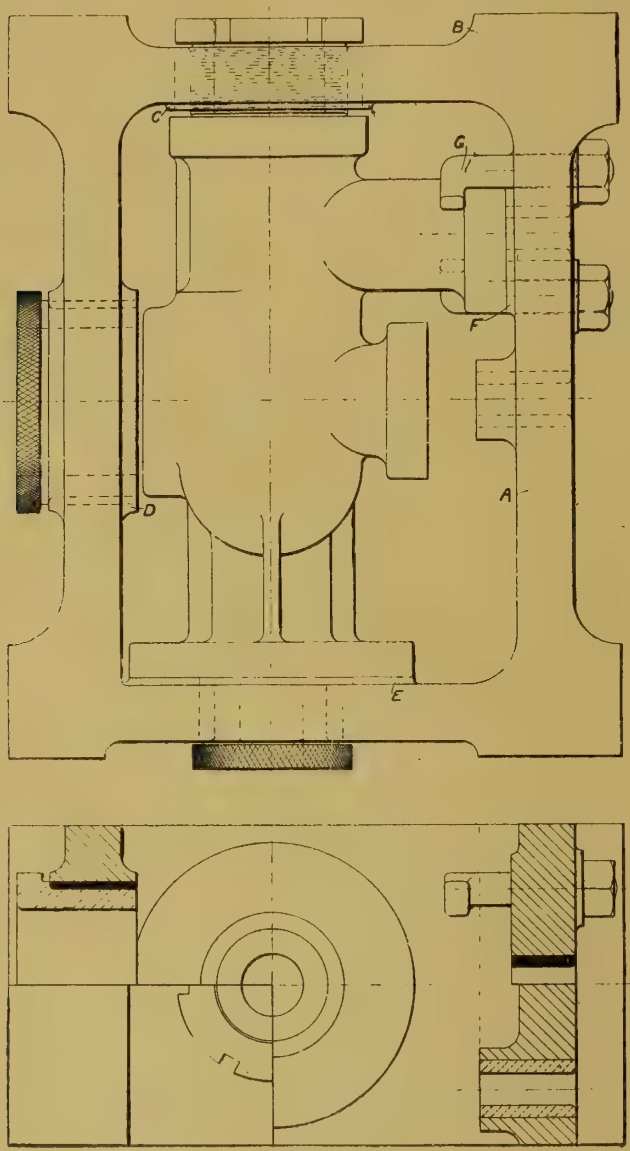

Fig. 2.

Machine used has tapping arangements and compound table, and prior to coming to the machine, castings have all flanges accurately milled to gauge.

Jig is first set up in the position shown, with screwed bush H, slacked back; work is inserted with its bottom flange central on facing E, screwed bush lightly clamped, and bolts G attached, bringing flange face hard up against facing F, after which, screwed bush is tightened down.

The 1½ in. gas bore is first dealt with, the cored hole being opened out to tapping size by 3-lip Stubb core-drill, and then tapped in the usual way.

Screwed bush is removed, and a bush having two screwed diameters is inserted, one to suit the jig and the other to suit the work; with this as a guide, both 1⅛ in. bores are three-lip core-drilled, reaming not being required.

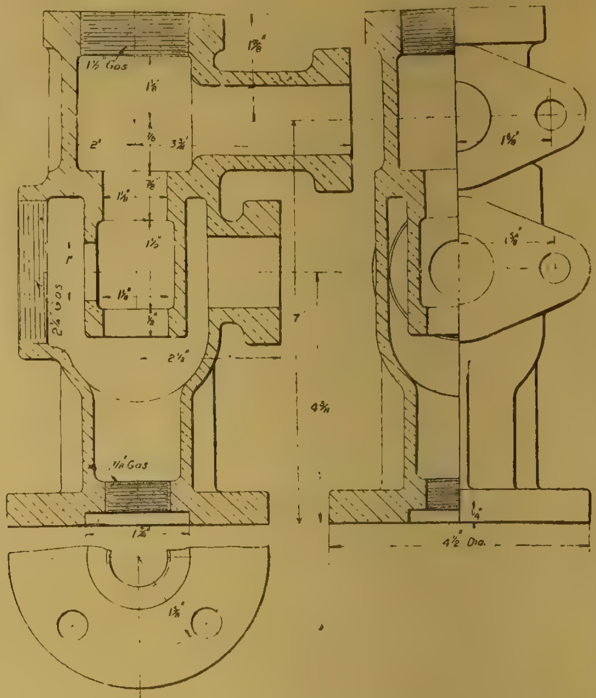

Fig. 1.

Jig is then set over, and the 2¼ in gas and 1 in. bores similarly dealt with. For the ⅞ in. gas bore, the hole is core-drilled as before, slip bush is removed, and using a counter-boring tool with pilot to suit drilled hole, is counter-bored to depth, threads being afterwards tapped.

The far bolt holes in this flange are then drilled, and back faced with a drawback facing tool. Operations are completed by drilling the two gland flanges and back facing the holes.

This method and jig proved efficient and expeditious in producing the parts with the required degree of accuracy.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 7th July, 1910.

Cardiff.—*First class :* A. Skyrme, J. M. Campbell. *Second class :* A. Howson, D. E. Hughes, D. H. Hunt, H. Johns, C. F. Paradise, W. Paterson, H. Sutherns.

Belfast.—*Second class :* N. Blaney.

Glasgow.—*First class :* A. Tweedie, B. Higgins. *Second class :* R. C. McConnell, R. D. McPherson.

Leith.—*First class :* J. Aitken. *Second class :* W. R. Nelson, J. Sharp, C. Sutherland, J. M. Walker.

Liverpool.—*First class :* W. J. Allsop. *Second class :* A. G. Amery, T. A. Davidson, A. P. Hardie, A. Ireland, W. H. Mays, H. T. Morgan, J. B. Nicoll, H. W. Simon, W. J. Spedding.

London.—*First class :* G. H. D. Lang, L. Clother. *Second class :* W. J. Briggs, T. J. Smith, W. T. Webb.

North Shields.—*First class :* J. McL. Clark, R. Spence, N. H. J. Farthing, H. Metcalfe, J. Foxall. *Second class :* J. Macdonald, E. C. Durrant, W. Matthews, J. Scorer.

Southampton.—*First class :* A. W. Bond, P. J. Deeks. *Second class :* H. W. Fooks.

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"London Matriculation Directory." No. 55. The Calendar, 1910. The University Tutorial Series. Burlington House, Cambridge. London: W. B. Clive. Price 1s.

This directory is brought out periodically for the benefit of students and intending students of the University Correspondence College, an institution second to none in the preparation of candidates for the London University Examinations. The success of the college tuition can be best understood when we state that during the year ending August 31st 1,144 successes are recorded, matriculation claiming 519 U.C.C. students, which is one in every five of the total who passed this examination during the year.

Advice is given as to the choice of the course, the fees and books required, with the professors and tutors connected with the college.

An appreciative section of the directory is the abstract of the regulations of the University of London, also the whole of the questions set at the examination in June last, and a complete set of answers to same.

The book is essential to all those aspiring to the various University degrees, and particularly to candidates for the London Matriculation.

"Model Balloons and Flying Machines." By J. H. Alexander, M.A., A.I.E.E. London: Crosby Lockwood and Son. Price 3s. 6d.

That much is to be learned from experiments with models is known from Froude's law of comparison, which has been so long successfully applied in the case of ships. The author thus justifies himself in his desire to instruct the enthusiast in the problems of flight. Full-size flying machines are expensive to build, and have an element of danger in testing. Models are cheap to build, and as the same principles hold good in their construction, much can be derived while experimenting with them.

A brief history of the advances made in dirigible ballons opens the book, with some instructions on the making and filling of a model with a body about 4 ft. long. This is followed by some notes on the fundamental principle of gliders and the comparison of monoplanes and biplanes. The construction of models is gone into with much detail, aided by five sheets of working drawings, each of which contains a different sized machine. There is a glossary of aviation terms and an ample index. The book includes an interesting account of recent performances, and should meet the requirements of enthusiast and amateur.

"The Oil, Petroleum, and Bitumen Manual and Kindred Companies, 1910." By W. R. Skinner. London: "The Capitalist" Office. Price 1s.

This manual is a complete compilation of companies dealing directly with the oil industry, and appearing at a time when there is a boom, it should be an acquisition, particularly to the investor. Its widespread importance can be gathered from the fact that it contains information of nearly £58,000,000. The particulars include the names of the directors and officials, date of registration, shares issued, purchase price, etc. There is also a list of names and addresses of 650 directors connected with the industry. The manual is an up-to-date record which should prove useful to those who have money to invest in mines.

Books Received.

"Official Gazette of the United States Patent Office." Vol. CLV., No. 4. Published by Authority of Congress, Washington.

"Matriculation Directory." No. 55, June, 1910, with Articles on Text Books. The University Tutorial Series. London: W. B. Clive. Price 1s. net.

"A Text book of Applied Mechanics and Mechanical Engineering." Vol. V. Theory of Machines and Practical Mechanism. Seventh edition, revised and enlarged. By A. Jamieson. London: C. Griffin and Co. Ltd.

A NEW DRAUGHT INDUCER FOR CHIMNEYS AND VENTILATING SHAFTS.

An improved device of the above nature which may be used on chimneys and ventilating shafts, locomotive and marine boilers, has recently been introduced by Mr. D. McClean, the inventor. Referring to the illustrations, fig. 1 is a front elevation and fig. 2 is a side-sectional elevation.

The funnel, chimney, or ventilating shaft *a* is provided with a collar *b*. Fixed on to the sleeve *d*, which surrounds the funnel or chimney is a cowl *c* provided with a flange *e*, the sleeve *d* being also provided with a toothed flange *g* which gears with a pinion *b*. *j* is a band which fits loosely around the cowl, its purpose being to stay the same whilst allowing it to revolve. *k*, *k*, and *m* are anti-friction rollers.

In using the cowl it is placed over the shaft or chimney so that the flange *f* on the sleeve *d* rests on the collar *b*. The function of the sleeve *d* is to make an air-tight connection where the bend of the cowl crosses the chimney or funnel, to provide support for the cowl whereby it will be guided in turning, and also to provide means whereby it may be turned.

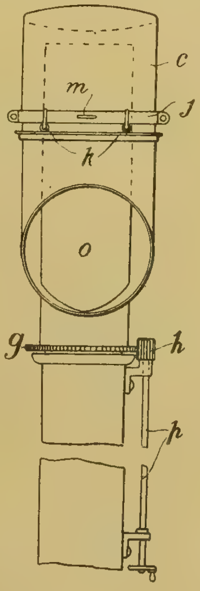

Fig. 1.

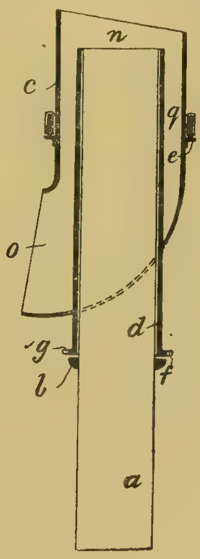

Fig. 2.

Air or gases entering the mouth of the cowl at *o* pass up the annular space *q* between the same and the sleeve *d*, the inlet being larger in cross sectional area than the area of the space *q*; the effect of this is to produce a jet action which increases the suction in the chimney or funnel. When it is desired to regulate the draught, the cowl is turned by means of a hand-wheel fixed on the same spindle as the pinion *h*, so that its mouth faces the wind or is disposed at such an angle thereto as may be necessary; in some cases a shutter may be used on the mouth of the cowl for the same purpose.

The cowl may be sloped as at *n* at the top for the purpose of giving more freedom to the draught on the leeward side. An advantage of the device when applied to a locomotive is that it permits the orifice of the exhaust cone to be enlarged, thereby reducing the back pressure on the piston.

A NEW PETROL ELECTRIC OMNIBUS.

A successful demonstration has recently been given of a petrol electric omnibus constructed by the Daimler Motor Co., Coventry, under Knight, Pieper, and Lanchester patents. The following description and illustrations give an idea of the principal features. The chassis frame, instead of being formed in the usual manner, is formed by the well of the omnibus body, and is built up of sheet steel rolled into a deep channel section, as shown in the plan, fig. 2. At the points of load application on the springs, transverse members, which are riveted to the steel well, are fitted, this giving the necessary strength at these points, and in order to obtain torsional rigidity a rectangular steel tube, which also forms the petrol tank, is riveted between the two sides of the steel well and situated under the driver's seat, as may be seen in fig. 1.

At each side of the steel frame are fitted the power units, which comprise two 12-H.P. (R.A.C. rating) Knight-Daimler engines, the crankshafts and frames of which are extended to support two dynamotors. Each of the dynamotors is rated at 3 k.w., but has a give-and-take capacity of three to four times of this amount. The drive from each power unit is by a worm driving a worm wheel fitted to each rear wheel through a tubular cardan shaft, as shown in figs. 1 and 3. The engines exhaust into a single silencer situated centrally under the body of the omnibus, while cooling is effected by a radiator connected with both engines, circulation being maintained by a single pump. The pump is driven by a small ½-H.P. electric motor, which also drives a fan situated behind the radiator. Ignition for the engines is obtained by means of magnetos, each driven direct off the engine shaft.

In ordinary light running the two engines drive the road wheels, and the dynamotors, which then act as dynamos, charge Tudor batteries of 24 cells (fig. 1) situated under the driver's seat, but when any extra load is put on the engines the batteries come into action and drive the dynamotors, which then act as motors and increase the available power of the omnibus. The automatic changing of the dynamotors from dynamos to motors is governed by a solenoid, which, when the accumulators are fully charged, operates the throttle levers of the carburetters and reduces the speed of the engines. The accumulators then discharge and the solenoid gradually loses its magnetism and opens the throttle again and increases the

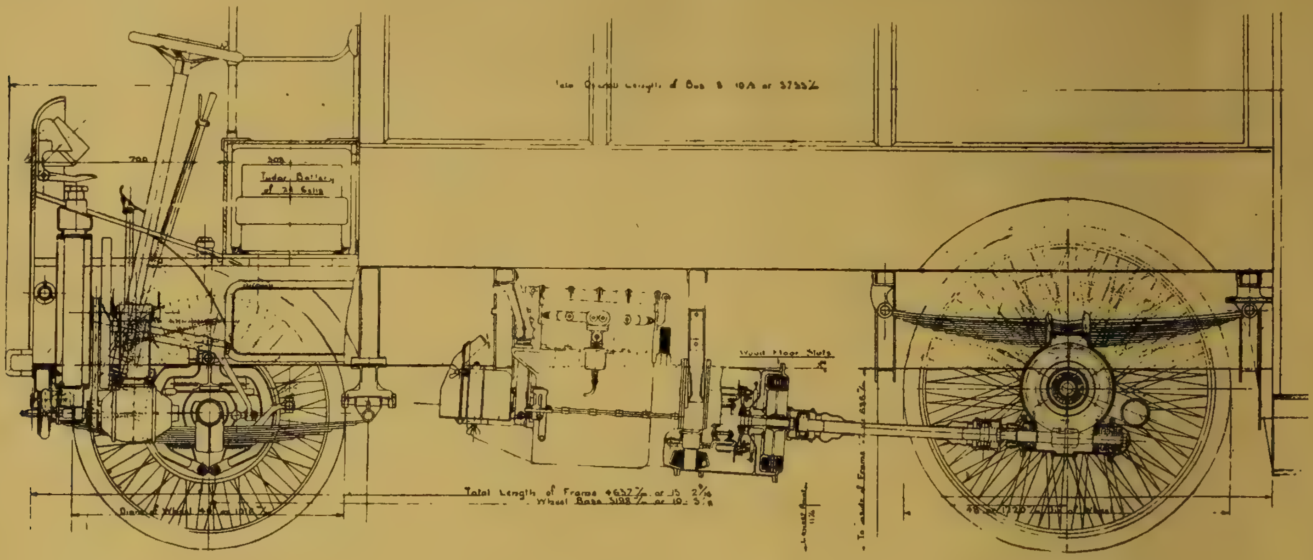

Fig. 1.

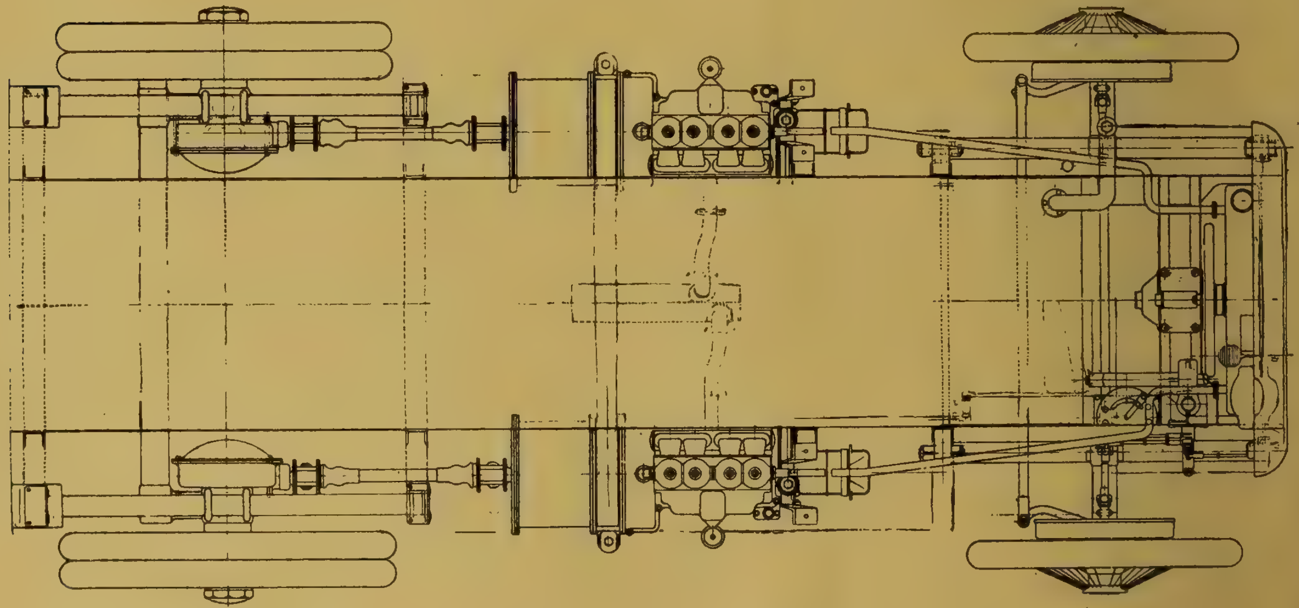

Fig. 2.

speed of the engines which, in their turn, drive the dynamos which recharge the accumulators. Reversal is effected by means of the dynamotors alone. For the control of the omnibus two levers are arranged on the top of the steering wheel, one connected to the dynamo field controller through a rheostat for controlling the speed, and the other connected to the two engine throttles. For forward running the two dynamotors are connected in parallel, for reversing they are connected in series, and these two positions are obtained by a lever used when a change of direction is required. The rear axle consists of a tubular-cranked axle tree, on the extremities of which are mounted the road wheels. The axle tree is so designed that each road wheel and worm gear by which it is operated are carried directly off the spring bracket; that is, the portion of the axle tree directly supporting the rear portion of the vehicle. The front axle consists of a steel tube, and has the steering pivots coaxial with the wheel centre welded in at each end. The road wheels are all of the Rudge-Whitworth wire wheel type, with solid rubber tyres, a special feature being the method of double-spoking, as shown in fig. 3. The arrangements of braking are as follow: The first is by bringing the levers on the steering wheel to the strongest field position, the second by magnetic brakes actuated by a foot pedal and acting on the cardan shafts; third, a foot or hand lever operating internal expanding brakes on the front wheels. The principal advantages for this construction of omnibus are: Absence of vibration, silence of running owing to absence of change and differential gears, and the employment of worm transmission, and the use of the Knight engine in place of the usual type of motor; also, the motor, being electrically started, renders it unnecessary to leave the engine running when taking up or setting down passengers. The power batteries are utilised for electric lighting, and the ventilators and other accessories are electrically operated. The total unladen weight of the omnibus including the batteries, which weigh 5 cwts., is 3 tons 9 cwt., the regulations allowing 3 tons 10 cwt. The main dimensions are as shown in the illustrations.

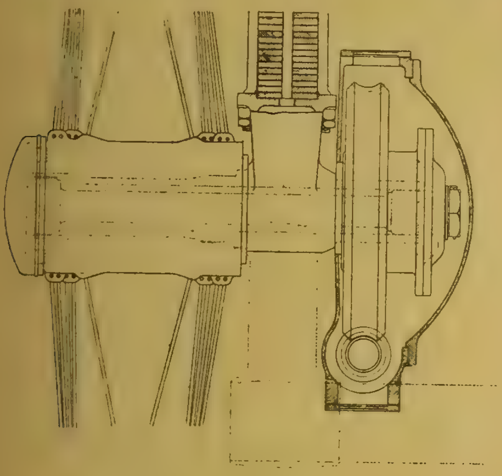

Fig. 3.

Shipbuilding Returns.—From the returns compiled by Lloyd's Register of Shipping it appears that, excluding warships, there were 394 vessels of 1,118,587 tons gross under construction in the United Kingdom at the close of the quarter ending June 30th, 1,115,484 tons gross being steam and 3,103 tons gross sail. The tonnage now under construction is about 61,000 tons more than that which was in hand at the end of last quarter, and exceeds by nearly 373,000 tons the total building 12 months ago. The figures of the warship tonnage now being built (378,523 tons displacement) are the largest reported since June, 1901.

VENTILATION AND DUST REMOVAL IN COTTON MILLS.—III.

[Contributed.]

(Continued from page 36.)

A gassing machine, or gassing frame, as made by Messrs. Arundel and Company, of Sovereign Works, Stockport, is illustrated at figs. 11, 12, and 13. Fig. 11 is a sectional end elevation of the machine, fig. 12 a general view, and fig. 13 a separate sectional view of one of the burners with ventilating hood.

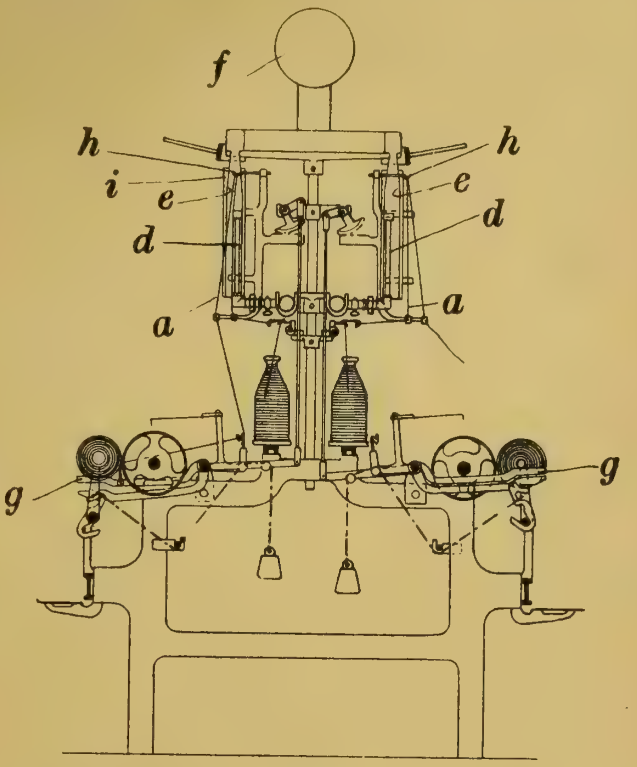

Fig. 11.

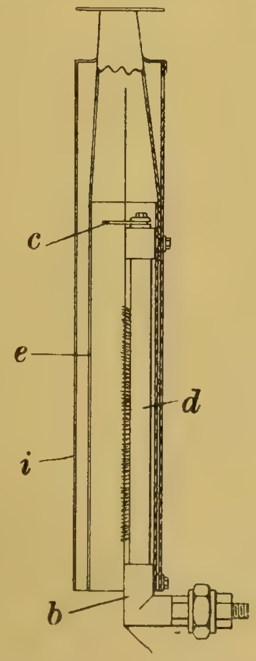

Fig. 13.

The yarn *a* from the bobbins at each side of the machine is guided by an external groove in the elbow piece *b*, at the lower end of its gassing burner, and by a guide fork *c* at the upper end of the burner (see fig. 13). The two sides of the machine are independent and separately driven. Each burner consists of a vertical tube *d* with a series of apertures therein, preferably pointing downwards. Around the burner tube is arranged a hood or combustion chamber *e*, which opens at its upper end into a duct *f* extending from end to end of the machine. At one end this duct is provided with a fan, by which the whole of the products of combustion, including the burnt fluff, are carried into a special chamber, where they are deposited on water. The yarn is guided into and out of the combustion chamber by parallel movements imparted from the stop lever *g*. At the left-hand side of fig. 11 the yarn is shown in the gassing position; at the right-hand side it is shown withdrawn from the combustion or gassing chamber. The yarn is given a sharp angular movement over the upper guide eye *h* within the combustion chamber, so as to break the charred fluff off the yarn. The detached fluff is then carried up through the ventilating hood. A supplementary casing *i* is arranged around the combustion chamber to prevent excessive radiation of heat into the gassing room.

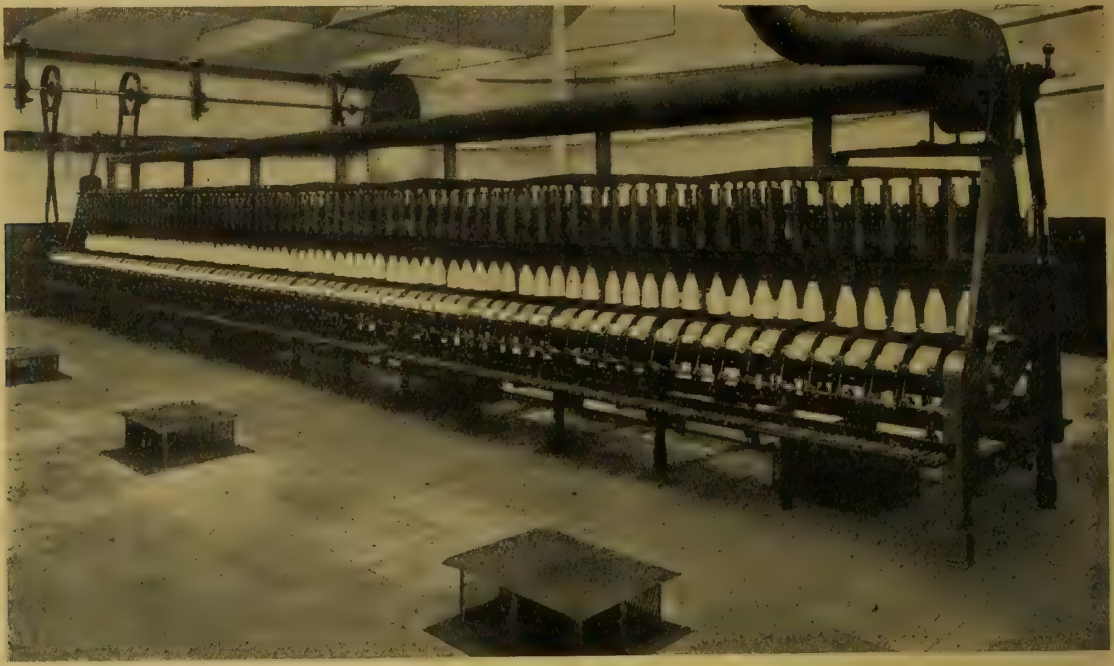

Fig. 12.

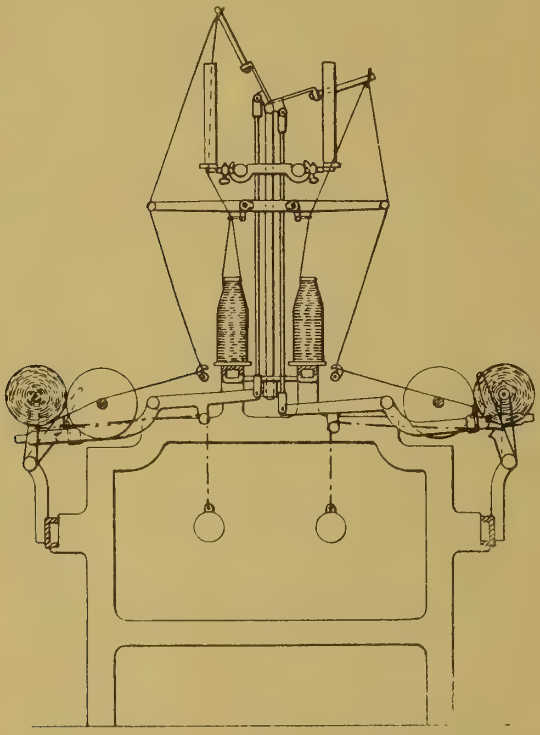

Fig. 15.

With this machine, all the charred fluff and other products of combustion are drawn off from each burner as they are generated, the result being a total absence from the gassing room of smoke, smell, or fluff.

Messrs. Arundel and Company rightly attach great importance to the proper mixing of the gas and air which is supplied to the burners. For such mixing they employ the patented apparatus as illustrated at fig. 14. It comprises two rotary pumps or blowers—one for air and one for gas—geared together to give a ratio of displacements corresponding to the required proportions of gas and air, and driven by a variable friction drive, which is governed automatically according to the rising and falling movements of the tanks or holders which respectively receive the gas and air. If the gas and air supply is less than the demand, the tanks fall and act upon the governing mechanism to increase the speed of the pumps. If, however, the supply exceeds the demand, the tanks rise and act upon the governing mechanism for decreasing the speed of the pumps.

The gassing frame shown by the aforesaid figs. 11, 12, and 13 comprises the subject matter of several patents; brief particulars of some of them, and also of other patents, are given hereunder.

The patent specification No. 12,257, of 1905, in the names of Higginson and Arundel, set forth an invention that may be said to consist in providing means for exhausting the contents of a tube or chamber into which the gassing flame projects, and through which travels the yarn being gassed.

In the specification No. 20,025, of 1907, by the same patentees, there is described an arrangement wherein the yarn is given a sharp angular movement within or in close proximity to the mouth of the ventilating hood, for the purpose of breaking the charred fluff off the yarn at a point where a strong exhaustion action exists.

The specification No. 20,026 of 1907 (Higginson and Arundel), describes the means illustrated at fig. 11 for guiding the yarn into the combustion or gassing chamber with a parallel movement. To prevent the gassing-machine attendant from being inconvenienced by the heat radiated from the slit in the combustion or gassing chamber of the gassing frame, a device can be employed as set forth in the specification No. 23,624, of 1907 (Higginson and Arundel), comprising a shield or guard which is automatically interposed between the attendant and the gassing burner when the yarn is being gassed. In the machine, as illustrated at figs. 11, 12, and 13, the means employed for this purpose comprise a supplementary external casing arrangement (see fig. 13) for providing a current of air around the combustion or gassing chamber, as fully set out in the specification No. 20,910, of 1908 (Higginson and Arundel).

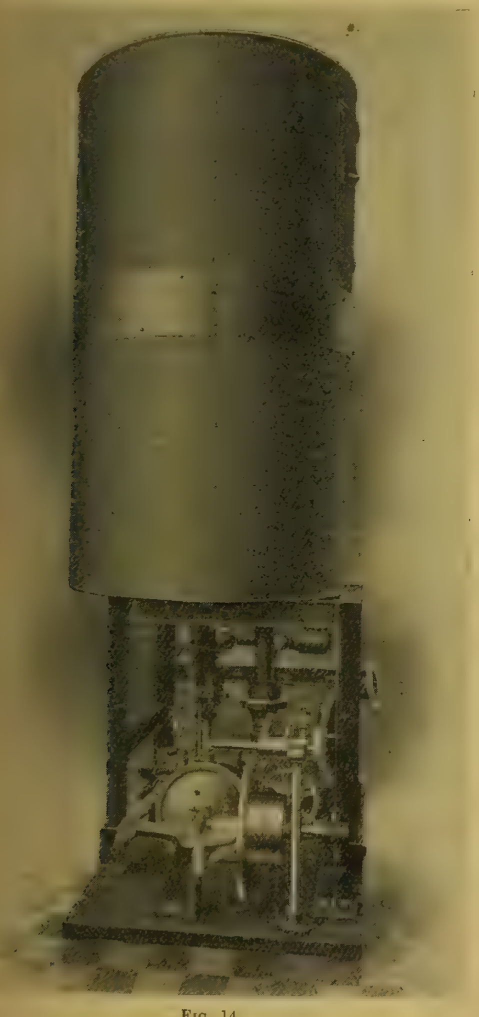

FIG. 14.

The specification No. 9,684, of 1909 (Higginson and Arundel), shows means for varying the length of the gassing flame to suit the counts or speed of the yarn being gassed.

In the gassing machine or gassing frame by Messrs. Asa Lees and Company Limited, of Soho Iron Works, Oldham, illustrated at fig. 15, the yarn is guided into and withdrawn from the combustion chamber by a pivoted guide eye operated from the stop lever. The right-hand side of fig. 15 shows the yarn withdrawn from the combustion chamber, whilst the left-hand side shows the yarn passing through said chamber. The combustion chamber is not connected with a suction or exhaust duct. Messrs. Asa Lees and Company rely upon the complete combustion of the loose fibre obtained by the use of a combustion chamber to render the products of combustion much less objectionable than with the ordinary type of Bunsen burners. They also place their burners well above the heads of the workpeople, a position considerably higher than is usually adopted.

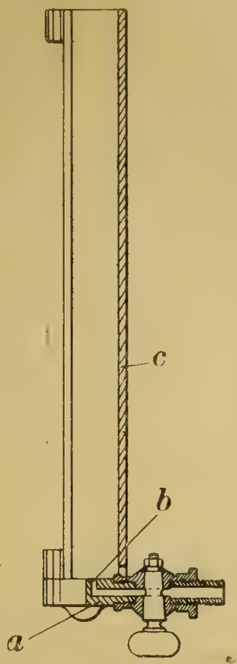

FIG. 17.

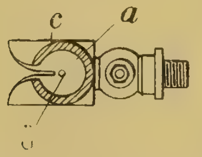

FIG. 16.

The burners employed by Messrs. Asa Lees and Company are made under Rivett and Oldham's patents Nos. 12,208, of 1905, and 2,821, of 1907.

According to the specification of the 1905 patent, the burner is made from a bifurcated base piece, upon which a tubular guard or combustion chamber is mounted. The gassing flame issues from an aperture in the base piece in a direction parallel with that in which the yarn travels. This type of burner is illustrated at figs. 16 and 17, fig. 16 showing the base piece *a* with flame aperture *b*, and fig. 17 a burner and guard *c*.

The burner described in patent specification No. 2,821, of 1907, differs from the earlier burner in that, instead of the flame issuing from the aperture in the base piece, it issues from a tube which extends from the base piece into the guard or combustion chamber. The flame apertures may be provided by slits or perforations in the tube.

(*To be continued.*)

WIRELESS TELEGRAPHY.—The Commonwealth Government has decided to adopt the recommendations of the conference held there last year of representatives of the Admiralty, the Commonwealth, New Zealand, and Fiji for the linking up of the British islands in the Pacific by wireless telegraphy. The scheme provides for the establishment of high-power stations at Sydney, Doubtless Bay, New Zealand, Suva, and Ocean Island, and medium-power stations in the New Hebrides and the Solomon Islands. All the stations will be controlled by the Government.

THE JAPAN-BRITISH EXHIBITION.—II.

(Continued from page 786, vol. xli.)

Messrs. The Thames Shipbuilding and Engineering Co. Ltd. have on show at their stand Nos. 51 and 52 in the Machinery Hall an interesting collection of models of twin-screw, armoured, barbette battleships constructed some years ago for the Japanese Government. H.I.J.M.S. "Shrikishima" was built in 1899. Its length was 400 ft., breadth, 75 ft. 6 in., draught of water 27 ft. 3 in., displacement 14,850 tons, horse power of engines 14,500, giving a speed of $18\frac{1}{2}$ knots per hour. H.I.J.M.S. "Fuji," built in 1896, had the following dimensions: Length between perpendiculars 374 ft., breadth 73 ft., depth 44 ft. 9 in., giving a total displacement of 12,500 tons, and engine speed of $18\frac{1}{2}$ knots per hour.

A fine model of an 18,000-H.P. triple-expansion engine, as built for H.M. Admiralty first-class battleships in the year 1900, and models of H.M.S. "Duncan," "Cornwallis," and "Albermarle" are also on view. A leading feature in the company's exhibits is the "Hone" patent grab, manufactured at their Canning Town works. There is a full-sized grab with dumping gear on exhibition; also a working model of a grab with suspension gear hung from a jib crane. The grab is applicable to any single-chain crane, and has been largely adopted for dealing with coal, coke, lime, etc., by the principal gas companies, colliery owners, coal merchants, and others at home and abroad, with excellent results, effecting great saving over the methods previously employed, and reducing the cost of handling to about 1d. per ton.

These machines are supplied of various types to suit different requirements, such as lifting ballast, sand, chalk, clay, gravel, ores, macadam, and grain; also for well and cylinder sinking underneath water, etc. We understand there are over 2,000 of these grabs at work in various parts of the country, and there is a big demand for them on the Continent. They have been extensively used by Government contractors at home and abroad in connection with docks and harbour works. It may be interesting to note that the smallest grab made of the "Hone" type was for the South Metropolitan Gas Works, Vauxhall, the dimensions being 2 ft. by 2 ft. and lifting capacity $1\frac{3}{4}$ cwts., while the largest, reputed to be the biggest in the world, was supplied to the well-known firm of Messrs. Sir Weetman Pearson and Co. Ltd., of Victoria Street, Westminster, S.W. It weighed 11 tons, was worked by a $1\frac{3}{8}$-in. chain, and had a capacity of 160 cubic feet. While at work at Dover Harbour, this grab, which was of the spoon-tine type, lifted a chunk of rock weighing over 30 tons to the surface of the water, but it had to be released, the crane in work at the time being not suficiently powerful to hoist it further. In connection with the second portion of the Dover Harbour contract, several grabs of seven tons with a capacity of 120 cubic feet were supplied to the above-mentioned contractors, and numerous similar-sized ones for digging purposes have been supplied from time to time to another eminent firm of Government contractors, namely, Messrs. Sir John Jackson Ltd., Victoria Street, Westminster, S.W. We are indebted for most of the foregoing particulars to Mr. Hone, the inventor, who favoured our representative with an interview at the Thames Civil Engineering Works, Canning Town, and gave practical demonstration of the working capabilities of this ingenious contrivance. Accompanying this description will be seen an illustration of the "grabs" under notice. Incidentally we may mention that there are over 100 grabs in use at the various stations of the Gas, Light, and Coal Co., and Messrs. William Cory and other large concerns employ them extensively.

Another exhibit which attracts a good deal of attention is "Normandy's patent sea-water distilling apparatus" (made by the Thames Ironworks, Shipbuilding, and Engineering Co. Ltd., Greenwich, S.E.). A large working model is shown generated by gas for the production of pure drinking water, and another of smaller capacity (not working). The apparatus is suitable for working on land near the sea, or more inland, to deal with impure waters from rivers, etc. It is made small, light, and easy to be taken apart for convenient erection purposes.

Amongst their other exhibits will be noticed an 8-in. and also a 6-in. patent steam trap, by Mr. Warriner, the company's manager at Greenwich. This trap, we understand, is used on many ships belonging to the Government, the last equipment being for H.M.S. "Nautilus," now under process of construction at the famous Canning Town shipyard.

A useful apparatus is also to be seen in the shape of a portable electrical drilling machine, having telescopic shaft with universal joints and change-speed gears.

"Hone" Grab.

A visit to the stand of this well-known firm cannot but prove of interest, where their courteous representative, Mr. H. D. Taylor, will, we have no doubt, afford the same facilities for obtaining information of their exhibits which we ourselves obtained.

R. S. Allan & Co.'s Wood-working Machinery.—A strikingly ingenious and useful piece of machinery is on exhibition in two forms at the stand of Messrs. R. S. Allan and Co., of Gateshead-on-Tyne. Fig. 1 of the accompanying drawings is especially adapted for making doors and staircase work, while fig. 2, by means of the circular motion and gear attachment, is more suited to patternmaking purposes. Both machines on exhibition are fitted with scales marked in 16ths and with carefully-set angles marked on face of quadrant for centring or gauging the work. The machine cannot but prove invaluable to practical joiners and patternmakers. The machine illustrated in fig. 2 will cut core boxes and patterns in a few minutes that would take hours by hand, and be impossible to cut on other machines. It will do this class of work more accurately and in infinitely less time than that required by other methods. The work is always under uninterrupted observation and complete mechanical control while operating. "Allan's patent comprehensive woodworker," which is patented in Great Britain, America, and Germany, is claimed to be the handiest, simplest, most powerful, and cheapest machine for the pattern shop ever invented, effecting a saving of from 80 to 90 per cent in labour. Its varied functions and uses embrace slotting, mortising, moulding, and half-lapping; also the making of core boxes, patterns, grooving, boring, and tenoning. The cutting tool is carried by a horizontal spindle driven by the small pulley seen at the right of figs. 1 and 2, this spindle being carried in self-adjusting bearings mounted on a rigid pedestal fixed to the bedplate. The work to be dealt with is attached to a carrier mounted on a four-legged stand which runs on V-guides on the bedplate. The position of the stand is controlled by a leading screw and the hand-wheel shown on the extreme left in figs. 1 and 2 at the rear end of machine, so that large or small work may be readily accommodated. Guides are formed in the top of the stand, and these carry a slide capable of moving to and fro parallel to the spindle axis, thus allowing for the adjustment of the work towards the cutting tool, either for regulating the depth of cut or for any other purpose. This motion is controlled by a hand-wheel between the legs on the stand. By referring to fig. 2, it will be seen that on the slide a vertical, semi-circular table is carried, the face of which lies towards the spindle, and on the upper edge of which teeth are cut. This table may be moved to and fro at right angles to the spindle axis by means of hand-wheels immediately above those controlling the slide. A slot, concentric with the teeth on the rim, is cut in the table to take a locking bolt. This bolt secures a long frame (shown perpendicular in fig. 2 and in an inclined position in fig. 1), which carries a slide that can be adjusted along the frame by hand-wheels at the top of the rest. The plane is carried on a pin in the centre of the table face, and may be rotated through an arc determined by the length of the circular slot. It is driven from the teeth round the edge of the table by a worm wheel connected by a pair of bevels to the small hand-wheel at the back.

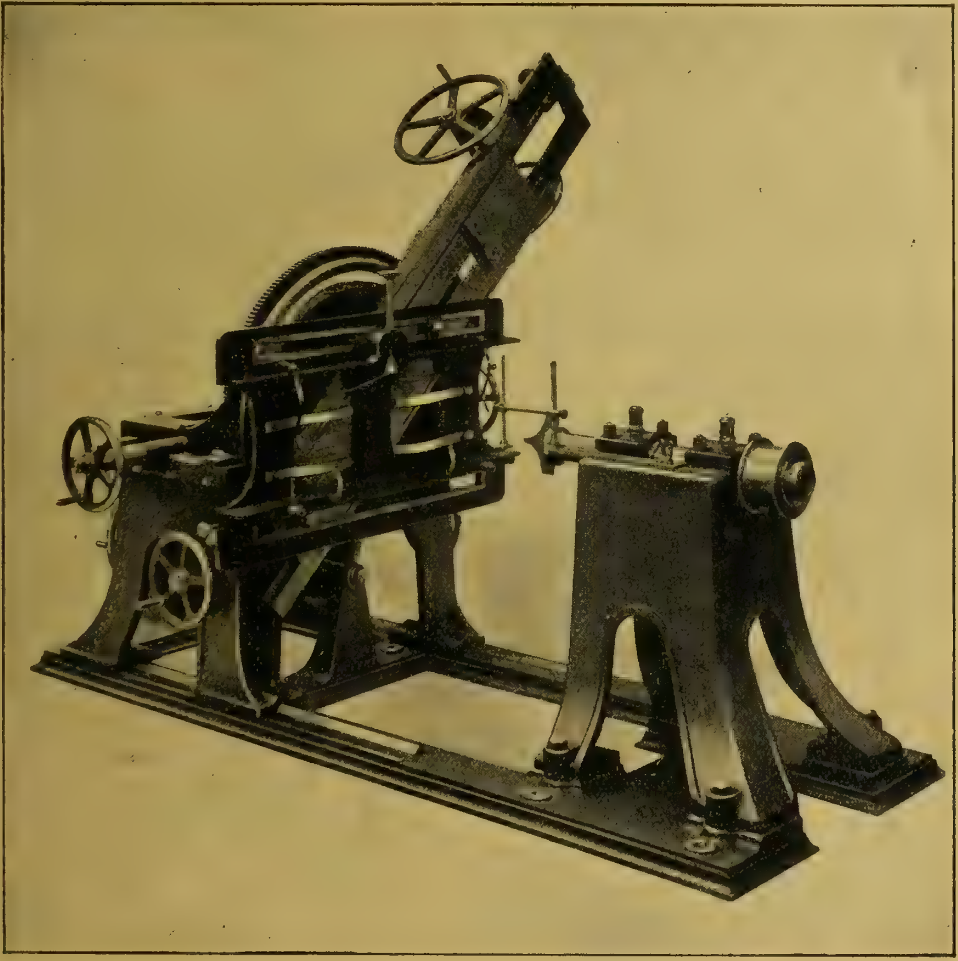

Fig. 1.—WOOD-WORKING MACHINE.

To the slide in the frame is bolted either a circular work table or the work carrier shown in fig. 1. The carrier is provided with a clamp, guides, and springs for holding the work, and is so arranged that it may be held horizontally, no matter what may be the angle of the slide rest. Work of any length may therefore be fixed horizontally, and grooves cut in it at any angle by the necessary operation of the slide. The circular work table is employed for core box or patternmaking, and when curved or circular work has to be done. It is secured to the face of the slide by a pivot bolt, on which it revolves, and is driven from the teeth cut on its circumference by a worm-wheel connected to small hand-wheels at each side of the slide-rest.

The woodworker is considered to be a most useful and economical machine for patternmakers, and it is claimed that complicated core boxes that would take two or three weeks if made by hand at the bench can be cut by this machine in a few hours. For grooving it has also been found very serviceable. Grooves can, the makers assert, be cut at any angle, and either straight or curved; and "a groove, 3 in. to 4 in. in diameter, 20 in. long, can be produced in 30 seconds." Other classes of work with equal speed are practicable, and, owing to the absence of vibration, the work produced is well finished. The machine occupies a floor space of 7 ft. 6 in. by 4 ft., and weighs 23 cwt.

Mr. Allan, the inventor of the machine, is to be seen at the stand, No. 23, in the Machinery Hall, where the exhibits are to be found and specimens of woodwork seen. The interest aroused in the minds of the practical engineer, joiners, carpenters, and patternmakers is particularly noticeable at the week-ends or when works are shut. Our representative found Mr. Allan on an occasion such as this a few days ago with a crowd of eager and interested men of various grades and positions watching and listening while he explained the mechanism and gave ocular demonstration of the work the machines are capable of doing.

Messrs. W. R. Sykes Interlocking Signal Co. Limited, of London and Glasgow, have an instructive and interesting exhibit of signalling mechanism and appliances, amongst them single-line instruments (minus staff and tablet), claimed to be the only instruments of their kind in existence, their object being to do away with staff and tablet; automatic signalling apparatus to overcome sand failures; power frame working signals and points by power; new motor gear for working semaphore arm with magnetic clutch; non-tamp electric lock (Sykes-Tarrant patent). For their power signalling S.Y.X. all electric system, the chief advantages claimed over others are less levers, smaller frame, smaller cabin, less labour, and cost of maintenance reduced to a minimum.

Messrs. Hans Renold Ltd., Manchester, who are specialists in the manufacture of every type of driving chain, are exhibiting on stand No. 24 in the Machinery Hall, opposite Messrs. Dobson and Barlow, of Bolton, who are displaying textile machinery in motion.

The four small chain drives shown include sizes for powers ranging from 3 H.P. to 40 H.P., and speeds from 400 ft. to 1,300 ft. per minute.

On the same stand a complete range of patent silent, bush roller, block, stud, balance, textile, and pipe wrench chains are exhibited, as also a full set of every type of cycle chain.

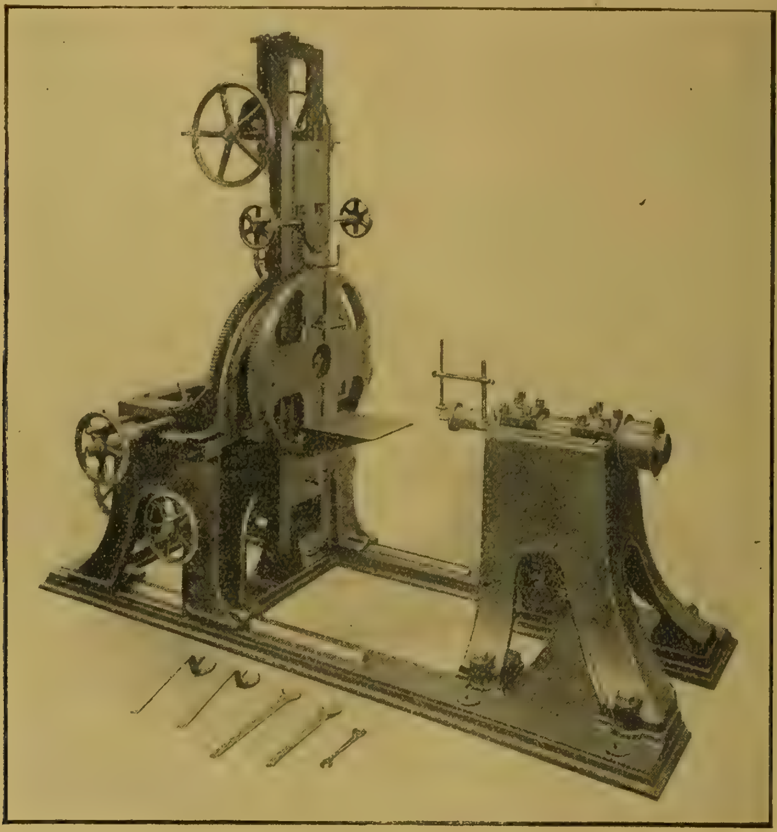

Fig. 2.—WOOD-WORKING MACHINE FOR PATTERN WORK.

A mortising chain outfit, with guide bar and sprocket, is also shown; also a complete range of various widths of mortises 1$\frac{5}{8}$ in. long.

We would also draw attention to models on exhibition in Pavilion No. 47 (Japanese education and industry) of the shipbuilding and engineering works and docks at Nagasaki and Kobe belonging to **Messrs. The Mitsu Bishi Co.,** Japan; also a model of the turbine steamer "Chiyo Maru," built by them for the Toyo Kisen Kaisha. This is the largest vessel yet built in Japan, and registers 14,000 tons gross, and has a speed of 21 knots.

(*To be continued.*)

We have received from **Messrs. C. W. Burton, Griffiths, and Co.,** London, a copy of their catalogue containing particulars and prices of different sizes of "Elliott" micrometers.

SOME TEST FIGURES FROM AN OIL ENGINE.*

By F. J. **Kean**, B.Sc. (Lond.).

(Concluded from page 52.)

Test Nos. 12a and 12b.

Test number	12*a*	12*b*
Conditions	Very early firing without water injection	Very early firing with water injection
Duration in minutes	30	30
Oil used per minute in the engine ... lb.	0·139	0·110
Water injection to the cylinder per min. ... lb.	nil.	0·052
Pounds of water injected per pound of oil used in the engine	nil.	0·469
Calorific value of the oil supply B.Th.U. per lb. (average value by calorimeter)	20,000	20,200
Average composition of the oil (Russian petroleum)	C. 86% H. 14%	C. 86% H. 14%
Speed in revolutions per minute	260·7	260·0
Explosions per minute	100·9	79·9
Explosion (or maximum) pressure lbs. per square in.	275	275
Compression pressure (before firing) " "	25	48
Suction pressure (from light spring diagram) lbs. per square inch	4·0	4·0
Release pressure " "	30·0	26·0
Mean effective pressure " "	54·1	72·2
Indicated horse power	11·02	11·65
Nett load on brake ... lb.	50·0	50·0
Brake horse power	6·31	6·29
Mechanical efficiency per cent	57·3	54·0
Jacket water in pounds per minute	19·3	15·0
Inlet temperature ... deg. F.	58·0	85·5
Outlet temperature "	100·0	102·0
Rise in temperature "	42·0	43·5
Temperature of the air in engine room "	63·0	65·0
Exhaust pipe temperature	754·0	732·0
Exhaust gas analysis by volume per cent	CO_2 9·2 CO 5·5 O 1·4 N, &c., 83·9	CO 10·3 CO 2·3 O 3·7 N, &c., 83·7
Ratio of air to oil by weight— (1) From light spring diagram (2) From gas analysis	 21·6 14·66	 20·8 17·22
Absolute thermal efficiency (on I.H.P.)	16·6%	22·2%
Absolute thermal efficiency (on B.H.P.)	9·5%	12·0%

Heat Account in British Thermal Units per Minute.

No. 12a.

Dr.	B.Th.U.	%	Cr.	B.Th.U.	%
Heat supplied from the oil	2,808	100	Heat equivalent of I.H.P.	467·2	16·6
			Heat rejected in jacket water	810·8	28·9
			Heat lost by incomplete combustion (forming CO)	452·0	16·1
			Heat carried away by the products of combustion	392·7	14·0
			Balance of heat account	685·3	24·4
			Radiation, errors of observation, &c., by difference		
Total	2,808	100	Total	2,808·0	100·0

Heat Account in British Thermal Units per Minute.

Dr.	B.Th.U.	%	Cr.	B.Th.U.	%
Heat supplied from the oil	2,222	100	Heat equivalent of the the I.H.P.	494·0	22·3
			Heat rejected in the jacket water	652·5	29·4
			Heat lost by incomplete combustion	174·5	7·8
			Heat carried away by the excess air	42·1	1·9
			Heat carried away by the products of combustion	299·0	13·4
			Heat carried away by the steam from the water injection	70·9	3·2
			Balance of heat account		
			Radiation, errors of observation, &c., by difference	489·0	22·0
Total	2,222	100	Total	2,222·0	100·0

Calculations for the Heat Account.

No. 12a.

Converting the volume analysis to a weight analysis—

	Volume fraction × Relative Density.		Fractional Weight.
CO_2	0·092 × 22 = 2·025		0·1371
CO	0·055 × 14 = 0·770		0·0521
O	0·014 × 16 = 0·224		0·0152
N, etc.,	0·839 × 14 = 11·750		0·7956
Total	14·769	—	1·0000

Analysis of exhaust gases by weight—

CO_2 13·71 per cent. CO 5·21 per cent. O 1·52 per cent. N, etc., 79·56

Weight of carbon in 1 lb. of dry exhaust gas—

$= \frac{3}{11}$ of the CO_2 by weight + $\frac{3}{7}$ of the CO by weight

$= \frac{3}{11} \times 0·1371 + \frac{3}{7} \times 0·052 = 0·0597.$

Weight of dry exhaust gas per 1 lb. of carbon burned—

$$= \frac{1}{0·0597} = 16·75 \text{ lb.}$$

Weight of dry exhaust gas per 1 lb. of oil burned—

= 16·75 × (the weight of carbon in 1 lb. of oil)

= 16·75 × 0·86 = 14·4 lb.

Weight of steam formed—

= 9 × (the weight of hydrogen in 1 lb. of oil).

= 9 × 0·14 = 1·26 lb.

Total weight of exhaust gas per 1 lb. of oil burned = 15·66 lb.

Weight of air used per 1 lb. of oil = 15·66 — 1 = 14·66 lb.

Weight of air theoretically needed per 1 lb. of oil—

= 11·56 × (carbon in 1 lb. of oil) + 34·67 × (hydrogen in 1 lb. of oil).

= (11·56 × 0·86) + (34·67 × 0·14).

= 9·94 + 4·85 = 14·79 lb.

Weight of products of combustion per 1 lb. of oil = 14·79 + 1 = 15·79 lb.

$$\frac{\text{Carbon burned to } CO_2}{\text{Whole carbon in 1 lb. of oil}} = \frac{CO_2 \text{ by volume}}{(CO_2 + CO) \text{ by volume}} = \frac{0·092}{0·147} = 0·626$$

∴ Carbon burned to CO_2 = 0·626 × 0·86 = 0·538 lb. per 1 lb. of oil.

Carbon burned to CO = 0·86 − 0·538 = 0·322 lb. per 1 lb. of oil.

Products of Combustion :—

		Per 1 lb. of products × specific heat.
CO_2	$= \frac{11}{3} \times 0·538 =$ 1·973	0·127 × 0·216 = 0·0274
CO	$= \frac{7}{3} \times 0·322 =$ 0·752	0·048 × 0·248 = 0·0119
O	= 9 × 0·14 = 1·260	0·081 × 0·480 = 0·0389
N by difference	= 11·585	0·744 × 0·244 = 0·1816
Total	15·570	1·000 Total 0·2598

Mean specific heat per 1 lb. of products = 0·260

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* Paper read before the Institute of Marine Engineers, June, 1910.

No. 12B.

Converting volume analysis to a weight analysis—

	Volume fraction × Relative Destiny.		Fractional Weight.
CO_2	0·103 × 22 =	2·266	0·1521
CO	0·023 × 14 =	0·322	0·0216
O	0·037 × 16 =	0·592	0·0397
N, etc.,	0·837 × 14 =	11·732	0·7866
	Total	14·903	1·0000

Analysis of exhaust gases by weight—

CO_2 15·21 per cent CO 2·16 per cent O 3·97 per cent
N, etc., 78·66 per cent

Weight of carbon in 1 lb. of dry exhaust gas—

$$= \tfrac{3}{11} \times 0{\cdot}1521 + \tfrac{3}{7} \times 0{\cdot}0216 = 0{\cdot}0507 \text{ lb.}$$

∴ Weight of dry exhaust gas per 1 lb. of carbon burned—

$$= \frac{1}{0{\cdot}0507} = 19{\cdot}72 \text{ lb.}$$

Weight of dry exhaust gas per 1 lb. of oil burned—

$$= 19{\cdot}72 \times 0{\cdot}86 = 16{\cdot}96 \text{ lb.}$$

Weight of steam formed = 9 × 0·14 = 1·26 lb.

Total weight of exhaust gas per 1 lb. of oil burned.

$$= 16{\cdot}96 \times 1{\cdot}26 = 18{\cdot}22 \text{ lb.}$$

Weight of air used per 1 lb. of oil = 18·22 − 1 = 17·22 lb.

Weight of air theoretically needed per 1 lb. of oil = 14·79 lb.

Excess air per 1 lb. of oil = 17·22 − 14·79 = 2·43 lb.

Weight of products of combustion per 1 lb. of oil—

$$= 14{\cdot}79 + 1 = 15{\cdot}79 \text{ lb.}$$

$$\frac{\text{Carbon burned to } CO_2}{\text{Whole carbon in the fuel}} = \frac{10{\cdot}3}{10{\cdot}3 + 2{\cdot}3} = \frac{10{\cdot}3}{12{\cdot}6} = 0{\cdot}818$$

∴ Carbon burned to CO_2 = 0·818 × 0·86 = 0·704 lb. per 1 lb. of oil.
Carbon burned to CO = 0·86 − 0·704 = 0·157 lb. per 1 lb. of oil.

Products of Combustion—

			Per 1 lb. of products × specific heat.
CO_2	$\frac{11}{3}$ × 0·703 =	2·577	0·163 × 0·216 = 0·0352
CO	$\frac{7}{3}$ × 0·157 =	0·366	0·023 × 0·248 = 0·0057
H_2O	9 × 0·14 =	1·260	0·080 × 0·480 = 0·0384
N	by difference =	11·587	0·754 × 0·244 = 0·1791
	Total	15·790	1·000 0·2584

Mean specific heat of products of combustion = 0·258.

Nos. 12A and 12B.

Heat lost by incomplete combustion—

= { (Weight of carbon burned to CO per 1 lb. of oil) × (the difference between the calorific value of carbon burned to CO_2 and carbon burned to CO) × (the number of pounds of oil used per minute).

Heat carried away by the products of combustion—

= { (Weight of products per 1 lb. of oil) × (mean specific heat of products) × (the difference between the exhaust pipe temperature and the atmospheric temperature) × (the number of pounds of oil used per minute).

Heat carried away by the excess air—

= { (Weight of excess air per 1 lb. of oil) × (specific heat of air at constant pressure) × (the difference between the exhaust pipe temperature and the atmospheric temperature) × (the number of pounds of oil used per minute).

Heat carried away by the steam from the water injection—

= { (Number of pounds of water injected per minute) × [(0·48 times the difference between the exhaust pipe temperature and 212° F.) + (the latent heat of steam at 212° F.) + (the difference between 212° F. and the air temperature)].

NOTICES OF MEETINGS, &c.

July 16th to 23rd.—Junior Institution of Engineering. Summer Meetings in Ireland.

July 16th: Reception at Dublin.

July 18th: Visits to Messrs. Guinness's Brewery and Dublin Corporation Electricity Works.

July 19th: Inspection of Dublin Corporation's New Reservoir under course of construction.

July 20th: Proceed to Belfast.

July 21st: Visits to Belfast Rope Works and York Street Flax Spinning Works.

July 22nd: Visit to Messrs. Harland and Wolff's Shipbuilding and Engineering Works.

July 23rd: Excursion to Portrush and Giant's Causeway.

TRADE NOTES.

The London and North-Western Railway have accepted the tender of **Messrs. William Geipel and Co.,** Vulcan Works, St. Thomas' Street, London, S.E., for the supply of "Henrion" arc lamp carbons during the year ending 30th June, 1911, for the whole of the company's requirements, the total annual consumption amounting to 1,373,000 carbons. The above is a renewal of last year's contract.

We understand that the **Palmer Shipbuilding and Iron Co. Ltd.,** Jarrow, have succeeded in booking an order for a large cargo steamer for the Ellerman Line Ltd. This makes the third steamer the firm have on hand for the above-mentioned owners.

The Glasgow steamer Ailsa Craig, belonging to the **Clyde Shipping Co.,** is reported sold to an Eastern buyer for a sum near about £12,000.

The Whitby-owned steamer Eskside, **Messrs. Smales,** managers, has been sold to Norwegian buyers for £9,500 for fishing purposes. The vessel is of 838 tons net register.

The Cunard Co. have placed an order for the building of a new liner to be named the Laconia with the well-known firm of **Messrs. Swan, Hunter, and Wigham Richardson Ltd.,** of Wallsend-on-Tyne. The new boat will be a sister ship to the Franconia to be launched on July 23rd next, and will be primarily employed in the Boston service.

The Imperial Trade Correspondent at Adelaide (Mr. J. K. Samuel) reports that the South Australian Railway Commissioner has issued an invitation for tenders for the construction in South Australia of (1) 7 or 22 Class T 3 ft. 6 in. gauge locomotive engines and bogie tenders; (2) 5 or 15 Class F 5 ft. 3 in. gauge locomotive tank engines; and (3) 9 or 19 Class Rx 5 ft. 3 in. gauge locomotive engines and bogie tenders. Tenders in the case of (1) and (2) will be received at Adelaide up to 19th July, and in the case of (3) up to 16th August.—*Board of Trade Journal.*

We understand that the **Leyland Shipping Co.** are disposing of all their remaining sailing vessels.

LAUNCHES AND TRIAL TRIPS.

Gloucestershire.—Messrs. Harland and Wolff Ltd. launched at Belfast on July 7th the steel twin-screw steamer Gloucestershire, 8,100 tons, built to the order of the Bibby Line, of Liverpool.

Benpark.—On July 9th Messrs. Craig, Taylor, and Co. Ltd. launched from their Thornaby Shipbuilding Yard, Stockton-on-Tees, a finely-modelled steel screw steamer to carry about 7,000 tons dead weight on a light draught of water. The owners, Messrs. Joseph Hoult and Co. Ltd., of Liverpool, were represented at the launch by Mr. B. Allen, of Liverpool, under whose superintendence the vessel has been built.

Highland Corrie.—This new Nelson liner, built by Messrs. Russell and Co., Port Glasgow, ran successful speed trials on July 5th. She returned to the James Watt Dock, Greenock, to complete her fitting out for her maiden voyage.

St. Albans.—The new steamer St. Albans, built and engined by Workman, Clark, and Co., Belfast, for the Eastern and Australian Steamship Co. Ltd., London, left Belfast Harbour on Wednesday, the 6th inst., and after adjustment of compasses and speed trials, which were highly satisfactory, the vessel proceeded to Cardiff to take in coal for Shanghai. The vessel is 380 ft. in length, gross tonnage 4,100, and is intended for passenger and cargo service between Japanese, Chinese, and Australian Ports.

Ellerbeck.—On June 30th the Blyth Shipbuilding and Dry Docks Co. Ltd. launched from their Shipbuilding and Graving Docks Works a new steel screw steamer, built to the order of Messrs. Sharp and Co., of Newcastle-on-Tyne. This vessel, which measures 255 ft. in length with a beam of 36 ft. 9 in., has been constructed under Lloyd's special survey for their highest class. Triple-expansion engines of good power will be supplied by Messrs. The North-Eastern Marine Engineering Co. Ltd., of Sunderland.

Corbridge.—On July 6th Messrs. Robert Thompson and Sons Ltd. launched from their Southwick Yard, Sunderland, a first-class cargo steamer, built to the order of Messrs. James Hoggarth and Co., Cardiff. The principal dimensions are: Length between perpendiculars, 300 ft.; breadth, 50 ft.; and depth moulded, 25 ft. 10 in. She will be classed 100 A1 at Lloyd's under special survey. The engines, by Messrs. The North-Eastern Marine Engineering Co. Ltd., Sunderland, have cylinders 25 in., 42 in., and 68 in., with a stroke of 45 in., steam being supplied by large boilers working at a pressure of 180 lbs. per square inch.

Thistleton.—Messrs. Irvine's Shipbuilding and Dry Docks Co. Ltd. launched from their Middleton Shipyard, Hartlepool, July 6th, this steel screw steamer, built to the order of Messrs. Allan, Black, and Co. (the Albyn Line Ltd.), Sunderland. The vessel is 382 ft. 6 in. in length by 51 ft. 4½ in. beam by 26 ft. 6 in. depth moulded, carrying 7,430 tons on a light draught, and she takes Lloyd's highest class. Triple-expansion engines will be supplied and fitted by Messrs. Richardson, Westgarth; and Co. Ltd., Hartlepool, the sizes of the cylinders being 25 in., 40 in., 68 in., by 45 in. stroke, with two large single-ended boilers working at a pressure of 180 lbs. per square inch.

NAVAL NOTE.

Sergipe.—This torpedo-boat destroyer for the Brazilian Government has had her official trial at the mouth of the Clyde. The contract speed of 27 knots, carrying a load of 100 tons, was easily exceeded. The actual speed obtained was 27·676 knots on the miles and 27·605 knots during a continuous run on three hours' duration. The Sergipe is the last of 10 destroyers ordered by the Brazilian Government from Messrs. Yarrow and Co.

CORRESPONDENCE.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only; and if accompanied by sketches, these should be neatly drawn, and forwarded on a roll, to prevent creasing. We cannot undertake to return rejected communications, or to reply to inquiries by letter. In all cases letters must be accompanied with the name and address of the writer.

We do not hold ourselves responsible for the opinions of our Correspondents.

CONCRETE PILES.

To the Editor of "The Practical Engineer."

Sir,—In your editorial note on the subject of reinforced concrete piles you suggest that there appears to be some doubt as to the preservation of embedded steel from corrosion. As a matter of fact, there is absolutely no reason for doubt in this respect, but since you suggest the desirability of setting the point at rest by proof from actual experience I take the opportunity of giving the following extracts from the Transactions of the Engineering Conference, 1907, of the Institution of Civil Engineers:—

Action of Sea Water on Ferro-concrete.—Mr. C. S. Meik (page 35): My experience, so far as it extends, proves that the deterioration of the steel in the concrete, provided the latter is properly made, is a negligible quantity.

A pile end, which has been in the sea for eight years at Southampton, was lately on view at Paddington Station. The exposed steel work in this specimen was much corroded, whereas the bars in the body of the concrete on being cut open were found to be quite free from any rust and as fresh as the day they were put into the pile.

Sir William Matthews (page 40), referring to the effects of two collisions in 1907 of an 8,000-ton steamer with the reinforced-concrete jetty built at Purfleet in 1903, asked: What was your experience of the concrete and the steelwork that was opened up by the damage?

Mr. Meik: It is all perfect. There are some piles down at Purfleet which I have had taken out of the river, and they are all perfect. I should be very pleased if any member of the conference could go down there, so that they could see for themselves the state of the steel inside the concrete.

Mr. C. A. Brereton (page 48): I have had an opportunity of seeing a piece of pile which had been submerged at Southampton for some seven or eight years, and which was taken up. I must say that steel and iron work in the centre showed no deterioration whatever. In fact, the blue scale was still on the rods just as at the time they were put in. Of course, that shows that they were thoroughly protected from the action of the sea water.

Mr. C. F. Marsh (page 51): As to the rusting of the metal, it has always been found that if the concrete has been properly made and the structure properly built the metal has not rusted in any way after a great many years.

Mr. J. Watt Sandeman (page 53): I make it an invariable rule for all sea work to have absolutely water-tight concrete, which will stand perfectly by making it of one part cement to two of sand and three of aggregate, and no doubt if concrete piles are made of that proportion they will be impervious to water.

Mr. J. Hannay Thompson (page 54): With regard to the rusting of the rods, I have taken up several heads of piles which have been cut off after having been subjected to very heavy driving and had been left in the water about three years, and on stripping the concrete the steel was found to be perfectly blue. One experiment I made was to test the effect on steel work that had been put into concrete bracings just above low water. I made two blocks of concrete about 5 ft. long, and I put into the concrete two rods similar to those that had been used in the construction, just as they came from the works, and two very rusty bolts, which had been corroded very much indeed and very much pitted, just as bad as I could find them. One of these blocks I had made in the dry, and after it was set it was put under water. The other block I made just above low-water level, and as soon as ever the concrete was out into the mould the tide came over the block. I allowed these blocks to remain in the water about three years, and took them up last week. As to the one that was made in the dry, the new steel rods were quite blue, and from the very rusty rods I found that the rust had gone entirely, leaving the bars free from rust. The block that was made at low-water level, and over which the water was allowed to flow at once, when broken up I found exactly the same thing there. One very interesting point with regard to that is that I found that that concrete was damp right through. There did not appear to be any sign of honeycombing at all, but the concrete itself was damp. But, nothwithstanding that, the whole of the steel was quite free from rust in every way.

Mr. W. T. Douglass (page 56: The question was asked this morning as to whether engineers had any experience with reference to the rusting or otherwise of steel rods in reinforced concrete. Although my experience does not go back so far as 1757, I may say that during the construction of Smeaton's Eddystone Lighthouse a small bundle of iron rods had evidently been left by accident in the masonry embedded in Aberthaw lime, and was discovered in the year 1881 when I took down the lighthouse. I may say the colour of these rods was just as if they had come from the mill, and there was no mark of rust whatever on them.

Mr. C. H. Colson (page 65: I had occasion some years ago to pull down an old wall about 150 or 200 years old, and in the middle of that wall (it was a masonry wall built with mortar) there were a good many large iron nails which were clean and had not rusted to any extent.

I could give many similar records both from the publications of engineering societies and from my own experience relative to the immunity of steel from corrosion when embedded in good concrete, but I think you will agree with me that the foregoing are more than amply sufficient to demonstrate the unfounded nature of the doubts which may be entertained by those lacking personal experience of reinforced-concrete piles.—Yours, etc.,

W. Noble Twelvetrees.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2266. Beams.—Will some reader kindly inform me how to calculate the strength of cast-iron beams? For instance, assuming C 1 to be five times stronger in compression than in tension, are calculations based upon a neutral axis in the position shown in

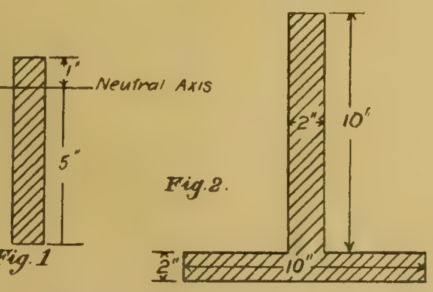

Fig. 1 *Fig. 2.*

fig. 1? Also if the neutral axis varies with the material used how can I calculate the neutral axis of the section shown in fig. 2, and alternatively with the section the other way up?—IGNORAMUS.

Answer.—"Ignoramus" has unfortunately, though perhaps not unnaturally, acquired quite a false impression of the significance of the "neutral axis" of a beam. This axis is a geometrical constant of each section, and is hence independent of the material used. The neutral axis is in all cases the axis of zero stress, and, except in compound beams (*e.g.*, "flitched" wooden beams, reinforced concrete beams, etc.), passes through the centre of gravity of the section. It is not necessary to trouble about the position of the neutral axis so long as a list of the moments of inertia, or, better, the bending modulii, of various sections is available. Such a list is given in a convenient and clear form in *The Practical Engineer* Pocket Book. The procedure in a case of beam design is as follows:—

Let M = maximum bending moment to which the beam is subject;

f = skin stress produced by M (for safety this must $= \frac{1}{\text{required factor of safety}} \times$ ultimate tensile or compressive strength of material, the lesser of these strengths being used);

Z = bending modulus of section. This is a geometrical constant of each section and $= \frac{I}{y}$, where I = moment of inertia of section, and y = distance from that surface of beam, in which the stress f is to be determined, to the centre of gravity of the section. (In symmetrical beams y = half depth of beam.)

Then

$$M = f Z \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

whence either (*a*) the stress f produced by a given bending moment in a beam of known Z can be determined; or (*b*) the permissible bending moment for a given f may be estimated; or (*c*) the beam required to carry a given bending moment without exceeding a given stress may be designed by determining Z, and thence, having settled upon the form of the section, isolating the various dimensions of the latter. Note that a beam of given bending modulus Z has the same skin stress f when submitted to a given bending moment M, whatever the material employed; whether this stress is permissible or not does depend on the material. A particular example for each of the beam sections illustrated will serve to make the above clearer in the shortest space.

Case 1 (fig. 1), as in query: Suppose such a plain rectangular beam, 1 in. by 6 in., to rest freely on supports 16 ft. apart, and with its deep edge vertical. A central load of ½ ton being applied, find the maximum skin stress and the factor of safety (ultimate tensile strength of cast iron being 7 tons per square inch). The beam is symmetrical, hence neutral axis is horizontally through its centre. Also

$$\text{B.M.}_{\text{max.}} = \text{reaction support} \times \tfrac{1}{2}\text{ span}$$
$$= \tfrac{1}{4}\text{ ton} \times 8\text{ ft.}$$
$$= 560 \times 96\text{ inch-pounds};$$

and

$$Z = \frac{I}{y} = \frac{b\,h^3 \times 2}{12 \times h} = \frac{b\,h^2}{6} \quad \text{(see \textit{Practical Engineer} Pocket book)}$$
$$= \frac{1 \times (6)^2}{6} = 6;$$

$$\therefore\ f\left(= \frac{M}{Z}\right) = \frac{560 \times 96}{6} = 8955\text{ lbs. per square inch,}$$

$$\text{and factor safety} = \frac{7 \times 2240}{8955} = 1{\cdot}75,$$

which is not great enough for practice; hence a shorter span, larger beam, better shape of beam, or smaller load would be required.

Case 2 (fig. 2): Considering the ⊥ beam used in the position shown, and supported and loaded as above—

$$\text{B M} = (560 \times 96)\text{ inch-pounds.}$$

But Z is clearly different for the top and bottom layers, for the neutral axis is no longer central. Let y', y'' = distances from top and bottom surfaces to neutral axis; then

$$y' = \frac{d}{2} + \frac{\frac{1}{2}\,B\,D\,t}{B\,T + d\,t} = 5 + \frac{120}{40} = 8\text{ in.};$$

and

$$y'' = D - y' = 12 - 8 - 4\text{ in.};$$

and

$$I = \frac{B\,(x^3 - Z^3) + t\,(y^3 + Z^3)}{3}$$
$$= \frac{(10 \times 56) + (1040)}{3} = \frac{1600}{3};$$

whence

$$Z_1 = \frac{1600/3}{8} = \frac{200}{3} : Z'' = \frac{1600/3}{4} = \frac{400}{3};$$

$$\therefore\ f_1 = \frac{560 \times 96 \times 3}{200} = 808 : f_{11} = \frac{560 \times 96 \times 3}{400} = 404$$

(pounds per square inch in cach case); f_1 is a compressive and f_{11} a tensile stress. Taking ultimate compressive and tensile strengths of cast iron as 45 and 7 tons per square inch respectively, the factor of safety in compression

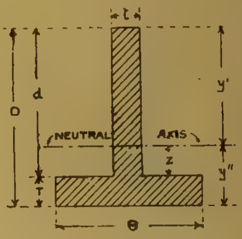

FIG. 2.

t = T = 2 in.
B = d = 10 in.
FIG. 1 as in query.

$$= \frac{45 \times 2240}{808} = 125,$$

in tension

$$= \frac{7 \times 2240}{404} = 38{\cdot}7,$$

and since the factor of safety of the whole is that of its weakest part, the nett factor of safety of the above ⊥ beam is about 38½ under stated conditions, and the beam will ultimately fail on its tension edge.—L. C.

[Other replies have been received from "Teacher," "Beam," W. S., W. W., C. H. S. H., C. I. D., W. G. D., and G. E. H.]

2268. Dimensions of Engine.—Should esteem it a great favour if any reader could give me suitable dimensions for inlet, transfer, and exhaust ports for two-stroke engine 2¾ in. bore by 3 in. stroke, also compression ratios in cylinder and cylinder case. Do you know of any simple method of ascertaining these dimensions?—A. P. S.

MISCELLANEA.

MANCHESTER ENGINEERING EXHIBITION.—A meeting of the general committee of the Manchester Engineering Exhibition, held at the Midland Hotel, Manchester, was attended by the representatives of 40 of the prominent machinery firms in this country. Details of the opening ceremony on October 14th were completed.

INSTITUTION OF GAS ENGINEERS.—Arrangements have now been completed for the establishment of a professorship of coal gas and fuel industries at the University of Leeds as a memorial to the late Sir George Livesey, upwards of £10,500 having been subscribed to the fund initiated for the purpose by the Institution of Gas Engineers.

OIL ENGINES FOR FISHING VESSELS.—The Swedish fishing vessel Bolinders VII., fitted with a patent oil engine, made some exhibition cruises at Granton recently. The vessel is touring the coast of the British Isles to demonstrate the utility of the engine. The engine is the patent of Messrs. Bolinders and Co. Ltd., Stockholm. The Bolinders VII. is 60 ft. long, 19 ft. beam, and 9 ft. deep, fitted with an 80 B.H.P. direct reversible engine. She has a speed of nine knots.

ROSYTH NAVAL BASE.—Messrs. Easton Gibb and Son Ltd., the contractors for Rosyth Naval Base, are taking every available step at their disposal in order to overcome the delay caused by the fire in the electric power house. They have one of their 250 H.P. engines in working order, and it is not only providing light for the works, but it enables the firm to keep the stone-crushing and concrete-mixing plant in partial operation. The shortage in the turnout of the concrete plant is delaying progress at the monolittis, and it has also retarded the operations in connection with the laying of the foundations of the walls of the submarine basin. In view of the delay following upon the fire, the contractors have approached the Admiralty with the object of being permitted to keep the work going on Sunday. As the result of the present delay, a considerable number of men have had to be suspended. An explosive store has been built for convenience in the centre of the submarine basin, where has also been fitted up during the week electric plant for the driving of the rock, channelling, and other machinery.

PATENTEES' CHRONICLE

OF

Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

JULY 4th, 1910.

15909 Door mat case. Campbell.
15910 Gas burner. Eshelby.
15911 Coal dust burning. Jevons.
15912 Tobacco cartridges. Crossley.
15913 Lawn cultivation. Hill.
15914 Lace manf. Woolley.
15915 Lace manf. Birkin.
15916 Ball castors. Mitchell.
15917 Ball castors. Mitchell.
15918 Aerial machines. Lawton.
15919 Motor car alarm. Stokes.
15920 Relating to travelling carriages. Gattie.
15921 Coin-freed mechanism. Evans.
15922 Radiator centre, etc. Cinderey.
15923 Reducing valves. Graham.
15924 Starting gear for motors. Fuller.
15925 Coal mines. Bailey.
15926 Colour production. Grime.
15927 Change speed mechanism. Saner.
15928 Cycle wheels. Martin.
15929 *Arc lamps. Nasmith.
15930 Springing of motor cycles. Alltree.
15931 *Cigarette paper manf. Verrie.
15932 *Bottle stopper. Hays.
15933 *Electric lamp. Russell.
15934 Fire, etc., alarm. Lassen.
15935 *Note blocks. Ham.
15936 Pneumatic tools. Schofield.
15937 Golf clubs. Payne.
15938 *Rotary transformer. Hoskins.
15939 *Comb manf. Wagner.
15940 *Emptying superphosphate chambers. Marks.
15941 Spring mattresses. Stoddard.
15942 Skirt supports, etc. Humphrey.
15943 Railway chair wedges. Kirke.
15944 Advertising device. Donlevy.
15945 Furniture legs, etc. Round.
15946 Envelope manf. Jackson.
15947 *Gloves. Chaddock.
15948 Cinematograph theatres, etc. Huher.
15949 Game. Hall.
15950 Valves. Hughes.
15951 Edge-setting, etc., machines. Spriggs.
15952 Beds, etc. Thomson.
15953 Coffee-caking, etc. Ernest.
15954 Internal-combustion engine. Lee.
15955 Carburetters. Lee.
15956 *Mail delivery appliance. Hill.
15957 Sliding doors. Willis.
15958 Stencils. Gibson.
15959 Treating lemon juice. Fernback.
15960 *Water meter valves. Siemens.
15961 Vehicle spring suspension. Harris.
15962 *Iron, etc., floors. Box.
15963 *Knitting machine. Grosser.
15964 *Warp tying apparatus. Colman.
15965 Pulley blocks, etc. Tabulo.
15966 *Wheels, etc. Overman.
15967 Roller blinds. Harrison.
15968 Sparking plugs. Light.
15969 Talking machines. Fischer.
15970 *Gas, etc., purifying.
15971 Propeller. Prestwick.
15972 *Heating, etc., apparatus. Lange.
15973 Ammonia manf. Johnson.
15974 Weed killing device. White.
15975 Liquid soap. Leathers.
15976 *Torpedo launching tubes. Schneider.
15977 Arc lamps. Lewis.
15978 Variable speed gear. Hills.
15979 Pencil holders. Jackson.
15980 Internal-combustion engines. Apjohn.
15981 *Safety hooks. Lange.
15982 Spinning machines. Mills.
15983 *Vacuum cleaner. Cochran.
15984 *Steel, etc., hardening. Dabritz.
15985 Sluice valve. Wilson.

JULY 5th, 1910.

15986 Cycle chain wheel. Hepworth.
15987 Farmers' tools. Bebbington.
15988 Electric cut-out. Railing.
15989 Cotton yarn manf. Dixon.
15990 Ironing board. Grant.
15991 *Cuprammonium solutions. Bernstein.
15992 Winding machines. Logan.
15993 Electro-motor control. Greenhalgh.
15994 Wheel hubs. Dixon.
15995 Window silencer. Lane.
15996 Insulated cable suspender. Thomson.
15997 Dust traps. Blakey.
15998 Driving belts. Mallett.
15999 *Gas separating. Hildebrandt.
16000 Cardboard boxes. Hulton.
16001 Tin labels. Davy.
16002 Lamp bracket. Main.
16003 Talking machines, etc. Vores.
16004 Parcel securing device. Greedie.
16005 Door, etc., fastening. Edmunds.
16006 Message transmission. Piercy.
16007 Ashtrays, etc. Piercy.
16008 Pile drivers, etc. Towse.
16009 Side tipping wagon. Hood.
16010 Bedstead, etc., manf. Hoadly.
16011 Motor car attachment. Allix.
16012 Toy. Harris.
16013 Carding engines. Shaw.
16014 Internal-combustion engine. Dunlop.
16015 Stone cleaning. Baxter.
16016 Spinning mules. Whitehead.
16017 Electric car, etc., controller handles. Shaw.
16018 Internal-combustion motor. Hallett.
16019 Telephone exchange system. Redfern.
16020 Spring tyre. Baier.
16021 Electric transmission of half-tones, etc. Palmer.
16022 Rotary engine. Veulle.
16023 Fluid transmission gearing. Veulle.
16024 Variable speed gear. Veulle.
16025 Motor cars. Maggiora.
16026 *Nut locks. Wedgworth.
16027 *Buttons. Winston.
16028 *Liquid concrete manf. Harms.
16029 *Artificial ice manf. Berryman.
16030 Collar stud, etc. McCommon.
16031 Ball bearing manf. Kemp.
16032 Joint holding device. Offlow.
16033 *Goods displaying device. Sloan.
16034 *Talking machines. Johnson.
16035 *Talking machines. English.
16036 *Talking machines. Johnson.
16037 *Wheels.
16038 Saucepan, etc. Hopwell.
16039 *Car wheels. Slick.
16040 *Steam turbine. Peters.
16041 Travelling trunks. Jonas.
16042 *Hydraulic power transmission. Lake.
16043 *Electrical device. Jones.
16044 *Corsets. Jenyns.
16045 *Advertising device. Lake.
16046 *Tyres. Vandervoort.
16047 Gas, etc., lamps. Hummel.
16048 *Compound. Wolff.
16049 *Motorist's, etc., goggles. Doyen.
16050 Planting machines. Patric.
16051 *Adding machines. Gates.
16052 *Toothed wheel gearing. Ritter.
16053 *Looms. Hallensleben.
16054 Radiators. Hall.
16055 Relating to windows. Welnhofer.
16056 *Pavement blocking. Blome.
16057 *Tapping apparatus. Spencer.
16058 Electric lamp holder. Steljes.
16059 *Balloon housing. Boult.
16060 Shop window supports. Sangweil.
16061 *Collars. Matheson.
16062 Self-lubricating bearing. Czeten.
16063 Secondary batteries. Apostoloff.
16064 Glass drawing. Pilkington.
16065 Tricycle stands. Dyson.
16066 Puzzle frames. Cole.
16067 Electrolysis. Arledter.
16068 *Gas lamp. Still.
16069 *Music playing device. Popper.
16070 *Moulds. Clark.
16071 Portmanteaux. King.
16072 Internal-combustion engine. Hopkinson.
16073 *Screw head manf. Weber.
16074 *Link chains. Fairweather.
16075 *Tunnelling rock, etc. Granger.

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16076 Railway carriage door. Rowley.
16077 Cycle forks. Sharp.
16078 Landing net. Warburton.
16079 Puncture mending in tyres. Adey.
16080 Water heaters. Low.
16081 Match holding device. Hoskins.
16082 Casks, etc. Plant.
16083 Firebars. Brown.
16084 Puncture finder. Simpson.
16085 Watering cans. Hill.
16086 Tobacco pipe filler. White.
16087 Knife cleaner, etc. Wild.
16088 Tripe bleaching, etc. Beak.
16089 Bottle case. Self.
16090 Internal-combustion motor. Scott.
16091 Boot, etc., manf. Robinson.
16092 Housing device. Straker.
16093 Internal-explosion engines. Hall.
16094 Musical instruments. Jones.
16095 Gas stoves. Riley.
16096 Brick manf. Mason.
16097 Shaving brushes. Brough.

16098 Wringing machines. Turnage.
16099 Sheep dipping apparatus. Watson.
16100 Alarm. Jane.
16101 Boring bars. Ashforth.
16102 Bags. Dunn.
16103 Cinematograph, etc., screens. Fairlie.
16104 Cinematographs apparatus. Fairlie.
16105 Window fittings. Penney.
16106 *Clutch mechanisms. West.
16107 Wheels. Reddaway.
16108 Ticket, etc., handling device. Reynolds.
16109 Worm grinding. Liebert.
16110 French staying device. Wild.
16111 Mats. Davis.
16112 Polishing wheels. Taylor.
16113 Electric switch. Wilkes.
16114 Match box. Oberhoffer.
16115 *Orange cutting. Allsopp.
16116 Sewing machine. Whittaker.
16117 Door construction. Wheeler.
16118 Lawn cutting device. Selley.
16119 Reels. Corrigan.
16120 Saline injecting device. Jones.
16121 Tyres. Dawson.
16122 Mine cages. Neville.
16123 Maps, etc. Moore.
16124 Cycle saddles. Brooks.
16125 Cycle saddles. Brooks.
16126 Bread manf. Cockburn.
16127 Artificial stone line post. Mackie.
16128 Road wagons. Ganly.
16129 Driving ropes. Shufflebottom.
16130 *Aeroplanes. Wildeblood.
16131 Saucepans, etc. Zlotnick.
16132 Carburetter. Lee.
16133 *Motor car brake, etc. Walbrunn.
16134 *Vapour engine. Hildebrand.
16135 Looms. Lusty.
16136 Pipe wrench. Perrott.
16137 *Cycle frames. Terrot.
16138 Propellers. Spazierer.
16139 *Detachable rims. Truelle.
16140 *Wheels. Truelle.
16141 *Removal of refuse. Dassy.
16142 Game scoring device. Stoney.
16143 Corsets. Reynolds.
16144 Number, etc., determining device. Hugill.
16145 Bottle washing. Parry.
16146 *Drinks. Barron.
16147 Retinoscopes. Clay.
16148 *Filling apparatus. Hick.
16149 *Filling apparatus. Hick.
16150 *Hinging machine. Edge.
16151 Carboxylic acid manf. Bloxam.
16152 *Electrical switch. Thomas.
16153 *Petrol motor. Luypaerts.
16154 *Boot, etc., manf. Johnson.
16155 Printing mechanism. Davis.
16156 *Filtering apparatus. Robacher.
16157 Railway points. Irvin.
16158 Rifle practice. Reid.
16159 Watches. Round.
16160 *Submarines. Sea Salvage Co.
16161 *Filtering apparatus. Robacher.
16162 Fish drying. Phillips.
16163 *Measuring garments. Rubin.
16164 Printing press. Walker.
16165 Spring mattress. Zobel.
16166 *Houses, etc. Harms.
16167 *Flame giving device. Buck.
16168 Disinfectant vessels. Racton.
16169 *Crystalline aluminium formiate. Jones.
16170 Wheels. Powell.
16171 *Diamond polishing. Poppe.
16172 *Electrical apparatus. Reeve.
16173 *Heating device. Schneider.
16174 Sash fastener. Leatherland.
16175 *Life saving device. Franz.
16176 *Talking machine discs. Martime.
16177 Alloy. Duke.
16178 Securing plaits of hair. Brenner.
16179 Button cleaner. Wilson.
16180 *Trussing machine. Sharrock.
16181 Eyesight testing. Black.
16182 *Air cushions, etc. Pebal.
16183 Tennis shoes. Adamson.
16184 *Ships, etc. Keissler.
16185 Hat stiffening device. Cooper.
16186 Boot manf. Bates.
16187 Reinforced concrete. Bourdrey.
16188 Reinforced concrete. Bourdrey.
16189 Belt fastenings. Hutchinson.
16190 Stain remover. Friedl.
16191 Spring tyres. Newbold.
16192 Cycle. Lynch
16193 *Sulphate of ammonia manf. Collin.
16194 Baths. Palmer.
16195 *Hair brushes. Corney.
16196 *Moulds. Robie.
16197 Fuel manf. Grimshaw.

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16198 Detachable rim edge. Evans.
16199 Lasting jack. Perkins.
16200 Grain, etc., drying. Stewart.
16201 Rainproof overlet. Chapman.
16202 Windscreen joint. Binns.
16203 Ladies' waist belts. Jennings.
16204 Paper tubes for yarn. Stell.
16205 Valves. Thompson.
16206 Dyeing, etc., device. Goetze.
16207 Swing. Gray.
16208 Potato diggers. Smith.
16209 Circular sieves. Hartley.
16210 Potato digger. Balchin.
16211 Electrical device. Taylor.
16212 Variable speed gear. Browne.
16213 Hockey sticks. Gough.
16214 Wooden hoop. Dukes.
16215 Measuring instrument. Lyall.
16216 Cycle wheels, etc. Turner.
16217 Bearings. James.
16218 Doors, etc. Davis.
16219 Electrical device. Gray.
16220 Pneumatic tyres. Smith.
16221 *Suspenders for garments. Colson.
16222 Valve. Wynne.
16223 Lock nuts. Jones.
16224 Door closing device. Jones.
16225 Match box. Murry.
16226 Curtain rings. Allan.
16227 Steam boilers. Smith.
16228 *Filter bed tiles. Stiff.
16229 Valve gear. Scott.
16230 Cycle lamps. Darby.
16231 Golf practice. Todd.
16232 Oil raising device. Coombs.
16233 Tumblers, etc. Kitson.
16234 Oil stoves. St. Amont
16235 Metal shelving. Slater.
16236 Calculating machines. Yahn.
16237 Furnace doors. Leask.
16238 *Milk churns. Abbott.
16239 Rotary cutting tool. Pugh.
16240 Boxes. Bowling.
16241 *Linen buttons. Lock.
16242 Spraying nozzles. Bingham.
16243 *Ball bearing pulley. Henry.
16244 Sliding window, etc. Lambert.
16245 Violin, etc., bridges. Jones.
16246 Veil tidy., etc. Walker.
16247 Corset. Temple.
16248 Lamp. Guimard.
16249 Sterilisation of liquids. Daguerre.
16250 Tyres. Sikkemu.
16251 *Treatment of leaves. Marshall.
16252 *Steam superheater. King.
16253 *Printing telegraph. Cerebotani.
16254 Travelling cases. Willmott.
16255 Winding machines. Fairbrother.
16256 Insulating electric cables. Lake.
16257 Electric switches. Merz.
16258 *Electric fuses. Kallmann.
16259 Insulating electric cable. Lake.
16260 Insulating compound. Lake.
16261 *Calculating machine. Cordt.
16262 *Cycle lock. Horster.
16263 *Street sweeper. Weller.
16264 *Road manf. Kelly.
16265 Nut lock. Clark.
16266 Toilet dishes. Price.
16267 Window sashes. Trevett.
16268 *Bricks, etc. Knapen.
16269 Copying press. Gorczynsky.
16270 *Folding sheets. Bergmann.
16271 Benzanthrone compounds. Johnson.
16272 Derivatives of the anthroquinone series. Ullmann.
16273 *Colour photography screen. Ruth.
16274 *Steam engine. Bloxam.
16275 *Acid manf.
16276 Aerial machine. Dunne.
16277 Valve. Rice.
16278 Moulding tablets. Khit.
16279 *Sorting mechanism. Drummers.
16280 *Gramophone. Puppel.
16281 Amusement. Rhodes.
16282 *Yarn winding device. Sohn.
16283 *Syphon heads. Smith.
16284 *Steam engine valve. Hochwald.
16285 Necktie frame. Roskilly.
16286 Rubber manf. Wassner.
16287 *Separating device. Clément.
16288 *Cabinets, etc. Faulkner.
16289 *Cigar, etc., holder. Fowler.
16290 Collapsible boxes. Dessau.
16291 Boots, etc. Dessau.
16292 Reciprocating engine. Plowman.

JULY 8th, 1909.

16293 Traffic controlling device. Smith.
16294 Traffic controlling device. Smith.
16295 Rat trap. Gingell.
16296 Cycle fittings. Yoxall.
16297 *Roller lever brake. Brampton.
16298 Violin bridge. Murray.
16299 Internal-combustion engine. Baird.
16300 Carding engine. Cook.
16301 Tyres. Barker.
16302 Rabbit catching device. Chappell.
16303 Wind screen. Tye.
16304 Wood screw. Garner.
16305 Toy building bricks. Bedington.
16306 Railway signals. Clarke.
16307 Kettle, etc. Spiby.
16308 Chair fitting. Limpson.
16309 Lifts, etc. Carey.
16310 Golf ball traps. Millar.
16311 Lavatory tap fittings. Moven.
16312 Air heating device. Sellars.
16313 Window frames. Ashworth.
16314 Vacuum casting machine. Wright.
16315 Spectacle lenses. Boatman.
16316 Steel rails. Bland.
16317 Friction clutch. Cooper.
16318 Gas lamp. Smith.
16319 Wads. Bathgate.
16320 *Knitting machine. Grieve.
16321 Tyres. Brown.
16322 *Signs. Pugh.
16323 Fastening device. Bass.
15324 Tyres. Halford.
16325 Sand mould preparing device. Longley.
16326 Trousers stretchers. Elliott.
16327 Motor car brake. Gazgard.
16328 Hair trainers. Riggs.
16329 *Electric signalling device. France.
16330 *Electric signalling device. Goldstein.
16331 *Electric signalling device. Goldstein.
16332 *Electric signalling device. Goldstein.
16333 *Electric signalling device. Goldstein.
16334 *Electric signalling device. Goldstein.
16335 Advertising device. Ailion.
16336 *Electric signalling system. Goldstein.
16337 Electric insulator. Brady.
16338 Road vehicles. Hopper.
16339 *Shaft coupling. Honold.
16340 *Shaft coupling. Honold.
16341 *Spraying apparatus. Doyen.
16342 *Electric meter. Siemens.
16343 Lifting apparatus. Morris.
16344 *Toast rack. Hanbury.
16345 *Switch throwing mechanism. Shemwell.
16346 Marine propulsion. Parsons.

16347 Turbine. Higgs.
16348 *Clothes hanger. Doherr.
16349 Gas burners. Ruppert.
16350 Cooking articles. Donkin.
16351 *Gullies. Plesch.
16352 Gas supply regulator. Atkinson.
16353 *Substitutes for leather, etc. Lapisse.
16354 *Wireless telegraphy, etc.. Eisenstein.
16355 Cinematographs. Williams.
16356 *Wireless telegraphy. Eisenstein.
16357 *Box folding. Filmer.
16358 Self-acting mules. Schmidt.
16359 Meat, etc., safe. Sayer.
16360 *Electrical signalling. Cerebotani.
16361 *Engine governor. Holm.
16362 Golfball manf. Pape.
16363 Levels. Russell.
16364 *Wireless telegraphy, etc. Eisenstein.
16365 Stud fastenings. Salcher.
16366 Gun barrel drilling. Merrich.
16367 *Magnets. Dorian.
16368 *Manf. of nitrides. Anilin.
16369 Ropes, etc. Arthur.
16370 Wheels. Ford.
16371 *Sparking gaps. Eisenstein.
16372 Gramophone sound box. Catchpool.
16373 Skirt holder. Pretty.
16374 Pile driving, etc., devices. Piercy.
16375 *Rope manf. Finlay.
16376 Gramophones. Holland.
16377 Fire extinguisher. Kronenberg.
16378 Printing machine. Hayes.
16379 Trunk locks, etc. Chatham.
16380 Curtain hanging, etc. Hircock.
16381 *Buoys. Downing.
16382 *Eyesight testing. Black.
16383 *Steam engine. Stumff.

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16384 Tobacco for smoking. Sutcliffe.
16385 Wind engine Ironmonger.
16386 Tobacco cartridges. Aronowitz.
16387 Tobacco case, etc. Macdonald.
16388 Brakes for velocipedes. Wilton.
16389 Printing device. Bentz.
16390 Gas mantle. Harsant.
16391 Sauce. Preston.
16392 Thermometer. Long.
16393 Lathes. MacDonald.
16394 Tyres. Law.
16395 Couplings. Samuel.
16396 *Rail joint. Adams.
16397 Eye bolts, etc. Gould.
16398 Rotating platforms, etc. Brookes.
16399 Starching machines. Lowe.
16400 Loom dobbies. Nelson.
16401 Winding frames. Maxfield.
16402 Advertising means. Klaber.
16403 Drying stoves, etc. Hunt.
16404 Electric cut-outs. Hill.
16405 Flying machines, etc. Sutherland.
16406 Raising, etc., ships. Pett.
16407 Rubber extracting device. Bridge.
16408 Moulds. Stubbs.
16409 *Table ware. Robinson.
16410 Indicator for vehicles. Crowley.
16411 *Braiding machine. Thun.
16412 Swing rings for mantles. Brown.
16413 *Cotton, etc., baling, etc. Rickie.
16414 Expansion joint. Kewney.
16415 Vermin poison. Perke.
16416 Engine governor. Sharples.
16417 Switchback railways. Crawshaw.
16418 Weaving device. Murphy.
16419 Wireless telephone installation. Kramer.
16420 Neckties, etc. Carter.
16421 Photo plate manf. Herzka.
16422 Baker's peels. Brown.
16423 Game. Russell.
16424 Dynamo. Milch.
16425 Revolvers, etc. Marshall.
16426 Stamp affixing device. Everett.
16427 Loose sheet binders. Pink.
16428 Lamps. Cole.
16429 Fenders, etc. Lycett.
16430 Cargo transferring device. Willis.
16431 *Clothes driers. Monk.
16432 *Floor, etc., construction.
16433 Piano damper coupling action. Elliston.
16434 Knife cleaner. Rawlinson.
16435 Carding engines. Smethurst.
16436 *Typewriters. Winklhofer.
16437 Artificial leather manf. Campbell.
16438 Artificial rubber manf. Campbell.
16439 Ribbon manf. Schmidt.
16440 Dye manf. Ullmann.
16441 *Glass manf. Bloxam.
16442 *Valves. Stumff.
16443 Ore cleaning, etc. Harris.
16444 Telegraphy. Heurtley.
16445 Kettles. Banks.
16446 Internal-combustion engine. Heinke.
16447 *Flexible, etc., pipes. Lemare.
16448 *Breast pumps. Bamforth.
16449 Gates. Missing.
16450 Displaying stands. Miller.
16451 Electric glow lamps Goimm.
16452 *Embroidery machines. Rikli.
16453 Measuring propeller thrust. Page.
16454 Manf. of ammonium nitrates, etc. Freeth.
16455 Manf. of ammonium nitrates, etc. Freeth.
16456 *Vulcanised undiarubber. Leemans.
16457 *Sparking plug. Schneider.
16358 Wind engine. Ironmonger.
16459 *Cooling firearms. Adam.
16460 *Concrete floors, etc. Wright.
16461 *Heaters. Norris.
16462 *Plaster treating. Chamberlain.
16463 *Flying machines. Kamarin.
16464 *Flying machines. Kamarin.
16465 Tube mills. Mann.
16466 Filters. North.
16467 Advertising device. Pearse.
16468 Turbine. Boyd.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to August 15th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1908.

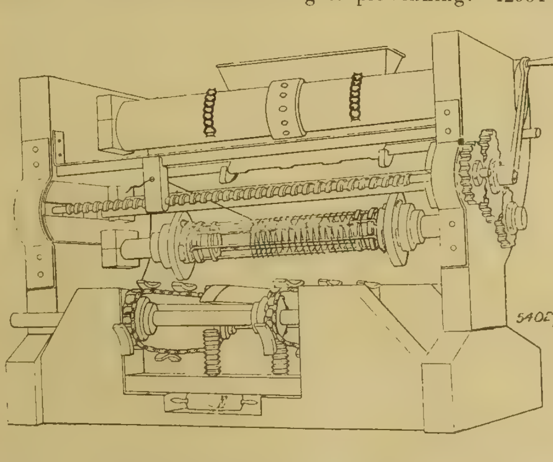
25344 Moore: Manf. of packets or cartons for containing granular or pulverulent materials and for other purposes. [Post-dated June 26th, 1909.] 27519 Winstanley and Hunt: Punching and stamping machines. [Post-dated June 14th, 1909.]

1909.

5247 Smith, Bell, and Rowland: Sewing machines. 5387 Felt: Calculating machines. 5399 Revaillot: Nozzles or sprinkler jets for spraying and pulverising liquids. [Date applied for under International Convention, March 6th, 1908.] 5400 Revaillot: Joints or connections for pipes of metal, reinforced concrete, and the like. [Date applied for under International Convention, March 6th, 1908.] 5401 Revaillot: Connection for indiarubber and like tubes or pipes. [Date applied for under International Convention, March 6th, 1908.]

5402 Revaillot: Machines for manufacturing pipes of reinforced concrete and the like. [Date applied for under International Convention, March 6th, 1908.]

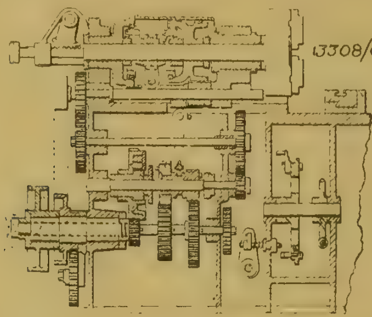
This invention relates to improvements in machines for the manufacture of pipes of reinforced concrete in which the pipe is moulded about a horizontal rotatable core. The pipes are formed with connecting sockets of cast iron or other appropriate metal at their ends. Pipes which have to withstand high pressures are provided internally with a thin sheet core or lining of appropriate metal fitted into the sockets in a circular groove formed for this purpose. The machine comprises a hopper and cement-mixing device, a horizontally disposed mandrel with adjustable face plates upon and between which the skeleton or metallic reinforcement is arranged, a metallic screen adapted upon the rotation of the mandrel to form a mould for the pipe in conjunction with the core or the metallic lining of the pipe, and a conveyer adapted to enable the finished pipes to be readily removed from the machine.



5620 Macpherson and Heys: Detersive and emulsive agent and the manf. thereof. 8270 Niblett: Means for producing a disinfecting and deodorising compound which is applicable also for bleaching purposes. [Cognate Application. 10911, 1909.] 10484 Schniewind: Coke ovens. 10713 Callow and Callow: Moulding or like treatment of dough. [Cognate Application. 28396, 1909.] 10750 Hurley: Wheels and resilient tyres for road and other vehicles. 10811 Reynolds and Ure: Hopper-fed stoves and the like. 10911. *See* 8270, 1909. 11012 Beck: Rotary engines. [Post-dated December 9th, 1909.] 12989 Walker: Guards for use in mining or pit sinking. 12991 Conti and Galli: Apparatus for the automatic operation of valves for gas lamps. 13064 Craig: Gramophone records and holders for the same. 13073 Dellwik: Method of and apparatus for agglomerating fine ores, metalliferous residues, and the like. 13080 Evershed and Vignoles Ltd., and Evershed: Electric energy meters. 13081 Halvorsen and Johansen: Extraction of iron and iron alloys. 13122 Brown: Guides for pit cages. 13183 Lodge: Manf. of cements from slag and apparatus therefor. 13192 Fenton: Manf. of woven driving belts or straps. 13214 Fulton: Road wheels for motor and other vehicles. 13228 Bastian: Incandescence electric lamps. 13237 Johns, and Johnson and Phillips Ltd.: Electric signalling or indicating apparatus of the resonance type. 13265 Francis: Stage arc lamp. 13276 Naylor and Naylor: Dyeing machine. 13278 Crowther and Jones: Drilling machines. 13280 Barr: Apparatus for making ice. [Cognate Application. 26636, 1909.] 13301 Akron Automatic Hot Water Co., and Meeker: Valve devices for use in conjunction with heaters. 13302 Hartford and Traill-Smith: Parallel rulers.

13308 Potter: Automatic turret lathes.

The object is to provide improved means for causing the chuck-carrying or head stock spindle to be driven at varying speeds according to the nature of the work in hand. Now according to this invention in an automatic turret lathe having a chuck-carrying spindle adapted to be driven at different speeds by any one of three sets of gears there are provided two intermediate gear wheels which revolve independently of each other, but are connected so as to be able to slide together axially to effect two changes of speed, and a third intermediate gear wheel which through an automatic clutch effects a third change of speed when the other two gears are inoperative.



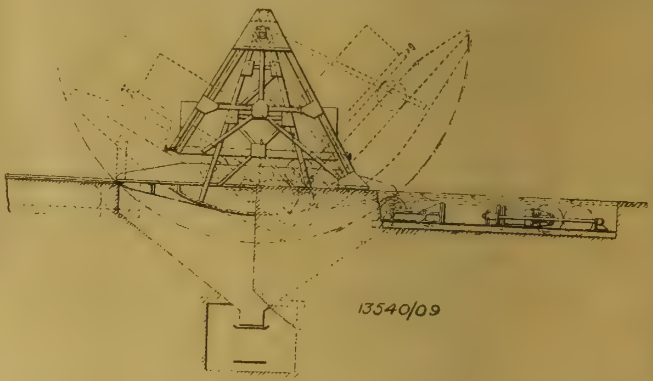
13308/09

13330 Ackermann: Manf. of mixtures adapted for use as a soldering flux or for other purposes. 13331 Lesmuller: Flash-light powders. 13350 Blake: Apparatus controllable from a distance for automatically turning on and off the lights of gas burners. 13351 Milne: Machines for imparting a linen-like finish to the surfaces of paper. 13368 Witzenmann: Hose-spiral winding machine. 13385 Schroeder: Screw-threading tools. [Post-dated December 3rd, 1909.] 13391 Clarke: Incandescent electric lamps of the "Nernst" type. 13394 McLean: Level. 13405 Richardson: Windlasses. 13418 Dunne: Controlling devices for aeroplanes and the like. 13419 Jones and Kynoch Ltd.: Automatic guns. 13440 Pawle: Vacuum filters. 13502 Adams: Closing and checking appliances for doors and the like. [Application for Patent of Addition to No. 12979, 1908.] 13508 Freckleton: Light-controlling screens for photographic purposes. 13510 Moore: Self-closing doors.

13540 Tuckett: Apparatus for tipping coal wagons and the like.

Relates to apparatus for tipping coal wagons and the like of the type in which the wagon is run on to a short track on a platform or cradle by which it is tipped endwise so that the contents of the wagon are discharged or tipped out through a door at one end of the wagon. The invention consists in a tipping apparatus adapted to tip each wagon in either of two directions according to the position of the end door of the particular wagon to be tipped at any time, whereby time in handling is saved. Further improvements consist in providing the driving mechanism of the tipping gear with means for automatically regulating the power transmitted to suit the load, which varies with the increasing leverage at which the weight of the wagon acts as the latter is tipped.

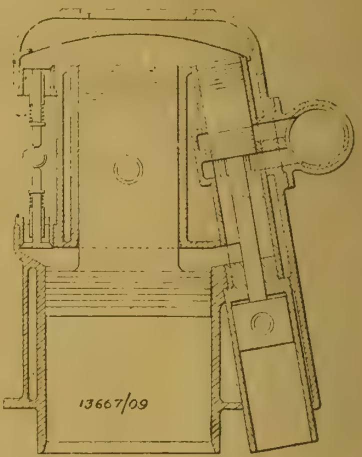
13550 John Musgrave and Sons Ltd., Cruse and Pope: Apparatus wherein exhaust steam is condensed and regeneration of steam is effected in accordance with variations of pressure in the apparatus. 13557 Gayley: Drying by refrigeration the air supply of blast furnaces, converters, and other metallurgical apparatus. 13566 Marks (Ges. fur mechanische Gewinnung Von Steintorf): Rotary press for peat, clay, and the like. 13567 Stevens: Drilling posts or pillars. 13568 Hooper, Bratt, and Knell: Hose-pipe couplings. 13573 Marks (Milton): Electric interrupters for ignition purposes. 13576 Harvey and Bass: Coverings for cables, riding whips, blasting fuse, and the like, in part applicable also as electric conductors. 13579 Nicholson: Locking device for screw nuts. 13585 Hiscox: Machine for thinning turnips and for similar purposes. 13588 Tonks: Book stands or carriers and other like shelf supports. 13641 Boult (Toledo Computing Scale Co.): Pendulum weighing scales. 13647 Abraham, and British Pneumatic Railway Signal Co.: Railway signalling apparatus. 13664 Krassilnikoff: Means for propelling ships, vessels, boats, and the like. 13666 Widmann: Method of making photographic pictures with a grained or half-tone effect.



13540/09

13667 Hewitt, and Hewitt Engines Ltd.: Internal-combustion engines. [Cognate Application. 28851, 1909.]

This invention relates to a method of working tandem cylinder internal-combustion engines and an engine specially suitable for such method, and consists in cutting off the supply of mixture to either cylinder independently or to both cylinders, the cylinders having different effective areas, and simultaneously opening such cylinder or cylinders to the atmosphere, so that three different powers can be obtained, and also consists in a tandem engine controlled by piston valves working in cylinders open at their ends to two engine cylinders, so that one set of ports acts for both inlets and another set for both exhausts.

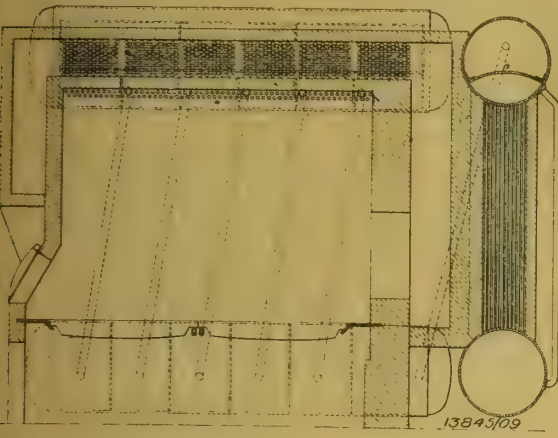


13667/09

13685 Tickell: Construction of tents. 13688 Unmuth: Self-driving machine. 13690 Rangeley and McMyn: Preparing and making up of tea, coffee, cocoa, and the like. 13720 Prat: Mechanical appliances for creating an induced draught with a fan external to the flue. [Date applied for under International Convention, December 31st, 1908.] 13771 Adams-Randall: Telephones. 13799 Smith: Scaffold shackles or cramps and the like. 13824 Casgrain: Presses. [Date applied for under International Convention, June 15th, 1908.] 13827 Bastian: Transformation of electrical energy into heat energy. 13834 Tubbs: Magazine electric arc lamps.

13845 Nicolson: Steam generators.

The object is to construct steam generators for naval and other services of great compactness and such as shall ensure complete combustion of the fuel and the effective utilisation of the heat derived therefrom for obtaining high evaporative capacity and efficiency. The steam generator comprises a furnace, a combustion chamber, and a convective evaporator and economiser, consisting of headers having compartments connected in series by nests of tubes through which the water travels in a circuitous course at high speed between the headers and from end to end of the same, together with enclosing flues through which the hot gases travel, also at high speed, in contact with the exterior of the tubes in a direction counter to that of the water flowing through the tubes.



13855 Gibson, Pegg, and British United Shoe Machinery Co.: Nail-feeding devices for loose-bill nailing machines. 13858 Huntington: Method of and apparatus for founding or casting metals. 13860 Brown: Apparatus for use in administering anæsthetics. 13889 Lawson: Compound fabric for use as sponge cloth. 13902 Skita: Process for manufacturing camphene. 13930 Marks (Columbia Postal Supply Co.): Stamp-cancelling or marking machines for postal and like purposes. 13934 Marks (Print Weave Co.): Photographic copying, enlarging, and reducing apparatus. 13939 Henning and Wetter: Elastic or resilient rollers and cylinders. 13956 Sundheimer: Burglar alarm systems. 13959 Voss: Method of packing eggs or the like. 14011 Circulators Ltd., Ross and Schofield: Circulating arrangements for steam boilers. 14016 Wells, and British Xylonite Co.: Process or method for the preparation of xylonite or celluloid to form the raw material for the manf. of combs and similar articles. 14041 Bonna: Method of making pipe joints. 14043 Todd: Reinforced concrete sleepers. [Cognate Application. 17046, 1909.] 14052 Mehne: Apparatus for opening and closing electric switches and turning on and off gas lights at definite times. 14055 Ayrton: Tent pegs, pickets, and the like. 14158 Punchard: Construction of reinforced concrete poles and posts. 14199 Eves: Machines for stretching, softening, and polishing yarns or threads. 14248 Hadfield: Tramway points. 14266 Elmassian: Process for the preparation of an extract of malt in dry form. 14277 Robson: Magazine pencils and the like. 14313 Newton (Farbenfabriken vorm. Friedrich Bayer and Co.): Manf. and production of a new double compound of zinc hydrosulphite—sodium sulphite. 14325 Markham: Convertible bed chair, couch, or settee. 14339 Isenmann: Locking nut. 14576 Codner: Apparatus for infusing tea, coffee, and the like. 14596 Clayton and Co. (Huddersfield), and Briggs: Application of hoisting mechanism to motor wagons and like vehicles. 14660 Thum: Electrolytic apparatus. 14786 Melvin: Machines for dividing and moulding dough and other plastic substances. 14856 Cochrane: Means for quenching and arresting explosions in mines. 14885 Croasdale: Weft forks for use in looms for weaving. 14965 Arcioni: Apparatus for avoiding the dangers resulting from excess voltages in distributing mains. [Date appled for under Internatonal Convention, June 27th, 1908.] 15005 Fraser: Means of controlling the piston valves of steam engines, pumps, and the like. [Post-dated December 16th, 1909.] 15148 Griffiths, Aldred, and Aldred: Haulage clip or grip for ropes and cables. 15150 Wilson: Propulsion of navigable vessels and other bodies. 15220 Freeman: Filters for beer and other liquids applicable for use in casking. 15251 Lodge and Lodge: Sparking plugs. 15353 Fearnsides: Holders for cigars and cigarettes. 15570 Haddan (Oil and Waste Saving Machine Co.): Apparatus for separating and filtering oil and similar material from dirt, water, and other foreign matter. 15796 Rudge: Lockets and the like. 15873 Lake (Matthews Gravity Carrier Co.): Elevators. 15885 Tutzer: Airships. 15981 Lertourne: Method and means of producing synchronism between the rotation of a controlling machine and the rotation of one or more electrically-driven machines. 16030 Roger: Golf balls. 16053 De Bechi and Blythe: Dissolving of impure tin or tin alloys chiefly for obtaining tin or tin compounds. 16183 Robinson: Mechanism for sonorously indicating the lifting of letter slot closures. 16216 McBride: Puncture-proof pneumatic tyre and means for securing same on wheels. 16401 Leslie and Donald: Card table tops. 16442 Hardingham (Trevithick): Steam generators of the locomotive type. 16470 Dawson: Trousers presses. 16632 Brotherhood and Bryant: Means for testing gauges and the like. 16657 Chameroy: Automatic belt-tensioning mechanism. 16680 Barker: Variable-speed belt gearing. 16776 Greener: Rifle sights. 16811 Siemens Bros. Dynamo Works and Kieffer: Alternating-current electric induction motors. 16834 Soc. Anon. Raffinerie Moderne Procede Natta: Crystallisation of sugar from concentrated juices. [Date applied for under International Convention, July 22nd, 1908.] 16835 Saul, Blyth, and Lepard: Bicycle carriers for fragile goods. 16871 May: Gas purifiers. 16984 Doccetti: Apparatus for projecting cinematograph pictures by solar light. 17022 Geisler: Loose-leaf note books and the like. 17046. *See* 14043, 1909. 17101 Hirst and Coates: Insulating device for electric lamp holders. 17178 Greenslade: Backing for opal plain and coloured glass tiles and the like. 17189 Midgley and Vandervell: Dynamo electric generating systems. 17318 Owens: Method for the removal of carbonic acid gas from mines or other spaces. 17340 Anderson: Apparatus for mixing or measuring liquid or other substances in definite proportions. 17382 Keller: Carburisation of steel. 17502 Smith and Smith: Fastenings for bracelets, necklets, and the like. [Post-dated February 22nd, 1910.] 17534 Ransomes, Sims, and Jeffries Ltd., and Murdoch: Means for controlling motor lawn mowers. 17730 Pearse: Rolls for gins and like machines. 17859 Pinders: Ball-grinding machines. [Date applied for under International Convention, November 4th, 1908.] 17914 Goldstein and Hampe: Manf. of highly absorbent or porous carbon or carbonaceous material. 18030 Gotthilf, Trumper, and Wilhelm: Device for retaining and fastening neckties. 18065 Muskett: Hose coupling. 18077 Klobukowski: Fireplaces. 18094 Bailey and Jackson: : Working of self-cleansing strainers. [Application for Patent of Addition to No. 5776, 1908.] 18130 Jolly and Willis: Combing machines. 18254 Williams: Cramp for frames, sashes, and the like. 18273 Flower: Bottle labelling machines. 18340 Marks (Natural Colour Moving Picture Co.): Moving picture machines and the films used therewith. 18354 Ropp: Pipes for smoking tobacco. 18397 Crighton, and Klein Engineering Co. (1908): Apparatus for cooling liquids. 18440 Yungel: Card index cases. 18483 Rose and Rose Bros. (Gainsborough) Ltd.: Cams and levers, or arms working in connection therewith. 18540 Buer: Process for obtaining lecithin from the seeds of leguminous plants. 18561 Willsdon and Willsdon: Ratchet spanner. [Application for Patent of Addition to No. 6225, 1909.] 18699 Wolff: Automatic photographic apparatus. 18776 Bond: Lubrication of loose pulleys, sheaves, or blocks and shafts. 18779 Hughes: Anti-vibrators for gas burners. 18807 Ackland: Self-closing valves. 18869 Broadfoot: Ships' telegraph apparatus. 18969 Holmes and Woods: Shuttle checker for weaving looms. [Post-dated September 8th, 1909.] 18980 Hunt: Dust-tight oil bath gear case for cycles. 18999 Jelley: Pneumatic or like tyres. 19016 Smith: Substitute for indiarubber. 19273 Walker: Destination or route indicators for tramcars and other like vehicles. 19321 Hogg and Mitchell, and Hamilton: Device or attachment for use in conjunction with botton-hole sewing machines. 19361 Wilson: Non-slipping devices for pneumatic and other tyres for road vehicles. 19434 Irving: Electrical detectors or contact makers for use with railway switch points and the like. 19440 Allen: Dies for moulding bricks. 19488 Johnson: Belt fastener. 19699 Martens and Schulz: Scaffolding. 19729 Jones and Williams: Pit cages in mines. 19806 Bunting: Couches, bedsteads, and the like. 19807 Kempson and Young: Steering devices for nautical vessels. 20013 Bruckert: Magneto ignition devices for internal-combustion engines. 20028 Rakousky: Car fenders. 20359 Alsenz: Date and time printing stamps. [Date applied for under International Convention, September 8th, 1908.] 20397 Bosworth: Method of and apparatus for making boot and shoe heels. 20445 Abt, Diebl, and Bayer: Treatment of effluents. 20524 Nelson: Bearing springs for motor cars and other vehicles. 20584 British Thomson-Houston Co. (Noeggerath): Dynamo electric machines. 20622 Millington: Range fires, applicable also to fireplaces and furnaces, for various industrial purposes. 20696 Hughes: Dibbers. 20817 Wuest: T-squares and drawing boards. 20828 Yates: Gas-heated radiators. 20847 Davis, and Siebe, Gorman, and Co.: Diving dresses, wading suits and trousers, and the like. 20952 Milne and Alexander: Stop mechanism for prepayment gas meters.

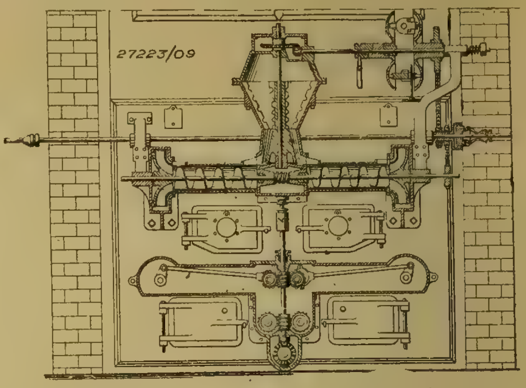
20995 Blattner: Oil-distributing pumps for motors. [Date applied for under International Convention, September 15th, 1908.]

The object is to provide an improved construction of pump whereby the oil is successively forced either in definite equal or unequal quantities through a number of separate exit pipes. To this end both the cylinder and piston plunger are provided with a plurality of circumferential grooves as contra-distinguished from pumps as heretofore constructed wherein the piston alone is provided with a single groove adapted to come successively in juxtaposition with a number of exit orifices. In a pump constructed in accordance with this invention each of the circumferential grooves on the cylinder is in communication with separate exit orifices and the grooves on the piston are all in communication with the interior of the latter. The reciprocating motion of the piston within the cylinder distributing the oil under pressure to the exit orifices when the grooves in the piston correspond for the time being with the grooves in the cylinder.

21049 Dempsey: Combination hand tool, comprising a hammer, nail extractor, pincers, gimlet, and screw driver. 21101 British Thomson-Houston Co. (General Electric Co.): Signal systems for railways and the like. 21171 Wyler, and Instanter Ltd.: Gas heating apparatus. 21227 Collier: Brush bridle. 21366 Still, and W. M. Still and Sons Ltd.: Incandescent gas lamps. 21570 Fetzer: Universal joints. 21635 Cook: Construction of collar for personal wear. 22027 Mauser: Trigger mechanism for automatic firearms. [Date applied for under International Convention, July 21st, 1909.] 22098 Hoffmann Manufacturing Co., and Schmidt: Ball or roller bearings. 22193 Thresh: Apparatus for use in the purification of water. 22302 Heimann and Schaffer: Method of working arc lamps in series with incandescent lamps. [Date applied for under International Convention, October 1st, 1908.] 22486 Cooper: Windows. 22582 Tanfield: Self-propelled road vehicles. 22738 Brightmore: Constructing the surfaces of roadways. 22753 Lowenthal and Bettney: Manf. of chain covers for bicycles. 22758 Ducellier: Apparatus for generating acetylene gas. 22771 Trasler Bros. and Co., and Trasler: Boot and shoe fillers. 22995 Monnin: Spinning machines of the ring and traveller type. 23071 Vaughan: Electrical table fittings. 23109 Boutet: Explosion motors worked by combustible fluids. 23142 Kerr, Kerr, and Kerr: Ships' rudders. 23144 Lewis: Apparatus for igniting miners' and like safety lamps. 23390 Portland Forge Co., and Ramsay: Ships' rudders. [Application for Patent of Addition to No. 4756, 1907.] 23394 Knight (Knight): Combination strap device for parcels and baskets. 23435 Wolf: Welding furnaces heated by gaseous or vaporous fuel. 23451 Sefton-Jones (Aktieselskabet Trykkeriet "Godthaab"): Printing machines. 23506 Newman: Burglar electrical alarm. 23521 Benstead and Aron: Lifting jacks. 23708 Shaw: Boilers for kitchen ranges. 23719 Boult (Acme Automatic Street Indicating Co.): Electric circuit closing devices on electric railways and the like. 23767 Oligny, and Peat Gas and Coal Co.: Peat gas plants. 23832 Paul and Beaudoin: Washing machines. 23836 Tattersall: Apparatus for making flour and meal. [Application for Patent of Addition to No. 12492, 1904.] 23967 Eiane: Flying machines. 24004 Cochran: Weighing scales. 24027 Curtis: Clip for stentering machines. 24199 Dawapurarathna: Reversing gear for steam engines. 24338 Whiteway, and Charles Macintosh and Co.: Pneumatic tyres for motor and other vehicles. 24524 Sackville: Apparatus for regulating the tension of textile fabrics. 24610 De Fontaine: Apparatus for automatically charging gas generators, blast furnaces, and the like. 24709 Johnson (Badische Anilin and Soda Fabrik): Manf. of derivatives of formaldehyde sulphoxylic acid. 24838 Milton: Magneto generators. 24939 Webb: Apparatus for maintaining a constant discharge of liquids or gaseous fluids. 24975 S. Sims and Sons Ltd., and Sims: Candlesticks and sockets for same. 25054 Baker: Nails for trees, shrubs, and other similar purposes. 25109 Mobbs and Lewis Ltd., and Lewis: Stretchers or forms for boot or shoes. 25451 Cantilli: Deep-boring apparatus. 25475 Walsh: Method of and machine for making wire glass. 25647 Triumph Cycle Co., and Hathaway: Gear wheels, and the means for securing same and removing them from their shafts. 25676 Lever: Driving gear for motor vehicles. 25944 Coleman: Containers or plant for the heating or treatment of varnish or other material. 25982 Varndell: Device for displaying advertisements and the like. 26124 Dr. C. Otto and Comp. Ges.: Removing tar from hot gases from coke ovens, gas retorts, or the like. [Date applied for under International Convention, December 22nd, 1908.] 26251 Harden: Electric furnaces. 26349 Forti: Apparatus for igniting and extinguishing gas burners. [Date applied for under International Convention, November 14th, 1908.] 26380 Ralph: Caps for securing detachable wheels. 26427 Frounzeti: Appliances or apparatus for removing incrustations from within the water tubes of steam boilers. 26636. *See* 13280, 1909. 26687 Lowthian: Method and means for actuating electro-mechanical fog signals for railways. [Application for Patent of Addition to No. 2973, 1907.] 26935 Labourdette: Hoods of vehicles. [Date applied for under International Convention, November 30th, 1908.] 26992 Thomas Locker and Co., and Locker: Sieves. 27064 McVail: Carburetters for internal-combustion engines.

27223 Elliott: Mechanical stokers.

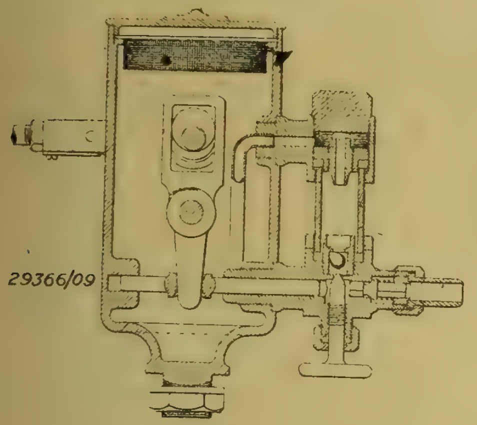
This invention refers to mechanical stokers of the kind having means for feeding the fuel to a device adapted to deposit the same into movable grate bars. A crusher for initially reducing the fuel has its discharge outlet leading to a worm which feeds the material to a centrifugal wheel opening over the grate. The worm shaft, which is driven from any suitable source of power, is geared to a secondary shaft which drives a third shaft for actuating the grate bars and an ash remover.



27337 Green: Loose-leaf books, files, and the like. 27433 Evans: Adaptable name or numeral sign plate for street name and the like. 27527 Schutt: Method and means for irrigating and aerating the rootstocks of trees. 27561 Baker and Hadley: Screw-down valves for use with hot-water circulation and like purposes. 27590 Scherl: Gyroscopic apparatus for bodies in unstable equilibrium. [Date applied for under International Convention, March 24th, 1909. Application for Patent of Addition to No. 21843, 1908.] 27800 Klewitz: Process for the manf. of blocks, slabs, plates, and the like from fibrous materials. 27892 Rottges: Flying machines. [Date applied for under International Convention, August 30th, 1909.] 27961 Staude: Mechanism for counting box blanks and the like. 28055 Moores: Apparatus for making gas from oils and spirits. 28273 Lake (Goss Printing Press Co.): Mechanism for casting stereotype plates. 28292 Hollis: Hoods or canopies for vehicles, boats, and the like. 28396. *See* 10713, 1909. 28444 Floessell: Portable wardrobe. [Date applied for under International Convention, December 18th, 1908.] 28469 Lake (Winchester Repeating Arms Co.): Small arms. 28475 Balachowsky and Caire: Driving axles of electrically-propelled vehicles. [Date applied for under International Convention, December 5th, 1908.] 28553 Jones: Handles for shovels and like tools. [Date applied for under International Convention, March 31st, 1909.] 28559 Harris: Serving trays and the like. 28632 Schulz: Water-tube boilers. 28802 Halliday: Apparatus for displaying advertisements and the like. 28836 Boult (Low): Centrifugal separating apparatus. 28846 Brachfeld: Device for use in the treatment of hair for the production of wigs and the like. 28851. *See* 13667, 1909. 28913 Mortimer: Manf. of newspapers and the like. 28954 Anger: Bearing springs or spring bearing devices for road vehicles. 28968 Stiel: Glass-facing tiles or plates for covering walls. 29245 Flanders: Fluid-pressure engines. [Date applied for under International Convention, January 25th, 1909.]

29366 Wakefield: Force-feed lubricators. [Request under Section 19 not granted.]

This invention relates to force-feed lubricators of the type in which an internal pump draws the lubricant through the sight-feed glass and delivers it positively to the delivery pipe so that the oil is fed under pressure to the part requiring it. Occasionally it happens that a partial vacuum is left in the sight tube when the pump stops, with a result that the glass becomes filled with oil. According to the present construction the lubricant is drawn through the sight feed from its upper end, a pump being provided at the lower end, and a device for controlling the supply between the bottom of the sight feed and the pump to prevent flooding of the glass.



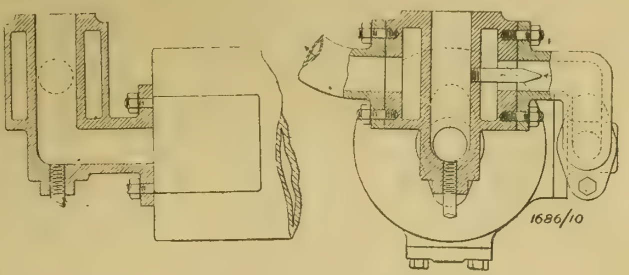
29544 Keller: Two-stroke cycle internal-combustion engine. 29554 Benegent: Motor vehicles. [Date applied for under International Convention, December 17th, 1908.] 29670 Automobilfabrik Turicum Akt.-Ges. and Kirchhofer: Carburetter for explosion motors. 29692 Kermode and Plummer: Packings for piston rods, shafts, and the like. 29761 Robertson: Dress belt buckles. 29797 Brown: Tramway brake blocks. 29844 Rogers: Type line-casting machines. [Date applied for under International Convention, February 20th, 1909.] 29872 Bailey: Tools for preparing the ends of lead or composition pipes for jointing. 29893 Berger: Frames for bicycles and the like. 30072 Maschinenbau-Anstalt Altenessen Akt.-Ges.: Coke-levelling apparatus for coke ovens. [Date applied for under International Convention, July 28th, 1909.] 30423 Morris: Pipe wrenches or the like. 30435 Peters: Bars for carrying wringing machines over baths, sinks, and the like. 30523 Petz: Heating devices for motor car bodies. 30535 Lees: Tobacco pipes, cigar and cnd cigarette holders. 30544 Lehmann: Machines for measuring fabrics.

1910.

12 Brown: Fishing reels. 45 Lever: "Chills" for chilling furnace firebars. 183 Wilzin: Capsuling of bottles. [Date applied for under International Convention, January 18th, 1909.] 287 Soc. Electro-Metallurgique Francaise: Process for the manf. of pure nickel. [Date applied for under International Convention, January 6th, 1909. Application for Patent of Addition to No. 14946, 1909.] 403 Thorne: Cigarette boxes. 482 Berthier: Means for automatically actuating the breech mechanism of firearms. [Date applied for under International Convention, September 19th, 1908. Originally included in No. 21383, 1909.] 521 Gilmour: Nut locks. 557 Grant and Legros: Apparatus for casting alloys for type and for like purposes. 769 West and Baker: Automatic safety locks for lifts or elevators. [Date applied for under International Convention, January 22nd, 1909.] 783 Loebinger: Valve for pneumatic tyres. 940 Short, Short, and Short: Devices for connecting and adjusting the tension of members such as tie rods, tension wires, wire ropes, and the like. 1166 Deutsche Gasgluhlicht Akt.-Ges. (Auer-Ges.): Apparatus for suspending lamps on supports crossing streets. [Date applied for under International Convention, September 2nd, 1909.] 1235 Sunngard: Automatic pistols. [Date applied for under International Convention, January 18th, 1909.] 1301 Siemens Bros. and Co., and Dieselhorst: Manf. of electric conductors. 1568 Singer Manufacturing Co., and McFarlane: Bobbin-winding device for sewing machines. 1635 Thompson (Wolle): Method of making beton or concrete sleepers with resilient rail supports. 1680 Moss: Steam steering gear.

1686 Leech: Oil engines.

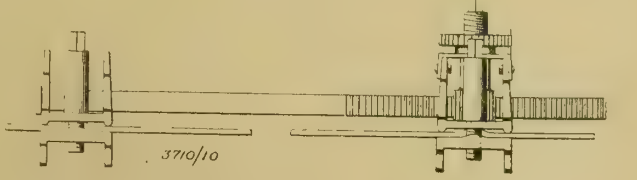
This invention relates more especially to small power engines using heavy oils where it is necessary to have a lamp burning continuously in order to keep the vaporiser and ignition tube hot enough to ensure a constant or positive ignition. The object of this invention is to set up an automatic or positive ignition in vaporisers forming part of the combustion chamber by placing the vaporiser and an ignition tube in the path of the hot gases from the exhaust and to heat the same by the gases in their passage to the exhaust outlet pipe. In this manner it is possible to dispense with the ordinary lamp and ignition after the engine has got fairly started, and so effect a great saving in oil or the expense of an electric ignition. The vaporiser and ignition tube are fixed at the exhaust end of the cylinder and surround the vaporiser with a suitable jacket having an inlet and an outlet. The inlet is connected by pipe with the exhaust, and the outlet to a further pipe connection for conveying the exhaust gases outside. An ignition tube is fixed in the side of the vaporiser and projects into the inlet pipe from the exhaust.



1730 Hunt: Game apparatus. 1752 Campbell: Cuspidors. 1803 Haddan (Continental Co.): Method of manufacturing cushion tyres and a former for use therein. 1881 Schumacher: Runner springs and their fastening with umbrella and the like sticks. 1929 Thomas Smith and Sons (of Saltley) Ltd., and Smith: Wrenches, pliers, spanners, and such like tools. 1998 Schrodter: Device for gauging the contents of casks and the like. 2011 Jenkins: Spirally-wound paper or like receptacles. [Date applied for under International Convention, October 22nd, Adt: Eyeglasses. 2426 Baldwin: Processes for separating dust, smoke, and other materials from gases. 2553 Ayme: Method and means for the ironing of velvets and plush fabrics. [Date applied for under International Convention, October 22nd 1909.] 2623 Loehler: Ventilators. [Date applied for under International Convention, February 9th, 1909.] 2654 Landsberger: Closures for jars and like receptacles. [Date applied for under International Convention, February 3rd, 1909.] 3436 Handschin and Kuny: Means for forming selve edges in looms for weaving. [Date applied for under International Convention, July 7th, 1909.] 3484 Dowell: Bottles, jars, tins, or the like. 3542 Blower: Securing railway rails to sleepers. 3544 Henderson: Window sash fastener.

3710 Meiers: Stretchers for driving belts.

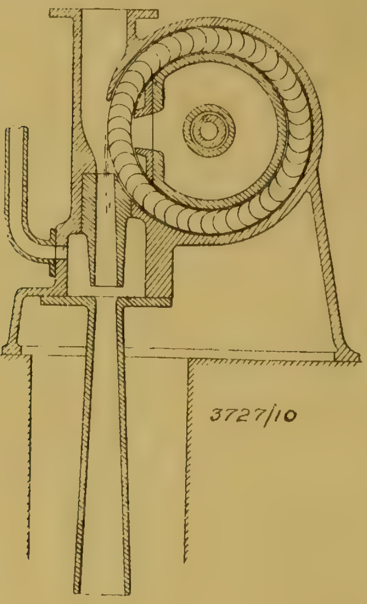
The invention relates to stretchers for driving belts, and more particularly to the class of belt stretchers for drawing together the belt ends to permit lacing thereof without the necessity of removing the belt from the pulleys. In devices of this kind it is usual to provide co-acting clamps which are moved towards each other through the intervention of rack and pinion or ratchet mechanism and other gear.



According to the present construction the belt stretcher is adapted to clamp the ends of belts of various widths and thicknesses, and the clamping jaws are moved by a centrally disposed rack and pinion, which latter has a screw-threaded shaft upon which is mounted a ratchet adapted to act automatically as a tightening nut under the control of a pivoted spring pawl.

3727 Soc. Anon. pour L'Exploitation des Procedes Westinghouse-Leblanc: Rotary air compressors. [Date applied for under International Convention, January 12th, 1910.]

This invention relates to rotary air pumps of the well-known Westinghouse-Leblanc type in which the air or other fluid to be extracted is entrained by jets, streams, or sheets of water or other liquid which are projected into the suction or vacuum chamber of the pump by means of a reversely driven turbine. The liquid and entrained air or other fluid which may include also condensed vapours is forced through a nozzle, then through a combining tube or chamber into a second diverging nozzle from which the extracted fluid and liquid are discharged. According to the present arrangement the combining tube or chamber in the apparatus above mentioned is connected to a chamber or space where it is desired to maintain a less vacuum than that in the main suction or vacuum chamber of the pump, by which means a single pump will extract air or other gases from two places where different pressures exist.

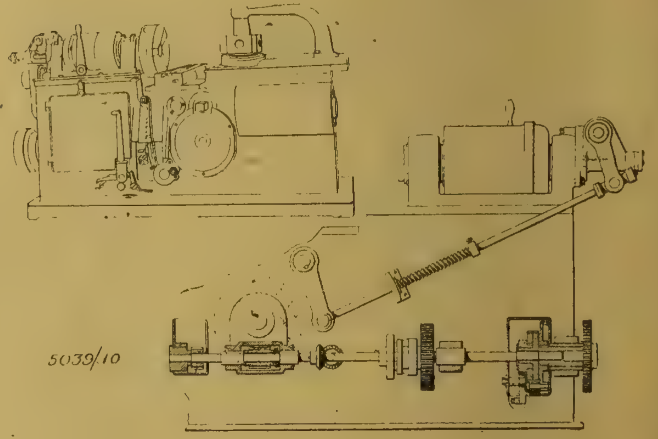


3902 Sayers and Salt: Railway electric automatic tablet or staff instruments. 3914 Siemens Bros. Dynamo Works Ltd. (Siemens Schuckertwerke Ges.): Arrangements for regulating the position of the brushes on the commutator of a dynamo electric machine. 4063 Hilling: Supports for displaying brushes. 4265 Redio Co., and Dagnall: Polishing cloths. 4266 Jarrett: Cream containers for dairy use. 4276 Velte: Brakes for sledges. 4411 Berning: Button-fastening tools or devices. 4574 Battle: Notice board. 4643 W. R. Sykes Interlocking Signal Co., and Sykes: Railway signalling and like indicating apparatus. 4677 Lake (Stoddard): Pipe couplings. 4684 Norris: Manf. of alkaline formates. 4752 Plattner: Coppers and washing machines. 4812 Vereinigte Uhrenfabriken von Gebruder Junghans und Thomas Haller Akt.-Ges.: Clocks. [Date applied for under International Convention, August 5th, 1909.] 4901 Muller: Litter or the like. 5038 Potter: Automatic turret lathes. [Date applied for under Rule 13, June 7th, 1909.]

5039 Potter: Automatic turret lathes. [Date applied for under Rule 13, June 7th, 1909.]

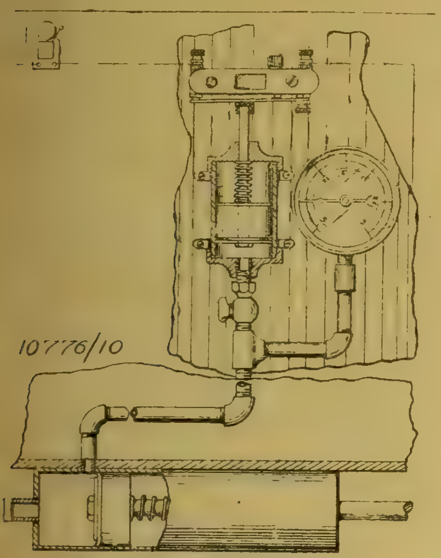
This invention relates to improvements in automatic turret lathes in which a turret-operating feed shaft is constantly in driving connection with the work spindle, but can be driven from a main driving spindle, and in which over-running gearing is provided for permitting the feed shaft to over-run the work spindle when driven from the main driving spindle. Now this invention provides a manual control mechanism which not only controls the clutching of the feed shaft to the main driving shaft, but also can be moved to operate an element in the over-running gear for the purpose of stopping the turret feed shaft when desired. The invention also provides a clutch with an automatic control which operates so that at the end of a turret-feeding movement the feed shaft is automatically clutched to the main driving shaft and the turret is returned at constant speed, and at the completion of the return movement the clutch is released so that the turret-feeding movement takes place as before, these feeding and return movements alternating until the automatic control operates upon the over-running gear to stop all movement of the turret. Moreover, the manual control can be operated to cause the feed shaft to be temporarily clutched to the main driving shaft for effecting quick feeding of the turret during such time as the automatic control has adjusted the parts for slow speed or for stoppage of the turret.

5040 Potter: Automatic turret lathes. [Date applied for under Rule 13, June 7th, 1909.] 5042 Potter: Automatic turret lathes. [Date applied for under Rule 13, June 7th, 1909.] 5092 C. F. Carver Ltd., and Hursthouse: Couplings for shafts. 5096 Fisher: Hair curlers or wavers. 5170 Yates: Razors. 5372 Behrens: Earth anchors. [Date applied for under International Convention, June 23rd, 1909.] 5547 Groome: Draught, dust, and weather excluders for doors, casements, and the like. 5640 Atlas Engineering Co., and Mycock: Ball or roller bearings for the bowls or rollers of calenders, mangles, and like machines. 5679 Osmond: Apparatus for marking the ground applicable for lawn tennis and other games. 5699 Griffin: Fire escape apparatus. 5834 Adamson: Apparatus for making tobacco cartridges for pipes. 6063 Soc. D'Electro-Chimie and Hulin: Apparatus for carrying out the electrolytic production of alkaline metals. [Date applied for under International Convention, May 6th, 1909.] 6291 Reifert: Combined pocket knife and pencil or rubber holder. 6306 Pybus and Pybus: Process for producing in the tubes of tyres or in similar enclosed spaces a resilient spongy material. 6544 Martin: Windows. 6708 Blower: Railway sleepers and means for securing rails thereto. 6875 Siemens and Halske Akt.-Ges.: Semi-automatic telephone exchanges. [Date applied for under International Convention, March 18th, 1909.] 7121 Walker (Mergenthaler Linotype Co.): Distributor mechanism of type line-casting machines. 7650 Homan: Device for charging or filling tobacco pipes with tobacco. 7663 Mickish: Button fasteners. 7813 Watkin: pyrometers, thermometers, and the like. 7825 "Kleine" Patent Fire Resisting Flooring Syndicate (Kleine): Method of constructing armoured concrete piers or the like. 7837 Brown: Machines for stoppering or sealing bottles and like receptacles. [Date applied for under Rule 13, October 27th, 1909.] 8216 Haddan (Safety Tyre Co.): Spring tyres. 8337 Soc. Anon. l'Explosifs et de Produits Chimiques: Means for propagating the ignition or detonation of explosive charges for mining and other purposes. [Date applied for under International Convention, April 19th, 1909.] 8452 Dumont: Moulds for glass workers. [Date applied for under International Convention, April 26th, 1909.] 9275 Coates: Production of anti-toxin materials and the application of same to soils. [Date applied for under International Convention, April 26th, 1909.] 9586 Rippingille and Martin: Nut locks. 9743 Kalle and Co., Akt.-Ges.: Manf. of a new amino-oxy-naphthalene sulphonic acid. [Date applied for under International Convention, May 11th, 1909.] 9832 Wilson and Wilson: Electric condensers. [Date applied for under Rule 13, June 9th, 1909.] 9946 Wolstenholme and Ashworth: Combined night commodes and slop pails or receptacles. 10574 Rossignon: Poultry houses.



10776 Cota: Air brake systems. [Date applied for under International Convention, May 1st, 1909.]

This invention relates to signalling apparatus for indicating the condition of the air pressure in any one of the brake cylinders of an air brake system. The air brake cylinder is connected to a reacting air pressure cylinder having a piston, the piston rod forming a circuit breaker for operating a make and break contact device which is included in a circuit with an audible signal.



12914 Walker: Pumping of pits or shafts. [Date applied for under Rule 13, June 2nd, 1909.]

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1909.

21174 Loloff: Process for enriching bacteria cultures.

1910.

6035 Petersson: Methods of and means for charging electric resistance furnaces. 7319 Presser: Process for the production of oxides of nitrogen. 9399 Druseidt: Electric switches. 10458 Peignon: Fencing and the like. 10747 Bauer: Means for attaching supporting brackets and the like to beams, girders, and masonry, more particularly of ferro-concrete. 10914 Firm Geb. Sulzer: Two-stroke cycle internal-combustion engines. 11907 Gabet: Elastic bullets. 12180 Shemwell: Switch-throwing mechanism. 12224 Heilpern: Manf. of pipes and tubes. 12502 Esnault-Pelterie: Aeroplanes. 12593 Soc. Industrielle de Delle: Device for leading current to an ignition device for combustion engines. 12602 Price: Single-trigger mechanism for firearms. 12713 Brehier et Cie.: Method of manufacturing wire hoops or other metallic circles. 12724 Siemund: Methods of and apparatus for electric welding and repairing. 12794 Urban: Wave sloats in the pressing surface of propelling apparatus. 12837 Graham: Differential mechanism for vehicles. 12899 Philipp: Spring button fastenings. 13037 Martinez-Silva: Tooth brushes. 13084 Kruger: Combined adding apparatus and pencil box. 13089 Worley: Railway switches. 13108 Reinhardt: Process and apparatus for producing malt grist for brewing purposes. 13129 Henri, Helbronner and Von

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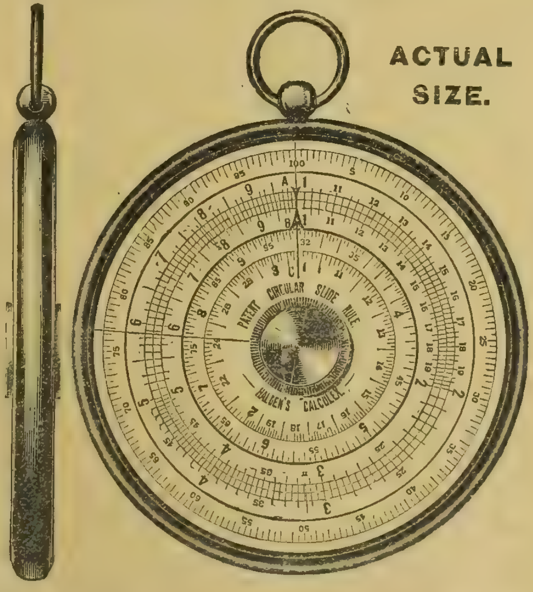

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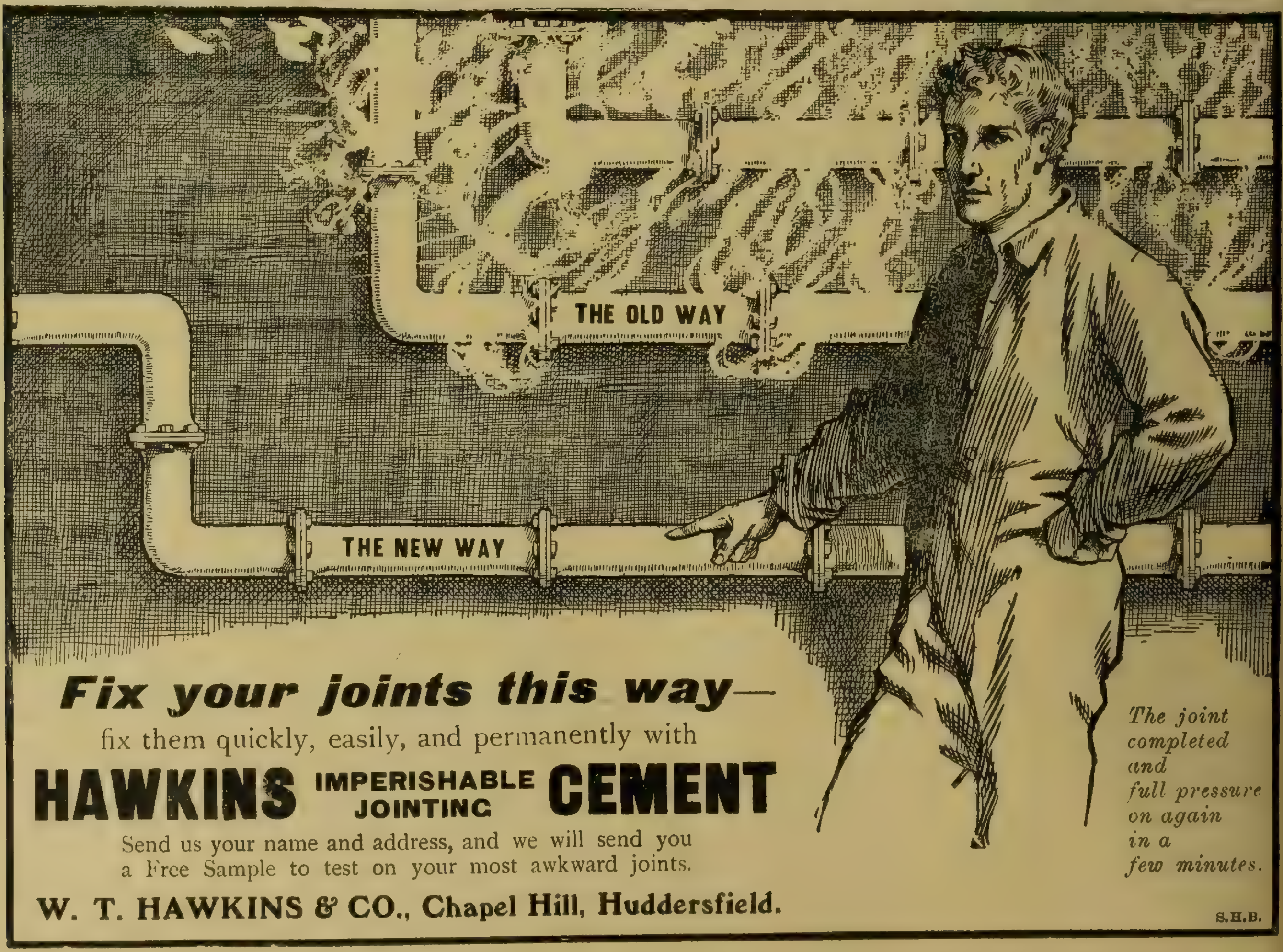
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PRECISION AND COMMERCIAL ENGINEERING.

EVERY engineer has at some time or other met the man who persists in sacrificing valuable time by struggling for exactness where extreme accuracy is unnecessary. Commercial engineering differs from account keeping and chemical analysis, in that certain basic factors are incapable of being estimated exactly without an undue expenditure in time, consequently allowances, based upon previous practice, are made for these items.

A simple instance of our meaning may be found in the estimation of the weight of a casting from the detail drawing. Give such a problem to an intelligent novice, and he will attempt to measure every little boss and fillet, and even when the result is thus laboriously arrived at, accuracy will not be attained owing to errors in pattern-making and moulding. The experienced estimator makes certain allowances for fillets, bosses, etc., together with the slight increase in thickness caused by the rapping of the pattern when it is extracted from the mould. Attacked in this way, the problem will be very quickly solved, and the weight thus found is more likely to be correct.

Similar principles apply to almost every problem in commercial engineering, and the man who attempts to be precise where precision is not needed must inevitably gain a reputation for slowness which will militate against his progress.

Dimensions for machined surfaces must obviously be exact, time being usefully expended in checking the figures shown upon working drawings to ensure accuracy.

On the other hand, the ouput of a pump cannot be correctly estimated, as some allowance must be made for slip, and it is customary to slightly increase the size to be certain of obtaining a minimum capacity.

Attention to detail is a very important factor bearing upon success, but good judgment is needed to distinguish details demanding careful attention from those which only repay a brief consideration.

Many men are held back their whole lives owing to lack of judgment in this respect, whilst others, with perhaps less intelligence, are able to push forward by quickly grasping essential points.

MANY HEADS VERSUS ONE.

It is perfectly certain that no "captain of industry" has even risen to eminence without the aid of others; in fact, it may be laid down that such distinction can only be attained by making the widest use of advice and assistance, both tendered and sought for. We may even go a step further by stating that no responsible position can be retained for long without resorting to similar means, unless backed up by undue influence.

As regards advice from subordinates, this is often particularly valuable, and should be encouraged. At the same time, the superior who is thereby benefited should, as far as possible, acknowledge the obligation by furthering the interests of an adviser who gives him many useful tips. Although improper use is sometimes made of information thus gathered, it is fortunately the exception; the taking and the giving of advice generally being beneficial to both parties concerned.

This feature emphasises the importance of tact in dealing with subordinates, as if their enmity be aroused, not only will no advice be forthcoming, but they will intentionally neglect to report errors for which they are not directly responsible. "The man who never makes a mistake will never make anything," but in engineering matters mistakes are frequently noticed and reported by subordinates before they have gone too far to be serious, attention being often called to them by those who could not have been saddled with the blame.

The need for amicable relations between those in responsible positions and their staff demands a certain age in the persons chosen to fill such appointments, as the promotion of too young a man—however efficient as regards technical ability—is almost always resented by his prospective assistants.

Another phase of the subject is the preparation of printed forms and the routine adopted for dealing with the work effectively. It is much better in these cases to consult everyone affected than to be compelled to alter some form or rule which has proved unworkable.

It is not for one moment suggested that all the proposals of a man's subordinates should be weakly given way to, but they should be courteously received if offered with a genuine desire to promote the efficiency of the department.

So far our remarks have had reference mainly to the arrangements within each department, but the relations with other sections of an engineering undertaking are equally important, particularly between the drawing office and the various workshops.

The chief draughtsman should be on the best of terms with the various foremen, who may be given the opportunity to suggest improvements in the designs, with a view to reducing the cost. He should also, on all possible occasions, consult the actual users of the machinery produced, who must be satisfied on every point if the product is to be a success.

The most grotesque mistakes are probably made in contractors' drawing offices where machinery is designed for shipment to the colonies or foreign countries. The work is admittedly difficult, as the manufacturers cannot easily be got at, and the actual users are only seen at long intervals. Then again, complaints can only arrive months after the machinery is sent off, and may not get through at all; hence, draughtsmen engaged upon work of this nature are apt to become careless.

Modern practice in engineering matters is all in favour of submitting important points regarding both routine and designs to the judgment of the largest practicable number, and only the young and inexperienced will attempt to settle such matters single handed.

New Dock for Liverpool.—At a recent meeting of the Mersey Docks and Harbour Board approval was given to a proposal to construct a new dock, 1,020 ft. long, with an entrance 120 ft. in width. Docks capable of containing four ships 1,000 ft. in length represent the aim which Liverpool has set before it for ultimate attainment. The present portion of the scheme will be completed, it is expected, three years hence, and is intended for the accommodation of the mammoth Cunarder. As tenders for that vessel have not been invited as yet, the Dock Board may be in time. As the new dock at Liverpool will apparently not be wanted by the White Star Line, which is to base its ships at Southampton, Liverpool must be acting in the firm belief that the Cunard has no intention of deserting it.

Testing Air Propellers.—Messrs. Vickers, Sons and Maxim have constructed at Barrow an apparatus for making practical tests of propellers. The apparatus consists of a cantilever arm, 166 ft. in length from point to point, the longer arm of the cantilever being 110 ft. It is mounted at the centre on a ball-bearing in a cast-iron column, and the propeller, which is fitted at one end and driven from a 100-H.P. electric motor, revolves the cantilever arm at any predetermined speed, ranging up to 70 miles an hour at the outer extremity. In the centre of the arm there is a recording station, where all the results are recorded and the efficiency of any given type of propeller accurately deduced. At the extreme end of the arm, 110 ft. from the centre, there is a steel platform carrying a bracket and bevel gear for driving the propeller, the power being transmitted from the motor by this gear to a line of shafting. The opposite end of the arm has a sheet-iron ballast tank at a radius of 56 ft., by means of which it is possible to accurately balance the whole structure. The propelling power is arranged so that the revolutions of the propeller may be varied from 500 to over 1,000 revolutions per minute, and the speed of the propeller through the air can be regulated by means of resistance screens to conform to the conditions for which it may have been designed, which speed may reach, if necessary, 70 miles per hour. As the propeller traverses a circular course the wind and other causes of resistance counterbalance each other. A system of accurately measuring the thrust of the propeller is included in the design of the bracket gear, the propeller shaft being allowed to move forward against a spring, a movement which is mechanically recorded in the observation station. It has been found from experience that the thrust can be accurately measured to within 1 per cent. of a total thrust of 500 lbs. The gear is made reversing, so that the efficiency of the propellers can be tested for going astern.

Turning Basin for Belfast Harbour.—The Belfast Harbour Commissioners have decided to construct a turning basin at the harbour entrance to facilitate the launch of the White Star liners Olympic and Titanic and other large vessels intended to be constructed in Belfast yards. It was pointed out that the total cost of the Trust for these launches would be fully £100,000.

PRACTICAL METALLURGY.

By Horace Allen.

(Continued from page 772, vol. xli)

Electricity Applied to Metallurgy.

Metallurgical processes generally require the provision of some heating medium to bring about the chemical changes in reduction, and also mechanical power to render the metallic product suitable for structural and other purposes.

It has already been shown that in processes which are dependent upon a certain given temperature, the reaction can only be economically effected by following the conditions formulated by Professor H. M. Howe, and a little consideration will do much in explaining the low efficiency of many of the older methods of smelting and heating by the combustion of fuel.

While we are still dependent upon the combustion of fuel for developing power and temperature, modern methods have made great strides in the direction of economy, by delivering the supply of heat at and above the critical temperature.

If coal is burned under a steam boiler with such an excess of air that the temperature does not reach 212 deg. Fah., no steam would be generated, however much fuel was consumed; and if steam is generated and carried long distances in pipes, in which radiation, etc., reduce the temperature below 212 deg., then no power can be developed.

Though metallic iron can be reduced from its ores by burning charcoal with natural draught, as it never reaches the melting point, it is produced in a plastic state in small quantities at a time.

In the reduction of ores and the physical treatment of the metal, to give it the most advantageous properties both heat and power are necessary, and the source of this heat is coal, coke, or gas. In most instances, the heat and power have to be transmitted some distance from the point of combustion of the fuel to that at which one or other have to be applied, with more or less loss due to this transmission. In steam practice, the boilers are naturally grouped, and the steam conveyed by pipes to the point of power application; the consumption of steam by a steam engine is least in proportion to the power developed when the engine is loaded to its most economical point, and increases under any change from these conditions. If the power requirement is intermittent, the loss of transmission is increased, for though there is always some loss due to radiation, condensation, etc., when the power is not being developed, the engine and pipes cool down, and the loss of transmission very rapidly increases.

When the fuel is gasified as a preliminary stage, and the gas is transmitted to gas engines, the loss due to transmission is much less than is the case with steam, but still the load factor plays a part in the economy. By the adoption of centralisation, it is possible to reduce the losses due to load factor and transmission to such an extent that all modern iron and steel works include an electric power station, to enable the power factor to be maintained high, and the transmission losses at a minimum, employing coal or waste gases as the driving power for the electrical generators. Where the electrical current has to be transmitted over small distances, continuous current is adopted; but for increased distances, when the cost of the electric cable becomes a serious factor, high-tension current is used.

The employment of electric motors for driving machines intermittently does not involve any transmission loss when the machinery is standing, as is the case with steam power, and the expenditure of current is directly proportional to the power required. Motors can be driven by either direct current or alternating, and can now be readily adapted to the various speed requirements.

Added to these advantages is the possibility of applying a *flywheel* effect to such machines as reversing rolling mills, without the intervention of such gearing as is necessary in steam practice. The Allis-Chalmers gas engine of 5,000 H.P. is suitable for the direct-driving 2,500 k.w. three-phase generators to deliver current at 6,600 volts and 25 cycles, or 250 volt direct-current dynamos.

Tandem, double-acting gas engines, of the Cockerill-Westgarth four-cycle type, have been built by Messrs. Richardsons, Westgarth, and Co. Ltd., of Middlesbrough, in units up to 1,250 B.H.P. for driving direct blowing cylinders, continuous-current dynamos, and alternators, reaching an aggregate of 22,100 B.H.P., and by the Société Anonyme John Cockerill, Seraing, up to 195,820 B.H.P., and the units can be supplied up to 2,500 B.H.P.

The best characteristics in gas engines which are to be employed for driving alternators, which are to run in parallel, are high number of impulses, with the cranks set at angles which give the most even-turning moment and high speed of revolution.

The cyclic regulation by the employment of heavy flywheels has disadvantages, while the lower the number of impulses the heavier the flywheel required to give the necessary cyclic regularity.

The advantages obtained for driving rolling mills by electric motors, either for continuous rotation in one direction or for reversing mills, are:—

(1) Economy in fuel consumption.

(2) Larger output from the plant.

(3) Reduced running costs in repairs, attendance, lubrication, etc.

(4) Greater convenience and reduction of management expenses, due to centralisation of the power supply.

(5) Economy of electric plant is maintained, and is not diminished by wear.

(6) By the system designed by Ilgner, flywheel effect can be applied to reversing mills, thereby reducing the size of mill motor, the peak of the load being provided by the flywheel, without reduction of the output due to reversing.

From some tests upon an electrically-driven reversing mill, reported by Mr. C. A. Ablett,* the author has worked out the kilowatt hours expended in rolling various sections from different weights of ingots, and finds that though the weights and sizes of the ingots varied very considerably, *i.e.*, from 1½ tons to 7 tons, and the finished product ranged from slabs 32 in. by 9 in., to channels weighing 92 lbs. per yard, the range of power in kilowatt hours per yard of finished section was only from 0·703 to 1·517, the mean being 1·037.

The maximum of 1·517 was in rolling 2½ ton ingots to 8 in. square blooms, and the minimum 0·703 rolling 6 ton ingots, 36 in. by 19½ in. to slabs 32 in. by 5 in. thick.

These figures, with those given in connection with rolling-mill practice, will be found most useful in estimating the power requirements of any given rolling mill. The employment of electricity for supplying the heat requirements of the smelting and refining of iron and steel has been making rapid progress. Prof. Dr. B. Neumann, of Darmstadt,† stated that last year Germany produced 20,000 tons of steel by electrical furnaces; two 15-ton electric-steel Héroult furnaces, making 12 heats per day of 24 hours, yielding 100,000 tons of steel per annum. At the beginning of this year there were 107 electric-steel furnaces running or under construction, the systems including 45 Héroult, 17 Girod, 15 Röchling-Rodenhauser, 14 Kjellin, 13 Stassano. Of these 32 were induction furnaces, and 72 electrode furnaces.

The steel produced by electric furnaces is mechanically superior to ordinary steel. By the Chaplet process, starting from cold material, the cost of transformation is stated to be £1 12s. per ton.

The Héroult furnace installed by the Illinois Steel Co., of South Chicago, in 1909, has been producing 3,000 tons per month of electrically-refined steel.

---

* Iron and Steel Institute Meeting, 1909.

† Dusseldorf International Congress, 1910.

The hot metal from a Bessemer converter is treated in the electric furnace to reduce the phosphorus, sulphur, and other impurities, and the steel rails show remarkable ability to stand hard wear, though the cost is higher than by ordinary processes.

Mr. Lars Tugstrom estimates that electric iron furnaces of, say, 2,500 H.P., may have an efficiency of 80 per cent, or produce three metric tons per horse-power year, when rich ore is used.

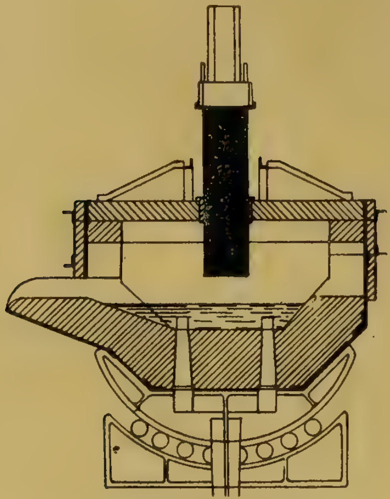

Fig. 64.—Section of Girod Furnace.

Th advantages of electric smelting over blast furnaces are claimed to be:—Lower installation costs, since blowing engines and heating stoves are not required; saving of about two-third of the coke used in blast furnaces; ore dust can be used without resorting to briquetting; the evolved gases have a high heat value, being free from nitrogen; the possibility of producing low-carbon iron; less attendance, as the transporting and charging of two-thirds of the fuel required in blast furnaces is done away with.

Mr. W. Borchers, at the Iron and Steel Institute meeting, 1910, described the Girod electric-steel furnace as the simplest of modern types, and suitable for either experimental work or for large size furnaces. It is a combination of a resistance and arc system, in which the metal to be refined forms one of the electrodes; it is covered by the refining slag as an electrolytic conductor, while one or more carbon blocks are introduced through the cover of the furnace and form the opposite electrode.

A sectional view of the Girod furnace is shown in fig. 64.

Mr. Borchers gives the cost of a complete plant of two 2½-ton furnaces, with all the appliances and melting house, but not including dynamos or transformer, as approximately £8,000 to £1,200, and for a 12½-ton plant as £12,000 to £16,000. Each 12-ton furnace requires about 1,200 E.H.P. The furnace is suitable for dealing with cold scrap or molten metal, suitable fluxes being employed as oxidising agents. The melting of the iron charge and of the first addition of refining material occupies about four and a half to five hours, when further additions can be made according to the quality of steel required. Lime and oxide of iron are chiefly used as fluxes. The completion of the process is effected by additions of deoxidising agent and metals to produce any special class of alloy, such as nickel, tungsten, chromium, etc. The voltage for small furnaces is from 60 to 65, and for larger ones 70 to 75, while the energy to produce one ton of steel is about 800 to 900 k.w. hours alternating current.

The Girod electric furnace does not differ much in principle from that patented by the late B. H. Thwaite and the author as long ago as 1894, No. 21,879, as shown in fig. 65, except that the capacity contemplated only referred to melting in crucibles. The first of the eight claims may be quoted. "The electro fusion of metals in a crucible . . . . . and in which the electric energy current in its circuit to or from the centre to the side of the fusion crucible or other vessel."

In most metallurgical processes, and generally in the manufacture of iron and steel, the application of heat is necessary; but to provide a sufficiently high temperature to the blast furnace hearth, the open-hearth steel furnace, crucible furnaces, etc., the heat provided by the burning of coal or coke with air, there is always a very considerable loss, owing to a number of causes, such as the weight and specific heat of the gases, the heating of large furnaces, from which heavy losses occur from radiation, etc. Owing to the high temperature directly developed by the electric ore, or by induction, free from losses due to large weights of gases, and in such a concentrated manner that radiation losses can be reduced to a minimum, the quantity of heat to carry out the melting of pure iron, the refining of steel, etc., by using the electric current, is much less than by the older methods, which accounts for the fact that the electric furnace is daily increasing in application, notwithstanding its expense.

In the blast furnace, only part of the coke charged is used for providing heat, the remainder acting as the reducing agent, and it has been found practicable to provide the heat by electric current, and so reduce the coke requirement that in districts where suitable coke is very expensive electric smelting has been adopted.

The temperatures ranging in the blast furnace, while being effective in reducing up to 99 per cent of the iron contained in the ore, are not so in regard to other metals, such as manganese, which only reaches about 50 per cent; and in the case of such metals as chrominum, tungsten, titanium, vanadium, only small proportions can be reduced, but with electric furnaces all these metals can be produced as rich alloys.

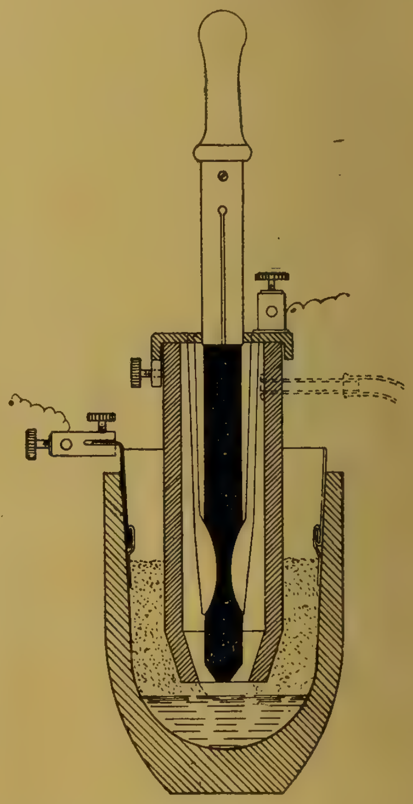

Fig. 65.

Electric furnaces may be divided into two classes: (1) Those employing carbon electrodes of the arc system; and

(2) those in which the heat is developed by induction and resistance, in which there is no arc, and the electrical apparatus does not come in contact with the contents of the furnace.

Arc furnaces include the following: Stassano, Héroult, Girod, etc., while the systems of Kjellin, Frick, Röchling-Rodenhauser, etc., do not employ the arc, or allow the apparatus to be affected by contact with the molten metal or slag.

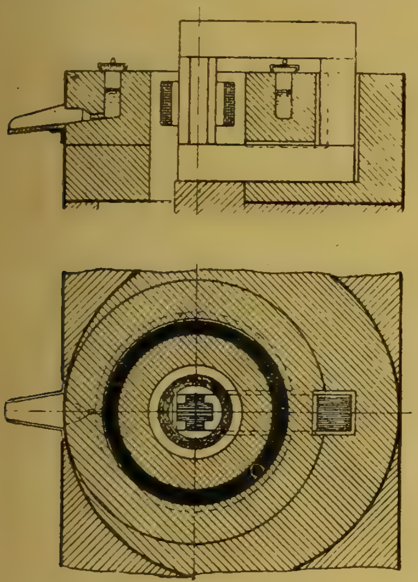

Fig. 66.—Kjellin Furnace.

The high temperatures developed by the electric arc necessitate very refractory materials for building the roof and furnace body, such as magnesite. In the Héroult furnace the arc is formed between the carbons and the metal, instead of between the carbons, as in the Stassano system; and as the carbons are introduced through the removable roof, the furnace does not require to be tilted. Where carbons are employed, they require to be protected and cooled where they pass through the roof, as otherwise oxidation of the carbon would take place owing to the high temperature it would attain.

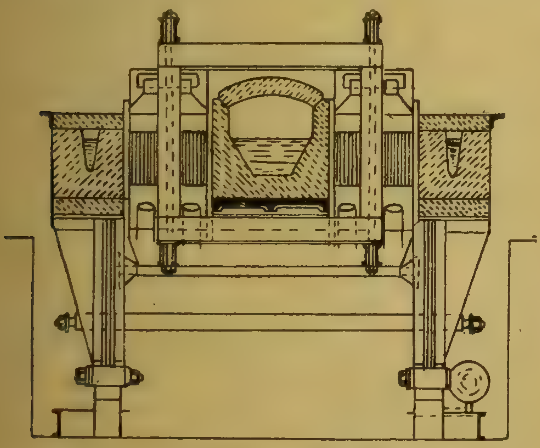

Fig. 67.—The Röchling-Rodenhauser Furnace.

The efficiency of the Héroult furnace when melting steel scrap, iron ore, and lime amounts to about 77 per cent, and the high temperatures possible render it possible to apply slags which will completely dephosphorise the metal, thus enabling open-hearth or Bessemer steel to be converted into the highest class of crucible steel at small additional cost.

Mr. W. Rodenhauser* summarises the operation of the arc furnace as follows: (1) The temperature of the charge cannot be appreciably increased by resistance heating; (2) The charge is almost entirely heated by the arc, and the heating is very much localised; (3) the passage of the current through the carbon electrodes gives rise to a considerable loss of energy, due both to the comparatively high resistance of the carbon and to the water circulation for cooling the apertures through which the carbons enter the furnace. The loss of energy is about 10 per cent, and the cost of maintenance of the carbons is also considerable.

Induction electric furnaces derive their heat from inducing a current in the metal to be treated, and depend upon the fact that when an alternating current is passed through a coil of copper wire it has the property of inducing a current (secondary) in another coil placed in its vicinity, without the coils being in any way connected; also to the fact that the current in the secondary coil may be much higher than in the primary, being inversely proportional to the number of turns in the respective windings.

In the Kjellin furnace, fig. 66, the passage of a current through the primary windings induces an exceptionally large current in the metal in the hearth, which constitutes a secondary winding of a single turn.

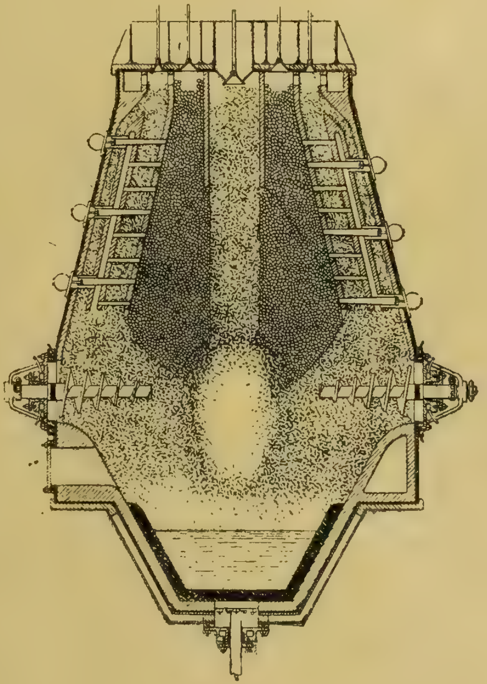

Fig. 68.

The Röchling-Rodenhauser furnace (fig. 67) is constructed to use single-phase and three-phase current, having two grooves metal melted in the first case and three in the second; these grooves open into an open-hearth working chamber, in which the metallurgical operations take place.

In melting washed metal, puddled bar, deal mill scrap, and alloys, the consumption of power has been reported from 440 to 560 kilowatt hours per gross ton in the Kjellin induction furnace. Fig. 68 is a diagrammatical section of an electric furnace for smelting pig iron direct from its ores. In this connection Mr. M. Ruthenbery has claimed to produce one ton of pig iron by an expenditure of 250 kilowatt hours.

(To be continued.)

Obituary.—All our electrical friends and those interested in X-ray work will regret to hear of the decease of Mr. H. W. Cox, a pioneer experimentalist. Death was due to disease brought on through his zeal for investigation.

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* Iron and Steel Institute, May, 1909.

THE MECHANICAL PRINCIPLES OF THE GYROSCOPIC MONO-RAIL SYSTEM.*

(Concluded from page 72.)

The foregoing discussion has all depended upon equation (4) and its applicability to the gyroscopic interactions actually occurring in the proposed arrangement. Equation (4) assumes that the axes B B are in their normal transverse positions at right angles to $T_1 T_2$. But owing to the precessions about D D we are compelled to consider what modifications are necessary in order to take into account the effect of such deviations in the positions of B B as may take place. Let *d* designate the amount of this angular deviation from the normal position at any instant. Then the angular velocity V may be regarded as made up of two components, viz., V *sin d* about an axis parallel to $T_1 T_2$ and V *cos d* at right angles to $T_1 T_2$, of which the latter component alone is effective in equation (4), which may be written—

$$T = M U V \cos d \qquad (4)$$

From this it is seen that with a given torque T the precession U increases with the deviation *d*, though the deviation is in fact usually confined to such small values that the precession is but slightly varied from this cause.

The practical effect, so far as balancing is concerned, is the same as if the gyroscopes were in normal position with axes at right angles to T T', and rotating with velocities V *cos d*, and besides that there was an additional pair of gyroscopes exactly like these mounted on axes parallel to $T_1 T_2$ and rotating with velocities V *sin d*. The effect of these latter, were they in action, will be readily seen to be nil so far as unbalanced loads on the car are concerned, as well as their effect on the centrifugal action in rounding a curve; but not so in regard the precessional effect in rounding a curve, which precession, as previously remarked, consists in a turning of the whole car including the gyroscopes about a vertical axis.

In case the gyroscopes stand at a deviation *d* while rounding a curve the stresses before described as produced in F F are diminished in the ratio of V to V *cos d*, the latter being the component of the angular velocity of the gyroscopes in the plane of the frame. Besides this stress, a twisting stress is induced in the frame by the angular component V *sin d*, the component rotation parallel to $T_1 T_2$, which exerts a torque about an axis perpendicular both to the axis of precession, which is vertical, and the axis of rotation T T', *i.e.*, about C C. This torque, therefore, consists of equal forces parallel to $T_1 T_2$ applied to the frame at the four points $D_1 D'_1$, $D_2 D'2$, such that those at D_1 and D'_2 act in one direction, and those at D_2 and D'_1 in the opposite direction, thus causing a bending stress in the frame E F, so that the torque exerted by one gyroscope is neutralised by the other, and the effect upon the car is nil.

It thus appears that no disturbance of the balance occurs by reason of the deviation caused by the precession occurring during the righting of the car. The sole effects are some slight variations in the rate of the precession and in stresses to which the frame is subjected, matters which have no influence upon the action of the gyroscopes in righting the car.

It is furthermore evident that the gradual or instantaneous elevation of one end of the car above the other, such as might occur in running on a slack cable, would, since it is a precessional rotation about an axis parallel to C C, have no effect, at least while the axes B B are in their normal position perpendicular to T T. The almost impossible case of such precession taking place during the continuance of a deviation *d* of perceptible magnitude could also be readily discussed, but it is practically negligible since the deviation *d* actually flutters back and forth each side of zero in almost infinitesimal instantaneous excursions that check every attempted lapse from an upright position at its very beginning, and simultaneously with the attempt, the only lag in action being the time required for the movement necessary to tip the car far enough to reduce the clearance between the axis at B and the plate G H to zero. That clearance may be made as small as desired.

The question that naturally arises respecting this car, in the mind both of the engineer and the layman, is as to the limits of its stability. How much of an upsetting torque is it able successfully to withstand? It is evident that the larger the amount of inertia and rotary velocity of the gyroscopes the greater the stability, as appears also from equation (5). Brennan has stated that the weight of the gyroscopes need not exceed some 4 or 5 per cent of that of the car. In his experimental car their weight is nearly 7 per cent of the unloaded car, but perhaps may not exceed 4 or 5 per cent of its total weight when loaded.

The point of danger in the apparatus is reached when the precession U has been so long operating as to carry the deviating axle B_2 (fig. 4) to the end of the friction plate G_2. The car must be righted before the deviation reaches this point or the car will upset. A deviation of more than 30 degrees would apparently be unpracticable, and in practice 10 degrees or 15 degrees is probably nearer the limit.

In order that the car be righted with such promptness as to avoid this danger, U' in equation (6) must be large, which in turn requires T' to be large. Now T' is the torque about a vertical axis due to the friction of the axle B_2 as it rolls and slides upon G_2. This torque T' depends upon the product of the pressure of B_2 upon G_2 and the coefficient of friction between these. It has already been shown that the precession U is unaffected by T'. It is U' alone that is affected by T'. Now it would seem that the only thing necessary to make U' of any desired amount would be some means of increasing T' *ad libitum* before the deviation reaches its limit. To ensure ultimate safety either the coefficient of friction should in some manner be made to increase enormously before the limiting deviation is reached, or the pressure between B_2 and G_2 should be enormously increased in some automatic manner before reaching that limit. It would appear quite practicable to so arrange magnetic coils about B_2 as to have an electric current pass through more and more of them as B_2 approaches its limit of deviation, and by that method automatically increase the magnetic pressure between B_2 and G_2 to any desired extent as the limit is approached, thus making T' and consequently U' both increase enormously at the limit. It would seem as if some such device must be adopted if occasional overturning from high winds and other accidental causes are to be avoided. The inertia of the gyroscopes in Brennan's experimental car is not known as yet, but computations based on assumed data make it probable that a very high wind causing a pressure of 30 lbs. per square foot against the sides of a car of ordinary construction might cause a total precessional deviation of 30 degrees in a fraction of a second, from which the suddenness with which the car must be tilted to oppose the wind may be inferred, and the necessity for some such automatic safety clutch is evident.

There is an action of the gyroscope still remaining which it is important to consider in connection with the mono-rail car, which action is included under the head of "nutation," so called. The actions treated thus far in this paper have not taken into consideration the inertia effects which are brought into play about the vertical and longitudinal axes of the car by reason of the sudden or gradual application of unbalanced loads. Consider the effect of a weight W suddenly applied at B in fig. 2. The discussion heretofore given treated the precessional motion as already established, and its steady continuance was ensured by the moment of W acting about C. In suddenly applying a weight W at B we have to consider the phenomena occurring during the establishment of the precession due to W. This precession, consisting in a constant, angular velocity about a vertical axis through C, must necessarily arise by the application of an angular acceleration (constant or variable) due to the inertia of the gyroscope.

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* Abstract of paper by H. T. Eddy in *Journal of the Franklin Institute.*

During the establishment of the precession due to W there is therefore a resisting couple about the vertical axis due to inertia, which acts in addition to everything previously taken into account. Such a couple produces precession about C E, fig. 2, in such a way as to allow W to begin to move downwards. This is clearly what should occur, since the precession does not become large enough to support W until the precession reaches the value required by equation (5).

The motion just described is the beginning of the nutation. The precession about the vertical will gradually increase until it is sufficient to support W were it at rest, but by that time W has acquired a velocity and momentum such as to carry it still further downward before it can be stopped. In thus being stopped in its course, W, by its inertia, exerts a couple which continues to increase the precession beyond the amount necessary to simply support W, so that by the time W has ceased to move downwards the precession is so large as to give W an upward velocity during the time necessary to reduce the precession. It may readily be shown that W will be carried upward to the level from which it is started, while the precession will also be diminished to the value it had to begin with. This oscillation of W up and down in unison with the increase and decrease of precession occurs harmonically, and constitutes the nutation.

In case the weight W is applied uniformly and gradually during the nutation, so that the whole of it is applied in course of the downward motion, it is evident that it will have half as much effect in causing nutation as if applied suddenly.

The relations just stated would enable us to investigate the amplitude and period of the oscillation were it important to do this. But, as will now be shown, such oscillations should not arise in the mono-rail car, and hence we omit the investigation.

In the mono-rail car the friction plates are designed for the very purpose of producing a couple about the vertical axis opposed to the inertia couple which causes nutation. If properly designed, the friction couple neutralises and greatly exceeds the inertia couple due to any load likely to come upon the car. It will then happen that the car will not give way under an imposed load at all, but will begin at once to bring the centre of gravity of load and car over the rail without any preliminary nutation, which would be a motion in the opposite direction. It might be possible, however, for a weight falling from a sufficient height to set up a small oscillation.

Forced Lubrication.—In a paper presented before the Institution of Automobile Engineers by R. K. Morcom dealing with forced lubrication, it was pointed out, in connection with the importance of the oil film, that the resistance of a fully lubricated surface might be only 1 per cent of a similarly loaded surface in which an oil film was not maintained. Resistance to shearing depended upon the viscosity of the lubricant, thickness of the film, and the area of film in shear. The temperature of the film might alter its viscosity; the extent of the film might not be equal to the extent of the bearing; the thickness of the film might not be such as entirely to prevent abrasion; and the clearance in the bearing might be irregularly distributed and inaccurate, and similar disturbances might be created by bad alignment of the shaft or its springiness, so that it was not possible to solve the problem entirely.

THE TESTING OF VACUUM GAUGES.

A new design of apparatus for the above purpose has been recently patented by Mr. Stanley Brotherhood, of the well-known firm of engineers, Peter Brotherhood Ltd., in conjunction with Mr. C. W. Bryant. The object is to provide an apparatus whereby definite differences of pressure may be obtained between the interior and exterior of a chamber connected to the instrument to be tested. Referring to the illustrations, fig. 1 is a front sectional elevation of the apparatus on the line A A of fig. 3. Fig. 2 is a side elevation of the exhaust pump. Fig. 3 is a plan of the apparatus. A cylinder *a* having a movable ram *e* therein is evacuated by an exhaust *b*. The cylinder body *a* is made separate from, and placed at the side of, the exhaust pump cylinder *b*, and the two cylinders *a* and *b* communicate with one another by a webbed pipe *c*. This pipe connection *c* terminates in a cap *d*, and is formed integral with the body of the pump cylinder *b*, and adapted to be attached to the ram cylinder by forming on the lower side of the cap *d* a circular opening *f* having a threaded internal surface corresponding to the threaded top part of the cylinder *a*. The upper side of the cap *d* is also provided with a circular threaded opening *g*, the thread of which is of the same pitch as that usually adopted on the nipple of all vacuum gauges, so that the latter, when being tested, can be easily attached to the ram cylinder *e* by screwing the nipple thereof into the opening *g*.

The gauge is connected to the interior of the ram cylinder by a passage *h* bored vertically through the cap *d* in such a manner that it intersects the horizontal passage *c* connecting the two cylinders, this passage *c* being closed at its outer end by a removable plug *i*. This is provided with a milled head for opening by hand in order to adjust the pressure in the cylinder *a* by allowing air to leak in by a small hole 8 until the ram and weights float.

The cylinder *a* is closed at its lower end by a ram *e*, which moves vertically in the cylinder in consequence of the vacuum formed therein by the exhaust pump, these movements being limited by suitable stops carried by a bracket formed integral with the cylinder body. The ram *e* is efficiently rendered fluid tight in the cylinder by a packing between the ram *e* and the cylinder walls, preferably consisting in grooves *j* formed in the cylinder walls and adapted to be filled with oil.

When a vacuum exists in the chamber *a*, the ram *e* is subjected on its end surfaces to forces tending to raise it upwards, and the measure of the differences in the pressures external and inside the cylinder which produce these forces is obtained by attaching to the lower end of the ram *e* several weights or loads *m* to balance these forces.

The means by which these weights or loads are attached to the ram *e* consists of a cylindrical piece *n* attached to the lower ram *e* by being screwed to a projection *o* formed on the ram *e*, and in order to prevent this screwed part from becoming unscrewed a lock nut or split pin is provided. A hollow or tank on the upper side of the piece *n* receives any drops of oil leaking from the ram cylinder. On the under side of the piece *n* a rod *q* is pivotally mounted, this rod having at its other end a washer *s* screwed thereto for the purpose of carying the weights *m*. These weights *m* preferably take the form of discs, each having a hole placed centrally therein, and a cut extending radially from the hole to the outer edge of the disc, so that the discs can be placed on the top of the washer *s*, with the rod *q* passing through the central hole of each without necessitating the removal of the washer.

Situated at the side of the ram cylinder is the exhaust pump *b* used for producing a vacuum in the chamber of the cylinder *a*. This pump is of the reciprocating type, and has a plunger *t* which is moved within the cylinder of the pump by means of linkage, this plunger *t* closing the lower end of the cylinder *b*. The plunger *t* is suitably rendered fluid tight in the cylinder by use of a groove *p* similar to that used as packing for the ram *e* in the cylinder *a*, and connected thereto by a pipe *v*, the oil being supplied to both grooves from a common oil reservoir 4 connected by a passage with the groove *p* and placed on top of the pump cylinder.

The linkage adopted for moving the plunger *t* consists of a forked lever *x*, the forked part *l* of which is pivotally attached to the lower end of the plunger *t*, while the end of the forked part is fulcrummed to a swinging link *y*, which is pivoted to the body of the pump cylinder. The lever *x* is constrained to move through a definite distance so as to allow of a correct stroke being given to the plunger *t* by forming on the swinging link *y* two stops *z*.

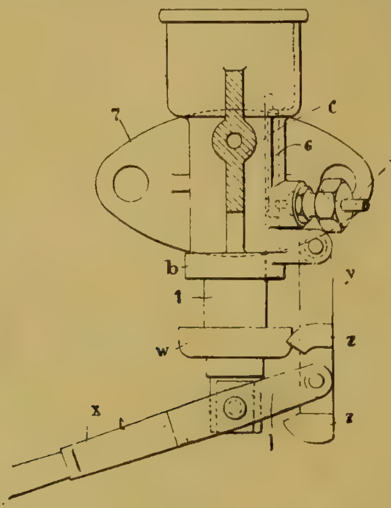

FIG. 2.

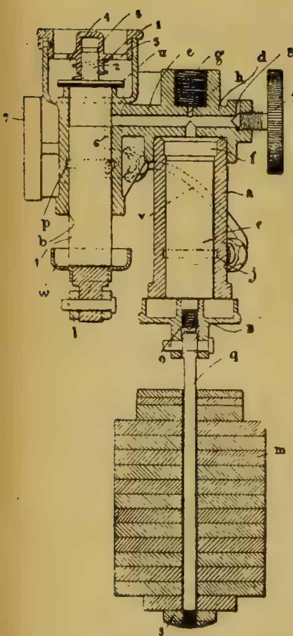

FIG. 1.

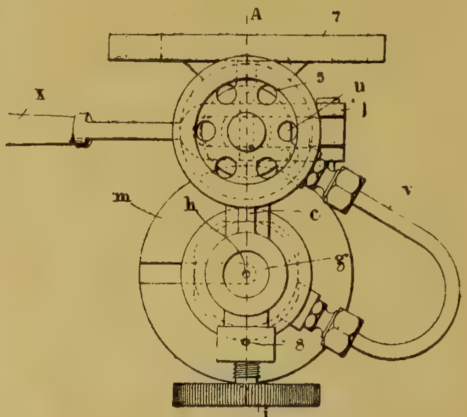

FIG. 3.

The upper end of the pump cylinder is closed by an exhaust valve *u*, which is of the poppet type and is immersed in the oil tank 4. This valve consists of a circular plate *u*, which closes the end of the pump cylinder, and is held thereon by a compressed spring 1, placed between the plate *u* and the lid forming tank 4. The plate is also guided by having on its upper side a projection 2, which is guided within a cap 3 formed in the lid 4. The lid 4 is screwed into the valve chamber and is formed as a tank to contain oil, which is allowed to cover the valve plate *u* by connecting the valve chamber with the lid 4 by several suitably placed holes 5. Any oil from the tank 4 which thus finds its way into the cylinder is caught on its exit therefrom by an oil seal cup *w* attached to the plunger *t* above the point of attachment of the operating linkage, while any superfluous oil in the pump cylinder is returned to the reservoir 4 on the plunger *t* lifting the valve plate *u*.

The advantage gained by using such a form of poppet valve is that the plunger *t*, on coming to the upper end of its stroke, raises the valve plate *u*, and eliminates any clearance volume at the end of the stroke.

As the plunger *t* is reciprocated within the pump cylinder, on the suction stroke air is sucked in through the passage *c* from the chamber *a* whenever the passage *c* is uncovered by the plunger; and on the return or exhaust stroke of the plunger *t*, the passage *c* is closed by the plunger and the air is exhausted through the poppet valve *u*. It will thus be seen that such an arrangement of the passage *c* relative to the plunger *t* dispenses with the use of a special inlet or suction valve, and forms also an exhaust valve for the ram cylinder.

The action of the apparatus is as follows:—

The gauge or the like having been connected to the ram cylinder by the screwed nipple, weights, proportional to the difference in pressure to be measured existing between the inside and the outside of the cylinder, are placed on the weight-carying rod and washer. The exhaust pump is then worked by means of the handled lever *x* for this purpose, care being taken that the plunger is moved the full length of its stroke and the tank 4 is kept full of oil, pumping being continued until the load is just lifted off the stops *k*. Under these conditions the degree of vacuum within the ram cylinder, and therefore within the vacuum gauge, being tested is measured by the combined weights of the ram, total load, rod and washer divided by the area of the ram subjected to the vacuum pressure. For convenience, this area is preferably made unital, say, one square inch.

When taking observations with the apparatus, the pump plunger should be at the top of its stroke and the ram floating between the upper and lower stops, and by gently taping or rotating the ram the errors due to friction may be eliminated.

MODERN AUTOMOBILE PRACTICE.

By A.M.I.A.E.

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(Continued from page 46.)

Two-cycle Motors.—*(Continued.)*

Port Sizes.—In a series of actual tests taken on an engine 4½ in. by 5 in. working on the three-port two-cycle, the compression pressure used was 49 lbs. and the best results were obtained with the inlet port 2⅛ in. by ⅝ in., by-pass 2¼ in. by ⅝ in., and the exhaust 2⅝ in. by $^{13}/_{16}$ in. This gives an average speed of the gas entering the crank chamber of 5 ft. per revolution, and allows for an expansion in the chamber of 1·058 to 1, and of a total expansion of the mixture after combustion of 1·6. These dimensions were considered to be quite reasonable, since the mixture would expand on entering the warm crankcase and would expand still more after explosion.

Cooling.—Much more heat has to be dissipated per square inch of surface exposed in a two-cycle than in a four-cycle engine, owing to the fact that there is an explosion every revolution. This is sometimes considered as being twice the amount of a four-cylinder, but such is not the case. The two-cycle cylinder is only exposed to the combustion flame for about half of the angular movement of the crankshaft, and consideration must be taken of the fact that with the two-cycle there are no valve pockets, and that the cylinder head is machined all over, but the cylinder does not receive the assistance of the cool, fresh charge every alternate stroke. When air cooling is employed care must be taken that the exhaust side has ample means for cooling, or distortion is liable to take place. The hottest part is, of course, the head..

Piston Head.—It should be borne in mind that if the piston above the top ring is appreciably less in diameter than the bore of the cylinder, then the piston ring and not the top of the piston determines the point of port opening and closing; it is probably preferable to reduce the piston head to such an extent that when expanded under normal working conditions it forms an easy working fit, it then acts as the point of opening and of cut-off, and furthermore protects the ring from rather severe usage.

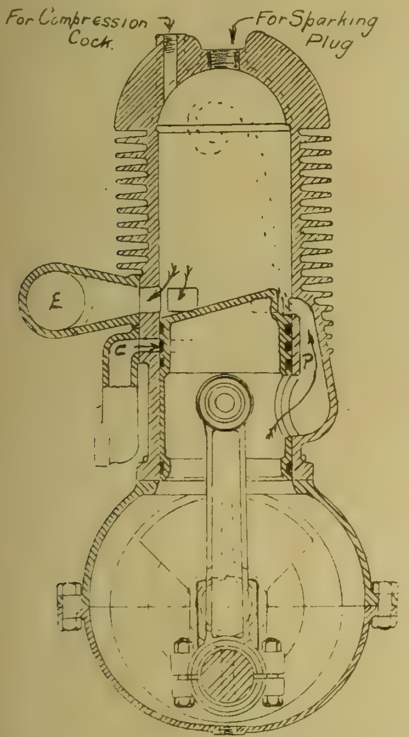


Fig. 11.—Section of "Chase" Three-port Air-cooled Two-cycle Engine.

Pressure Leakage.—This is generally assumed to be a very difficut problem, and certainly does require careful attention. The joint of the crankcase split need not be a difficult matter; a paper gasket should prove quite satisfactory. The greatest chance for leakage is along the crankshaft bearings, and attempts are sometimes made to prevent this by using a stuffing gland. Stuffing glands, unless very carefuly designed, are, however, not so satisfactory for a revolving shaft as for a sliding one, and are apt to wear a groove on the shaft, thereby increasing the chances of leakage. It will probably be found that the most satisfactory method is to employ bearings that will withstand wear and to make them longer than usual, and to lubricate them by a system of force-feed, the pressure of which should be slightly in excess of the pressure in the crankcase. The Trojan Company make their 1⅝ in. diameter crankshaft bearing 4 in. long, or 2·46 times the diameter, whilst their crank pin is 1⅝ in. diameter by 2⅛ in. long, or 1·3 times the diameter.

Lubrication.—When the above-mentioned system is employed the question of lubrication is much simplified, for if a slightly excess quantity is supplied to the bearings it will work its way through in both directions. That working through to the crankcase will be thrown about and will be sufficient to lubricate the cylinder and gudgeon pin, the oil coming outwards can be caught from an oil-thrower and drained down into a sump provided for the purpose. A method frequently employed is to mix the oil and the petrol together but this causes a rather high oil consumption.

Chase Air-Cooled, Three-Port, Two-Cycle, 18 H.P. to 20 H.P. Engine.—This engine is a three-cylinder one, 4⅛ in. bore by 4⅛ in. stroke, the lubrication system of which is exceedingly simple; all parts in frictional contact are lubricated by mixing the oil with the petrol before pouring into the tank. This mixture consists of 1 part of oil to 20 of petrol, so that if the engine is doing 25 miles to the gallon of petrol the oil consumption is two gallons per 1,000 miles, which is about double that of an ordinary four-cycle engine. However, it is claimed to be thoroughly satisfactory, even in the hands of inexperienced drivers, since it is impossible to wrongly adjust the supply or to forget to give it attention. It also has the advantage that the consumption is directly proportional to the output of the engine, and that over-lubrication with its attendant troubles and wastage are entirely overcome. With the exception of a greaser on the contact-breaker shaft, and the provision of an oil pipe to each of the main bearings for use with a hand pump as a stand-by in case of emergency, there are no other oilers or greasers on the engine. A section of this engine is shown in fig. 11, from which it will be seen that the engine, which is of the three-port type advocated above on account of its extreme simplicity, precompresses the charge in the crankcase; the mixture is drawn in through the carburetter port C, is compressed in the chank chamber, and then passes up the passage P, integral with the cylinder casting, through a hole in the piston. By this means the passage is greatly reduced in length and results in a reduction in the resistance to the passage of the charge from the crankcase to the cylinder. The bearings, which are of the phosphor-bronze type, are exceptionally long; the crank webs are separately balanced by means of counter weights, which also help to reduce the volume of the crank chamber, which consists of iron castings split on the crankshaft centre. The piston head, it will be noticed, is slanted down from the top of the deflector plate towards the exhaust port, as previously shown in figs. 8 and 9. The cylinders have annular flanges cast integral with them, and vertical flanges on the head. With this system a rather novel type of fan is used; the flywheel is cast in the form of a paddle wheel, sucking the air in at the hub and driving it out at its periphery like an ordinary centrifugal fan, the air being so guided that it is drawn across the radiating fins of the cylinder and forms an efficient method of cooling. The connecting rods are stamped H section, and carry hollow gudgeon pins as shown in fig. 11.

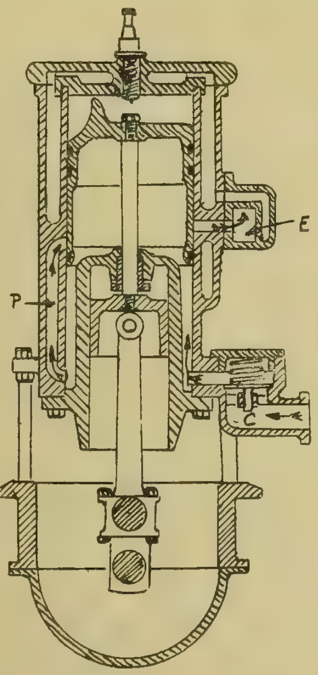


Fig. 12.—Sketch of "Palmer-Moore" Tandem Pump Two-cycle Engine.

$$\text{The } \frac{\text{stroke}}{\text{bore}} \text{ ratio} = 1.$$

Palmer-Moore Tandem-Pump, Two-Cycle Engine.

In this engine, which is shown in fig. 12, the charge is not compressed in the crankcase as in the last example, which is illustrative of the general practice, but is compressed in a closed chamber underneath the piston; by this means any desired precompression can be obtained, that usually employed by this company being 12 lbs. per square inch, which is higher than standard practice. The example shown in fig. 12 is that of a marine type in which the crankcase is left open, but for road vehicles this is enclosed in a sheet-metal cover to prevent the entrance of dirt; one would think that the prevention of the entrance of salt water was just as important, and it is therefore somewhat curious why the marine type is not also enclosed. The action of the engine is as follows: The mixture is drawn in through the carburetter port C by way of the spring-loaded non-return valve shown on the right-hand side of the sketch; as the piston descends, the mixture is compressed in the place above the cylindrical-shaped cross-head guide, which contains a gland to prevent wastage of pressure, the compressed mixture then passing up the passage P in the ordinary way and subsequently out of the exhaust port E.

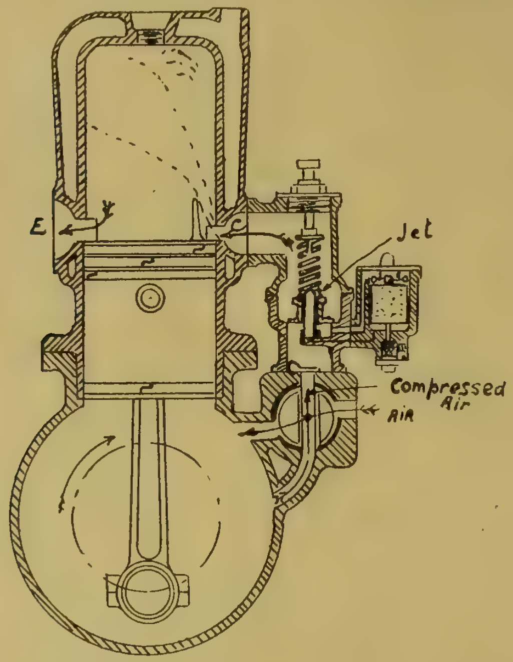


Fig. 13.—Section of "Ulrich" Rotary Valve Two-cycle Engine.

The engine is a two-cylinder, $5\frac{1}{4}$ in. bore by $4\frac{1}{4}$ in. stroke, 10 H.P., and runs loaded from 200 to 1,300 revolutions per minute.

$$\text{The } \frac{\text{stroke}}{\text{bore}} \text{ ratio} = \cdot 809.$$

This company prefers mixing the oil and petrol together before filling up, but also takes advantage of the practical impossibility of oil entering the cylinder from the crank case to also carry a large supply in the base for the big ends to dip in.

Ulrich Rotary-Valve Two-Cycle Engine.

This engine, which is illustrated in fig. 13, introduces a rotary valve mechanism to admit air to the crankcase under the influence of the suction due to the ascending piston and discharge it through the carburetter to the cylinder, as will be easily gathered by reference to the figure. The valve admits air to the crankcase when the piston is half way on the up-stroke, or 90 deg. past the bottom dead centre, and closes 20 deg. past the top dead centre; when the air is at about $3\frac{1}{2}$ lbs. per square inch pressure it is dicharged through the carburetter, thus forming the explosive mixture which passes direct to the cylinder. In order to assist in the rapid transfer of the mixture the rotary valve has a lead of $^{1}/_{16}$ in. to $\frac{1}{8}$ in. of its travel; the effect of this is to release the air from the crank chamber slightly in advance of the opening of the inlet port of the cylinder. The rotary valve, which is lubricated by splash from the crank chamber, is mounted on ball bearings, and to reduce its friction in the housing has a clearance of about $^{2}/_{1000}$ in. on the diameter. By this means, and in consequence of the low pressure in the crankcase, the oil film from the splash renders the valve practically air-tight.

Dolphin Separate-Pump Two-Stroke 30 H.P. Engine.

Instead of separately compressing the air in the crankcase, the Two-stroke Engine Company, of Horsham, who are the makers of the Dolphin engine, employ a separate cylinder. This is shown diagrammatically in fig. 14, where it will be seen that the mixture is sucked in through a non-return valve by the piston of the compressing cylinder; this piston is worked by a connecting rod operated off the chankshaft by being pivoted to the big end of the main connecting rod. Each working cylinder has one of these compressing cylinders mounted on the crankcase and at about 75 deg. with it, both pistons descending at the same time, so that the suction in the compressing cylinder occurs whilst the other is doing its work, but owing to the fixing of the connecting rods relative to each other, compression begins in the one whilst the exhaust ports E of the other are still uncovered; the new charge thus enters a second non-return valve in the head of the working cylinder and assists in the scavenging of it.

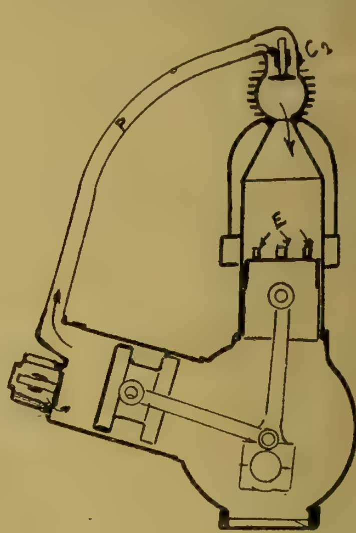


Fig. 14.

The engine has a bore of 102 mm. and a stroke of 102 mm., or a ratio of 1. The lubrication is by pressure, and the ignition by high-tension magneto, with accumulator and coil for starting, and to act as a stand-by,

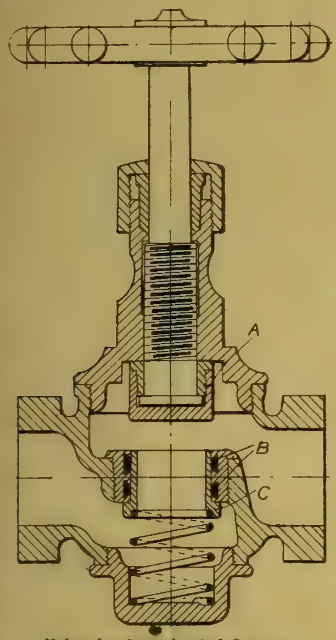
(*To be continued.*)

Forthcoming Colliery and Mining Exhibition.—The *Engineering Review* has organised a Colliery and Mining Exhibition to be held in the City Exhibition Hall, Manchester, in June and July of next year. Already the patronage of many well-known men and mining specialists has been secured for the enterprise. The hall has the advantage of being a permanent building, laid with a solid floor, and is situated in the centre of the town, within a few minutes reach of the principal railway stations. Exceptional facilities exist also for delivering heavy goods to the building, since practically only the width of the street divides it from the goods station of the London and North-Western Railway. The exhibitors themselves will form an Advisory Board to assist in the management.

AN IMPROVED VALVE FOR SUPERHEATED STEAM.

It is well known that steam under high pressure and temperature has a detrimental effect upon valve seatings, and after they have been in use for some time become scored. With the object of overcoming this defect, The Dover Engineering Works Ltd. have designed the valve illustrated below.

The valve proper A is of the cylindrical plug type, and joint is made with metallic packing B. The plug is free on the stem, and therefore does not rotate when the stem is screwed up or down. Fitting loosely in the valve seating is a shield C, which is kept in engagement with the same by means of a spring. The action of the improved valve is as follows: When the valve is open, the shield is kept up as shown in engagement with the valve seating, and protects same against the action of the rush of steam. When the valve is being closed, the plug A on descending meets the end of the shield and depresses it until the spring is compressed and the plug has passed well within the seating. When it is desired that the valve shall be only partly open, the steam passes through the opening formed between the underside of the plug and the upper end of the shield. Valves of this type have been tested to a pressure of over 1,000 lbs. per square inch and found absolutely tight. In order to test the wearing qualities of the plug and valve, a valve has been submitted to a test in a machine which opened and shut it 10,000 times, and after this it was tested by hydraulic pressure, and found to remain quite tight 800 lbs. per square inch.



Valve for Superheated Steam.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 14th July, 1910.

Dundee.—*First class:* G. A. Matthew, G. L. Lowson. *Second class:* G. L Ritchie.

Greenock.—*First class:* H. Wadsworth, J. Morgan, D. Brown, J. Morrison, J. Cowie, D. H. Montgomery, R. Stewart, J. T. Austin.

Hull.—*First class:* L. Myers. *Second class:* J. W. Martin, W. M. Topham.

Liverpool.—*First class:* G. N. Dougall, W. Callister, K. H. Adam, J. Buchanan. *Second class:* W. Griffith, O. Lancaster, J. Scott, C. J. Waller.

London.—*First class:* W. J. Philip, W. R. Nicholas, A. Dayes, N. A. McLean. *Second class:* C. W. Coppinger, W. O. P. Rance.

North Shields.—*First class:* A. E. Douthwaite, J. J. Ferguson, F. S. Kennedy. *Second class:* E. J. Chappel, M. McGillivray, R. G. Marsh, A. W. Thomas.

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"The Design and Construction of Oil Engines." By A. H. Goldingham. Third Edition. Revised and Enlarged. London: E. and F. N. Spon Ltd. Price 10s. 6d.

The relatively high heat efficiency of modern gas and oil engines have made them serious competitors of steam engines. They have practically ousted the latter for small and medium powers, and where gas can be manufactured cheaply they combine many advantages to the detriment of the steam engine, even for large powers.

This book has been written entirely upon the oil engine to meet the demand for a practical treatise dealing with the erection, testing, installing, running, and repairing, besides giving detailed descriptions of the essential parts of English and American types of engines. To bring it up to date, particulars of some of the recent oil-spraying and vaporising devices have been added, while the chapter on design and construction has undergone revision, and new matter included on testing. There are some new formulæ, and these have been checked and compared with the best types of engines now being built.

The instructions for running, where and how to look for engine troubles, are commended to the attendant. Some particulars are added of large size engines, with tests of the Diesel engine, and some useful information will be found on the various oils with their specific gravities, heating power, etc.

Taken in its entirety, this is a valuable work giving sound practical matter. It is simply and clearly written, and in conjunction with the many excellent illustrations is useful to student and practitioner.

"An Elementary Text-book on Mechanical Drawing." By J. E. Jaggers. London: Charles Griffin and Co Ltd. Price 10s. 6d.

The object of this book is to show the student how to acquire the ability to read with rapidity and accuracy mechanical drawings; to make drawings that may be easily understood by the ordinary workman; and to enable him to make use of the experience obtained by studying the examples in any future mechanical construction he may undertake.

The book, which is of large size, comprises 250 pages, and contains examples of drawings of machinery and apparatus that are found in connection with most branches of engineering, and likely to be most often met with.

The drawing implements required are explained; the method of preparing tracings and several examples are given on cloth, blue and white printing paper, also the correct method of geometrical projection.

All the illustrations show great care in preparation, and are fully dimensioned, each plate being accompanied with sufficient descriptive matter to make the reasons for the particular design clear. Personally we prefer to see drawings made with finer lines, but this is only one opinion, and does not detract from the merit of the work.

Among the many books we have met with, compiled to aid the youth who wishes to become proficient in machine drawing, we know of none which better attains its object.

"Electric Trains." By H. M. Hobart, M.Inst.C.E. London: Harper Brothers. Price 6s. net.

This author has already attained an enviable reputation in connection with his writings on electrical subjects, chiefly upon dynamo construction and design. He has been fortunate in this instance in dealing with a subject upon which there is a dearth of matter in a condensed form, and practically treated so as to be of use to those engaged in the design and operation of electric railways.

The subject is now already an important one, and the field so wide that the author has found it necessary to limit himself to the treatment of electric trains for city and suburban service to the exclusion of electric locomotives.

The opening chapter contains several diagrams and tables connecting speed and acceleration with time, also showing the effect of cut-off application of brakes, etc., and this is enlarged upon by considering the influence of stops and momentum, both of which are of considerable importance in a suburban service having frequent stops.

The author next explains a method of estimating the energy consumption of trains on the assumption of negligible train friction and of full efficiency of the electrical equipment.

The following portion deals with the efficiency of the electrical equipment of a train; includes a number of curves giving estimates of energy consumption and capacity of equipment, with a specification of a typical four-coach train on the Lancashire and Yorkshire Railway. Other chapters follow upon the determination of the efficiency of the electrical equipments of the trains on the Central London Railway, the analysis of energy consumption on the Great Northern, Piccadilly, and Brompton Railway, tractive force and acceleration, train friction, and the predetermination of the power curve.

We are given some important particulars of the Midland Railway Company's electrified section at Morecambe, the first single-phase system to be worked in this country, some notes on the heating of railway motors due to the internal losses, and the weights and costs of electrical equipments.

The value of the book is greatly enhanced by the large number of tables—64 in all—most of which are the results of actual tests. From the amount of information collected, the author is able to draw valuable conclusions, which will no doubt have their influence in guiding railway engineers towards their decisions.

The whole work, while being of a high order, is quite free from involved mathematics, the idea throughout being to bring the subject down to its most matter-of-fact and logical conclusions, based on the best and most recent practice.

We heartily commend this work as the best digest on electric train service that has been brought before the public.

Books Received.

"Patents and Designs: The Law and Practice Relating Thereto." By D. Fulton. Fourth Edition. London: Jordan and Sons Ltd. Price 15s.

"Experimental Applied Mechanics for Technical Students." By James L. Maxim, B.Sc. (Vic.). London: Longmans, Green and Co. Price 2s.

"Practical Electro-Plating." By G. Gentry. Marshall's Practical Manuals, No. 9. London: Percival Marshall and Co. Price 1s.

Ferro-concrete Bridge.—A new ferro-concrete bridge is being constructed across the Stour, near Long Melford. The structure will consist of three spans of 31ft., the ends being supported upon four rows of ferro-concrete piles. The piles are 16 in. square by 35 ft. long, and the two end rows are placed about 9 ft. from the abutment walls. Arched main beams 3 ft. deep at the haunches and 1¼ ft. in the centre by 9 in. wide are supported directly upon the piles, and cross beams 9 ft. 9 in. long by 5 in. wide and 12 in. deep are placed at 5 ft. intervals. A 20 ft. roadway between kerbs and a footpath at each side will be provided, the footpath being supported by corbels placed at every 10 ft., with an overhang of 18 in. The ferro-concrete decking will be 5½ in. deep under the roadway and 4 in. under the footpaths.

THE GRILLE WATER-TUBE BOILER.

This boiler, which is used a great deal on the Continent, is now being placed on the market in this country by The British Grille Water Tube Boiler Co., of Craven House, Kingsway, London, who have made arrangements with Messrs. Fraser and Fraser Ltd., of Bromley-by-Bow, London, E., for its manufacture, and through the courtesy of the former company we are enabled to give the following description and illustrations of the principal features. Referring to the illustrations, fig. 1 is a sectional view of the boiler, fig. 2 is a sectional elevation showing a system of reverse circulation for maintaining the boiler free from scale, fig. 3 is a view illustrating the method adopted for bringing the drum and boiler tubes clear of the boiler casing for inspection, and fig. 4 shows an installation of boilers and superheaters at the Lesquin works of the British Thomson-Houston Co., France.

The steam and water drum R is provided with upper and lower cast-steel headers G, which are united by U tubes. The drum has riveted to it at each end a steel standard J.

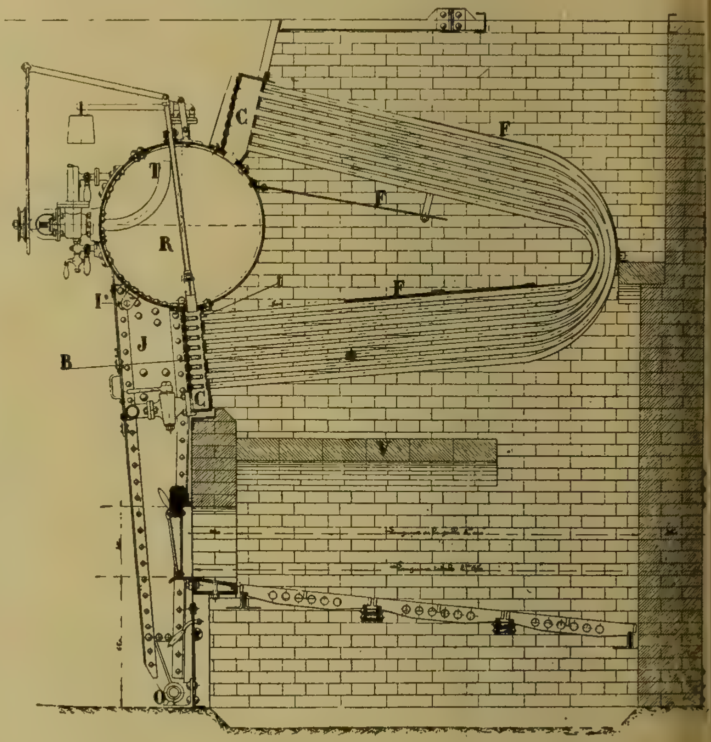


Fig. 1.

These steel standards are pivoted to the general framework at O, and the steam and water drum R, when in its normal position, shown in fig. 1, fits into a segmental recess in the framework, the arc of contact being packed with asbestos. On each arm J a bracket is provided which is engaged by swing bolts on the framework, thus holding the tubes and drum in their normal position; but when it is desired to inspect the drum tubes, etc., they can be swung round the pivot O free of the framework, as illustrated in fig. 3. A jack is provided to facilitate this operation, attached by an eyebolt to the boiler and also to an eyebolt anchored to the ground. Baffle plates F are provided to deflect the furnace gases passing to the flue. Each of the headers is divided into sections, and communication between the drum and lower header sections can be shut off by means of valves A (fig. 4), one only being shown, the blow-off cock B being then opened. A reverse flow takes place owing to the pressure of steam, which blows the water out of the tubes, the steam at the same time scouring and removing any deposit adhering to the tubes. As showing the effectiveness of this system of removing scale we give the following particulars of an inspection made by the Inspector of the National Boiler and General Insurance Co. Ltd. on a boiler erected at the works of Messrs. Fraser and Fraser Ltd. The boiler generates 3,300 lbs. of steam per hour on natural draught, and 6,600 lbs. on forced draught with 2 in. pressure. Prior to erection in England, it ran 2,800 hours at the Bordeaux Exhibition, 1907, and since then 1,800 hours at the above works. The feed water was supplied direct from the East London supply mains at atmospheric temperature, which contains a large proportion of mineral matter in solution. One of the outer tubes, subject to the hottest furnace gases, was selected and cut into short lengths so that the inside could be examined, and it was found that there was practically no deposit, the draw marks being still distinctly visible.

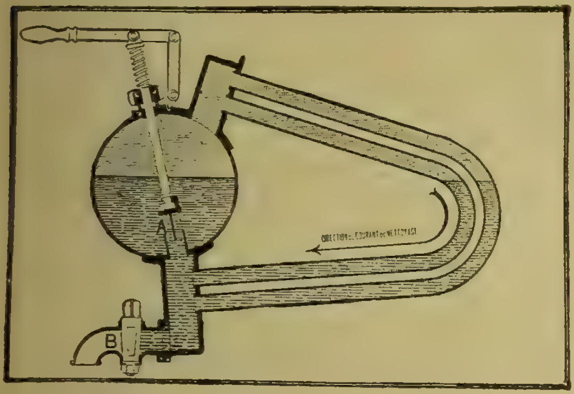


Fig. 2.

Fig. 4.

An arrangement is also made in the boiler for cleaning the exterior of the tubes of soot, which consists in directing a steam jet through hollow stays, which connect the header sections, on to the tubes.

Another feature of the boiler is the system of Solignac tuyeres, which are placed in the ends of the tubes attached to the lower headers, and by which, it is claimed, the amount of water admitted is restricted to that required for effective evaporation. The Grille boiler gives an evaporation of 6 lbs. of water per hour per square foot of heating surface, water-tube boilers generally evaporating 3 lbs. of water per square foot of heating surface per hour. On normal duty and with natural draught of ½ in., the efficiency is 76 per cent. The boilers are adapted both for marine and land work, and superheaters and economisers have been designed for use in conjunction with same.

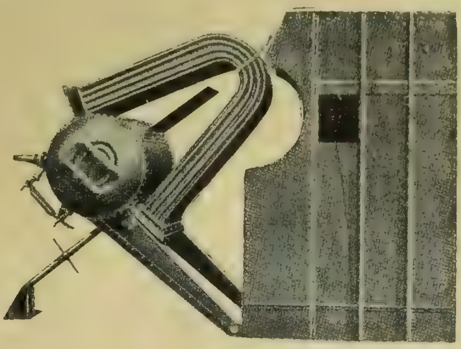


Fig. 3.

The dimensions of an installation for evaporation of 2,200 lbs. of water per hour are as follows:—Height, 12·5 ft.; distance from back to front, 8·5 ft.; breadth measured along the front varies with the horse-power, and is regulated by the number of sections, each section being 13·6 in. wide. We give below some tests made on Grille boilers at the Thomson-Houston Works and on the French torpedo boat Kabyle.

Tests of Boilers at the Thomson-Houston Works.

The Trials were Made on One Set of Twin Boilers.

	Natural draught.	Artificial draught.
Duration of trial ....hours..	3	3
Steam pressure per square inch............lbs...	210	200
Temperature of feed water ....deg. Fah.	74	92
Total grate area per set............sq. ft...	76	76
Ditto heating surface ....sq. ft...	2200	2200
Rate of combustion per hour per square feet of grate ....lbs...	15	31
Draught on water gauge ....inches..	0·5	2
Water evaporated ....lbs...	33026	64834
Ditto evaporated per lb. of combustible ....lbs...	9·63	9.01
Ditto from and at 212 degrees Fah. ....lbs...	11·55	11

Tests on Grille Water Tube Boiler on board the French Torpedo Boat "Kabyle" by the Naval Authorities at the Dockyard, Toulon.

Date of trials during 1909	Jan. 14th.	Jan. 23rd.
Duration of trial ....hours..	8	4
Steam pressure per square inch............lbs...	210	210
Grate area ....sq. ft...	22·8	22·8
Total weight of coal burned ....lbs...	3716	5575
Ditto per hour ....lbs...	464	1393
Ditto water evaporated............lbs...	35913	48300
Temperature of feed water ....deg. Fah...	77	77
Water evaporated per hour ....lbs...	4489	12075
Ditto per lb. of coal ....lbs...	9·66	8·7
Ditto evaporated per square feet of heating surface per hour ....lbs...	6·74	18·1
Moisture of steam ....per cent...	0·007	0·0083
Ditto allowed by contract .... per cent...	2·5	2·5
Draught ....ins...	0·75	4·75

BOILER EXPLOSIONS.

Abstracts from Recent Board of Trade Reports.

Explosion from a Boiler.

Report of Preliminary Inquiry, No. 1,919.—The explosion occurred at The United Alkali Co., Ltd., Ammonia Soda Works, Fleetwood. The boiler is of the Stirling Water-tube type, having three steam drums, 12 ft. 10 in. long by 42 in. in diameter. The steam and mud drums are connected by four bays of weldless steel tubes, in four rows of 19 each, making 76 in each bay and 304 tubes in all. There are also a few rows of tubes connecting the drums in a horizontal direction. The tubes are not screwed at the ends, but are fastened to the tube plates by expanding the ends. The steam drums are surmounted by a steam receiver 11 ft. long by 42 in. in. diameter. The steel tube plates are $\frac{5}{8}$ in. thick, and the tubes No. 9 J.W.G. in thickness and $3\frac{1}{4}$ in. external diameter. The usual mountings are provided on the boiler. The explosion was caused by a tube end gradually working in the tube plate until it eventually lost its grip and was blown completely out of position by the steam pressure acting on the bent pipe, no adequate provision having been made to prevent such a contingency. No one was injured by the explosion.

Explosion from a Heating Apparatus.

Report of Preliminary Inquiry, No. 1,920.—This explosion occurred at Greenlaw Parish Church, Greenlaw, Berwickshire. The boiler consists of a tubular coil, such as is usually fitted to Perkin's patent high-pressure heating apparatus. It supplies hot water to a system of heating pipes in the church, and is composed of two rectangular coils of piping, each coil consisting of rather more than six complete turns. The turns are pitched sufficiently apart to allow those of the one to lie between those of the other coil. The coils are made from butt-welded iron pipe $^7/_{32}$ in. thick, $1^5/_{16}$ in. in external diameter, and $\frac{7}{8}$ in. in internal diameter. The several lengths of pipe are joined together by couplings screwed with right and left-hand threads. The outer and larger coil is $21\frac{1}{2}$ in. long by 13 in. broad, measuring from centre to centre of the pipe. The other coil is 18 in. long by 13 in. broad. The coils are enclosed by a casing of sheet steel $^3/_{16}$ in. thick, with base and top plates of cast iron, $\frac{5}{8}$ in. thick. A cast-iron plate $\frac{5}{8}$ in. thick, resting on angle bars, supports the coils and brickwork. The explosion was of a violent character, and coil was ruptured at a point in the third turn. Its position was on the side next the fire, within the zone of most intense heat. The explosion was caused by a fire having been kindled in the boiler while some vital portion of the system was obstructed by ice. No one was injured by the explosion.

Explosion from a Main Steam Pipe.

Report of Preliminary Inquiry, No. 1,921.—The explosion occurred on the s.s. Uranium whilst the vessel was off the Royal Sovereign light vessel, near Beachy Head. The pipe was 11 in. in internal diameter and about 11 ft. long. It was made from copper sheets No. 1 B.W.G. (*i.e.*, 3 in.) in thickness. The sheets being bent into semicircles and shaped to the desired form, the edges were scarphed and brazed together, thus forming a somewhat irregularly shaped bend with double brazed joints. Copper collars, ·348 in. in thickness, were then brazed on the ends of the ends of the pipe to form lips or faces for jointing by means of Pope's patent flanges. It was further strengthened by round steel hoops shrunk on about 5 in. apart. Several repairs were made to the pipe, a new end ring being brazed on owing to the collar jointed to the throttle valve chest having cracked at the root of the fillet. An expansion joint was also fitted to the range to give the pipes more flexibility and freedom, the adjoining length being shortened to permit this arrangement. On another occasion when the pipe failed a heavier end ring was brazed on, and a few places in the seams had been repaired at various times. The pipe cracked circumferentially for a distance of about 15 in. around the neck of the end ring next to the expansion sleeve. The full boiler pressure is 180 lbs. per square inch, but the steam pressure at the time was about 155 lbs., the reduction being due to cleaning fires. The cause of the explosion was due to the material being unable to withstand the stresses caused by the structural movement of the machinery and the vessel generally. No one was injured by the explosion.

Explosion from a Main Steam Pipe.

Report of Preliminary Inquiry, No. 1,922.—The explosion occurred on the steamship Formby, when the vessel was about eight miles north-west of the Skerries on a passage from Dublin to the Mersey. Steam is supplied to the propelling machinery by a cylindrical single-ended boiler. The main steam pipe, which was made from a copper tube with a brazed longitudinal seam, was bent at right angles at each end to a mean radius of 21 in. It was fitted with brass flanges about $11\frac{1}{2}$ in. in diameter, one of which was connected to the boiler stop-valve chest by eight bolts $\frac{7}{8}$ in. in diameter, and the other was similarly secured to the stop-valve chest on the engine. The distance between the centres of the flanges was about 8 ft. 1 in., while the ends were 2 ft. 7 in. and 1 ft. 11 in. in length at the boiler and engine ends respectively. It was $5\frac{1}{4}$ in. in internal diameter and 7 B.W.G. in thickness. The pipe was repaired some months prior to the explosion, and was found to be fractured at both ends, close to the flanges. The defective ends were cut off, and the flanges rebrazed on the pipe. It was then tested by hydraulic pressure to 250 lbs. per square inch. The pipe fractured close to the flange on the engine stop-valve chest for $1\frac{1}{2}$ in. circumferentially, and the fracture subsequently extended to about 3 in., steam escaping therefrom until the vessel reached port. The explosion was primarily caused by excessive vibration set up by the pitching of the vessel and the heavy racing of the engines during stormy weather, the vessel being in ballast at the time.

MACHINING DOUBLE-BEAT REGULATOR VALVES.

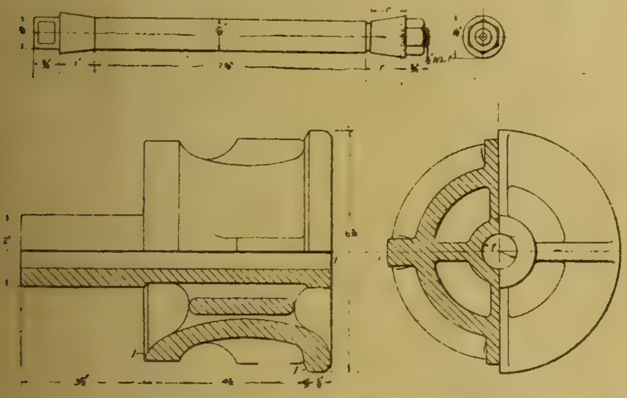
[CONTRIBUTED]

The locomotive type double-beat regulator valve shown formed the subject of an order passing through the shop, and of which quantities did not permit extensive outlay for equipment to deal with them.

The surfaces to be machined are marked *f*, and the requirements were that such surfaces be absolutely true relatively.

The casting is of a very close grey iron, with the two valve seats chilled, and as these seats are opposed, necessitating both internal and external machining, the job was precluded from grinding economically in the usual way.

The castings were first sent to a No. 3 Herbert turret lathe, where they were chucked by the shank and set true, rough drilled, opened out with a three-lip core drill, and finished to gauge by four-lip finishing cutter.



Machining Double-beat Regulation Valves.

They were then passed to an 8 in. centre lathe provided with a grinding attachment fitted to top slide of tool rest, which was capable of being set round to an angle in the usual way. Wheels up to 6 in. diameter could be used on the attachment with ample rigidity.

A special mandrel A was provided, carrying hardened steel cones B—one fixed and the other loose—with adjustment by end nut; mandrel ends were nicely centred and hardened, and the flat C accommodated driving dog screw.

The valve is adjusted on mandrel and hung on lathe centres, with shank towards poppet head. Using a 2 in. diameter wheel, shank is first ground to finished size, attachment is then swung round to required angle and top seating ground. Still retaining the angle, the saddle is run back to position for internal seating, which is then ground.

This method of dealing with the valves proved to be both expeditious and accurate, as with positioning pins for parallel and angle little time is required to set round, while the size of wheel used gives equal efficiency on side and face cutting for this work.

TRADE CATALOGUES.

A copy of a pamphlet of **Messrs. The National Time Recorder Co.,** London, has been forwarded to us from Mr. A. L. Curtis, of Chatteris, R.S.O., agent of the firm, giving particulars and information relating to time-recording instruments.

Messrs. The Electric Eclipse Co., of Bootle, Liverpool, have sent us a 12-page booklet containing particulars relating to their vacuum cleaners. Various constructions are illustrated, some of which are for hand operation and others for driving by electric motor, which may be connected to the usual electric light plug.

We have received from **Mr. E. E. Coy,** of Bootle, Liverpool, a circular, M/DI, giving particulars and prices of "Coy" small power motors, dynamos, and combined electric sets for accumulator charging, etc.

Messrs. Babcock and Wilcox, Oriel House, Farringdon Street, E.C., send us a booklet of their mechanical chain-grate stoker, containing 75 pages of particulars and special references to many leading installations.

We have received from **Messrs. The Rhineland Manufacturing Co.,** London, a copy of their catalogue list, No. 6, dealing with ball bearings. It contains particulars and illustrations of various designs and sizes of ball bearings and ball thrust bearings. In the front of the catalogue is a treatise of the theory of the ball bearing which gives the history of the art from the beginning of their use to date, and is based on a paper read by one of the managing directors of the firm. A copy of this catalogue will be forwarded by Messrs. The Rhineland Manufacturing Co. to any of our readers commercially interested.

Mr. W. P. Butterfield, Shipley, Yorkshire, has sent us his monthly list containing dimensions and capacities of riveted cisterns in stock on July 1st.

We have received from **Messrs. The Ragosine Co. Ltd.,** Bow, London, a 21-page catalogue giving particulars and prices of their colours, varnishes, enamels, etc. The firm will forward a copy of this catalogue to any of our readers who are interested.

Messrs. The Yorkshire Boiler Co. Ltd. have sent us their new 30-page catalogue of steam specialities. The first eight pages give valuable information regarding the Yorkshire boiler, and notes are also given in the following pages with respect to their fuel combustion indicator and torpedo smoke preventer, for which it is claimed that besides entirely stopping black smoke it makes a saving of 10 per cent for equal evaporation. It is also stated that the firm are prepared to issue licences to any approved boilermaker at a nominal figure for the right to manufacture the "Yorkshire boiler."

The **London Hydraulic Power Co.** has issued a new pamphlet containing illustrations showing the recent applications of hydraulic power on their system of distribution. This company supplies motive power in London from street mains on the high-pressure hydraulic system, available day and night all the year round, at a pressure of 700 lbs. per square inch. The company is supplying a very large amount of power for various purposes, and we may mention that at present there are 170 miles of hydraulic mains laid in the vicinity of the docks and other parts of London. The central stations are at Blackfriars, Grosvenor Road, Wapping, City Road, and Rotherhithe. The reservoir of power consists of accumulators loaded to a pressure of 750 lbs. per square inch, producing the same effect as if supply tanks were placed at 1,700 ft. above the street level. The water is taken from the Thames, the Regent's Canal, and from wells, and all sediment is removed therefrom by filtration before delivery into mains. The pamphlet is neatly got up, and in addition to a scale of charges to users and illustrations of pumping and other appliances, it contains a list of leading hydraulic engineering firms and a useful map of London from Kensington to Limehouse Reach and the West India Docks. The address of the company is Palace Chambers, 9, Bridge Street, Westminster, S.W., where all inquiries should be sent, and from whom copies of the above pamphlet may be obtained.

The **Skefko Ball Bearing Co. Ltd.,** Carlton House, Lower Regent St., send catalogue of the "S.K.F." ball bearings. These bearings are the invention of a Swedish engineer, and among the special features claimed we notice self-alignment which allows of deflection of shaft without injury, over twice the number of balls used in bearing to any other type of elastic cages, and, further, they are capable of withstanding axial as well as radial loads. A complete set of standard sizes are listed for light and heavy work of all descriptions.

THE JAPAN-BRITISH EXHIBITION.—III.

(Continued from page 82.)

The Hydraulic Engineering Co., of Chester, are showing a complete hydraulic installation. A set of three-throw pumps driven by an electric motor deliver 40 gallons of water per minute at a pressure of 700 lbs. per square inch. The pumps work in conjunction with an accumulator having a ram 12 in. diameter and a stroke of 12 ft., and are stopped and started automatically as the accumulator rises and falls.

Various hydraulic machines are shown in operation, comprising a boiler-feed pump, a deep-well pump as used for Artestian wells, a hydraulic jigger for lifting purposes, a Pelton motor, an automatic injector fire hydrant, an automatic ejector for draining basements, etc., and a hydraulic vacuum cleaner. In addition to these, the company's standard stop valves and "Thornton" lubricators are shown, as well as photographs of coal tips, etc.

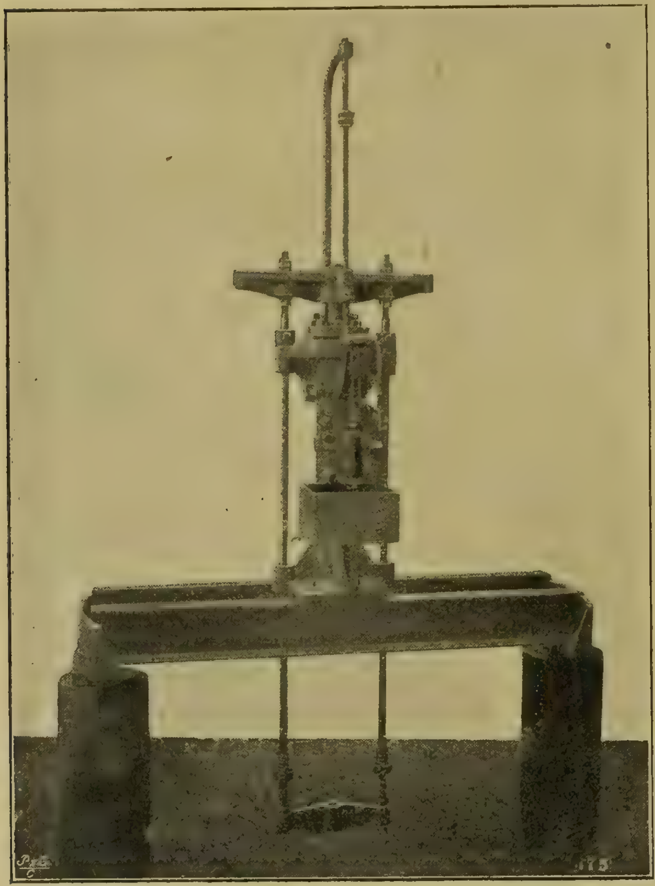


Fig. 1.

The boiler-feed pump is designed to deliver 2,000 gallons per hour against a pressure of 180 lbs. per square inch, and suitable for dealing with hot water. The pump is double acting, and is placed horizontally on a bed plate, between two hydraulic operating cylinders, which are fitted with pistons and rods. The rod from these cylinders and the pump rod are connected to a crosshead. Constant pressure is admitted to the annular space round the piston rod, and the other side of the piston is connected alternately to pressure and exhaust by the working valve, which is hydraulically operated by a small valve worked by a tappet rod from the crosshead.

The deep-well pump consists of a cylinder and ram placed vertically above the well, the ram pointing upwards. A crosshead on the top of the ram is connected by means of a rod on each side of the cylinder to the pump rod. The cylinder is connected alternately to pressure and exhaust by the working valve, which is hydraulically operated by means of a small valve, worked by a tappet rod from the crosshead. When the cylinder is connected to exhaust, the pump rod falls by its own weight.

The accompanying illustration (fig. 1) shows a hydraulic apparatus specially designed for working an Artesian well pump. A number of these have been installed in London, worked from the mains of the London Hydraulic Power Company, for the supply of water to large blocks of offices and residential flats where Artesian wells have been sunk. By the use of this hydraulic gear a supply of pure water raised from a depth of 300 ft. or more below ground can be delivered direct to a storage tank placed on the roof of the loftiest building, and a constant supply for domestic and other purposes thereby ensured. The whole apparatus mounted on the girders seen in the illustration is contained within a cast-iron cylinder at the top of the well, and everything stands below the ground level.

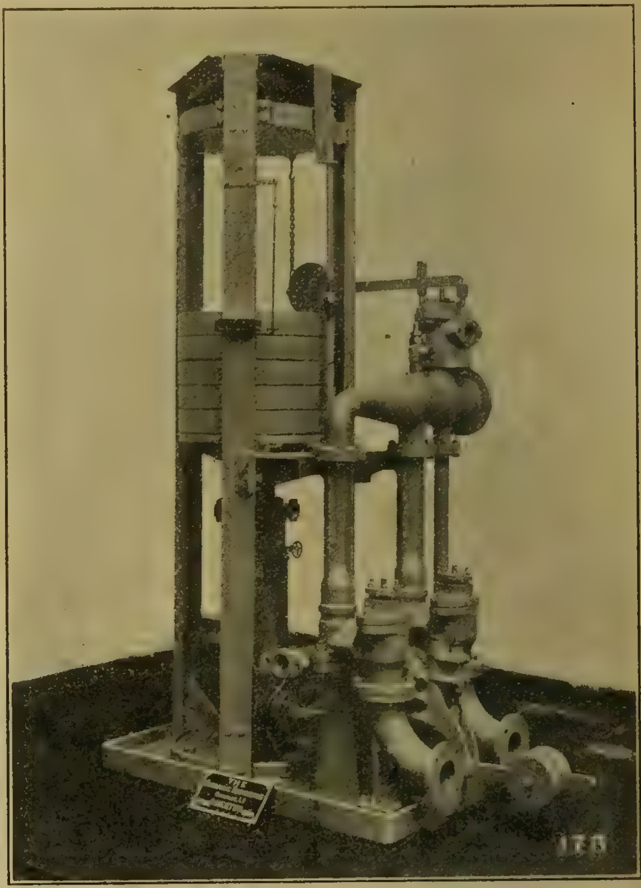


Fig. 2.

The set of three-throw horizontal pumps shown deliver 40 gallons per minute at a pressure of 700 lbs. per square inch. A small tappet switch, operated by the accumulator, starts them by means of an automatic starter when the accumulator falls, and stops them when it reaches the top of its stroke.

One of the most interesting of the company's exhibits, of which we give an illustration (fig. 2), is a patent hydraulic injector apparatus for automatic supply of water for fire extinction, used in connection with sprinkler systems and fire hydrants.

This apparatus maintains a constant pressure in the fire main, and when a hydrant is set to work, or a sprinkler comes into action, it automatically starts the hydraulic injector, which sucks water from a tank and delivers it at the required pressure. A small accumulator loaded to the required pressure, usually about 80 lbs. per square inch, is connected to the fire main. A hydraulic injector is connected at one end to the fire main, and at the other to a tank through a back-pressure valve. If a hydrant comes into action, the pressure in the main falls, the accumulator comes down, and by means of a tappet opens a valve and admits pressure water into the injector, which delivers water from the tank to the fire main. By means of a small leakage, the accumulator is allowed continually to move up and down slowly, so as to ensure that everything is kept in working order. We understand that a considerable number of these injectors have been supplied, and can be seen at work at the New War Office, The Admiralty, and in various other Government offices and works. They are also very extensively used by private firms in London and elsewhere. In the former district the apparatus combines the pressure from the London Hydraulic Power Company's mains, with water from a suction tank or direct from the mains of the Metropolitan Water Board.

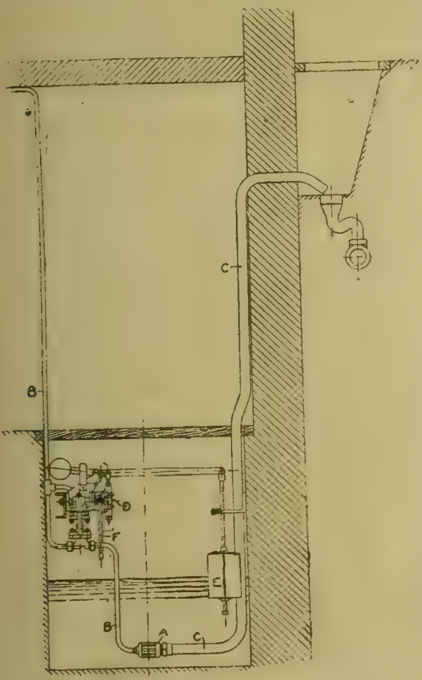


Fig. 3.

A simple but extremely useful and effective contrivance on exhibition is an automatic hydraulic ejector for emptying sumps and draining cellars, etc. It responds immediately to any rise of water in sump, will raise boiling or dirty water, and works night and day without attention. The ejector is placed at the bottom of the sump, the delivery being led to a main at a higher level. The pressure pipe is brought from the ejector to the operating valve placed above the sump. This valve is worked hydraulically by a small valve, which is connected to a float in the sump. The float rises with the water and starts the ejector. When the sump is empty the float shuts off the pressure water.

The apparatus illustrated (fig. 3) is designed to be worked at high pressure, such as is obtainable from the public hydraulic-power supply mains or from other sources of high-pressure supply. Where no such high-pressure supply exists, the apparatus can be adapted to work from the ordinary town water supply mains.

In the accompanying illustration, A shows the ejector with its suction strainer, B the hydraulic power supply pipe, C the delivery pipe, which may be carried to the nearest drain or other convenient means of disposal. D is the working valve; E the float which, by the rise and fall of the water in the sump, automatically controls the action of the apparatus; F is the discharge pipe from the working valve.

The vacuum cleaner shown on the stand consists of a form of hydraulic ejector, the suction pipe being connected to the nozzle of the former. The discharge is connected to the drain. When the apparatus is started by turning on the water, the dust, etc., removed by the cleaner is carried direct to the drain. Further information regarding the valuable exhibits and specialities of this well-known firm may be obtained at the company's stand in the Machinery Hall, or from their London manager, Mr. Calvert, at Palace Chambers, Bridge Street, Westminster, S.W., to whom we are indebted for the foregoing particulars and illustrations.

Mr. John Thompson, Wolverhampton and Dudley.—On Stand 121 and 122, opposite the Hydraulic Engineering Company's exhibit, in the Machinery Hall, Mr. John Thompson has an interesting exhibit of boilers and steel work.

Chief amongst these stand out a section of 30 ft. by 9 ft. 3 in. "Thompson" dish-end Lancashire boiler with corrugated flues. This firm was the pioneer of the dish-end type of boiler in this country. The ends are very massive, and are flanged under heavy hydraulic presses.

The chief advantages claimed for this type of boiler are: Greater freedom for expansion and contraction strains, no stays or stay rivets, neither longitudinal or gusset stays being required, and all rivets on ends being subject to shearing instead of tensile strain and the flues being carried well out; wet ashes do not lie against the front end to cause corrosion and pitting.

These boilers have been supplied for working pressures up to and including 230 lbs. per square inch, the shell being made of only three plates, and fitted with corrugated removable flues.

On this stand is also shown a model Lancashire boiler, fitted up with superheater and pipe work.

Superheaters are also shown, the one on the stand being of this firm's special straight-tube type, which gives a very high degree of superheat. For moderate temperature, this superheater is supplied with ordinary bent tubes; the bodies in either pattern being solid welded, and the taper caps patent metal-to-metal joint.

A steel chimney with base plate and cap is in the centre of the stand, and this is an exact model of a 100 ft. chimney. Steel chimneys are much cheaper than brick, and can be erected in a very short time. Mr. John Thompson has erected a steel chimney 120 ft. high, putting in brickwork foundations and lining with firebrick, the whole being complete in about 15 working days after the material arrived on the site.

Boilers with few plates are a speciality of this firm, and in a corner of their stand they have a vertical boiler 8 ft. high, the shell made in one plate only.

Welded petrol tanks, welded and riveted pipe lines of any diameter, together with pressed steel work, are all shown; the welding of these thin tanks reflecting great credit upon this exhibitor.

They also show some good samples of Lowmoor iron on a massive iron table, which we feel sure will be of interest to visitors.

Messrs. J. Hopkinson and Co. Ltd., of London and Huddersfield, have a neat exhibit of valves, including their patent full-bore parallel slide type. The most prominent feature, however, of their exhibit is the Hopkinson-Ferranti patent stop valve, of which they are the sole makers. The Hopkinson-Ferranti stop valve possesses all the features of the full-bore type, but as the discs are made of one material throughout, and they are of relatively smaller size, they are not so liable to leak. It is especially suitable to work with superheated steam, and costs and weighs less than the full-bore type, owing to the special "converging diverging" design of the steam passages. It is gratifying to note that Messrs. Hopkinson have been awarded a diploma for gold medal for their exhibit of boiler mountings and valves at the Japan-British Exhibition.

Messrs. Babcock and Wilcox Ltd., Renfrew, N.B., and Oriel House, Farringdon Street, London, E.C.—In the Machinery Hall, at stalls Nos. 13 and 14, this well-known firm are exhibiting, in operation, their patent tipping tray conveyor, many of which have been successfully installed in electric power houses, gas works, and other industries, for the mechanical handling of coal, minerals, etc. Their patent gravity bucket conveyor has been adopted in a very large number of works, and is in use at the Osaka Electric Light Company's Works, Osaka, Japan; and the South Manchurian Railway Co. Ltd. have also installed it at the Dalny Electricity Works.

At the same stalls are shown models of a land-type boiler, automatic water softener, and a collection of wrought-steel steam piping, boiler parts, turbine tube cleaners, etc.

The high appreciation in which the Babcock and Wilcox patent water-tube boiler is held by steam users throughout the world is seen from the fact that over 7,600,000 H.P. land-type, and over 1,900,000 H.P. marine-type boilers have been installed in all industries. In Japan alone some 144,000 H.P. are in use.

Messrs. The Beldam Packing and Rubber Co., 93 and 94, Gracechurch Street, London, E.C., have a varied collection of their specialities, including specimens of their patent pilot packing duplex type Excelsior metallic rings, corrugated metallic valves, patent serpent packing, pilot jointing and patent tube stopper, etc. They are also showing in working form an automatic whistle valve, known as the "Willett-Bruce" steamship whistle control, which has already been fitted on various ships belonging to the White Star, the Atlantic Transport, and other well known lines of steamers at home and abroad on the Continent.

Careful consideration of the whistle problem, and long experience of actual requirements, have led to the evolution of a system whereby the ordinary whistle arrangement is so modified as to provide both for clear blasts and automatic control.

Designed by Mr. W. J. Willett Bruce, R.N.R., superintendent engineer to the White Star Line, the first vessel fitted with the improved whistle control was the White Star R.M.S. Cedric, on board which the apparatus has now been at work for well over two years. During the last 12 months 11 steamers have been fitted, and 11 more building have it specified.

The primary object of the system is to provide means whereby the steam whistle may be sounded regularly and clearly when the vessels encounter fogs, and is obliged to comply with the usual signalling regulations. To effect this the apparatus includes a timing device, operating an electro-magnet which controls the whistle, the frequency and duration of the blast being controlled either automatically or by switch from the bridge.

Ease and rapidity in manipulation are afforded by the provision of bridge switches, so located that the officer in charge may instantly sound the whistle from whatever position on the bridge he may happen to occupy. These bridge switches are of the two-ways type, one contact closing the timing circuit, the other being for such hand signalling as may be required by the commanding officer. In addition to the foregoing, signals may be made at any time by hand lanyard, thus providing a stand-by available at all times, and quite independent of the electrical control. The whistle valve is so designed that the pull required in operating amounts to only some three pounds, irrespective of the boiler pressure.

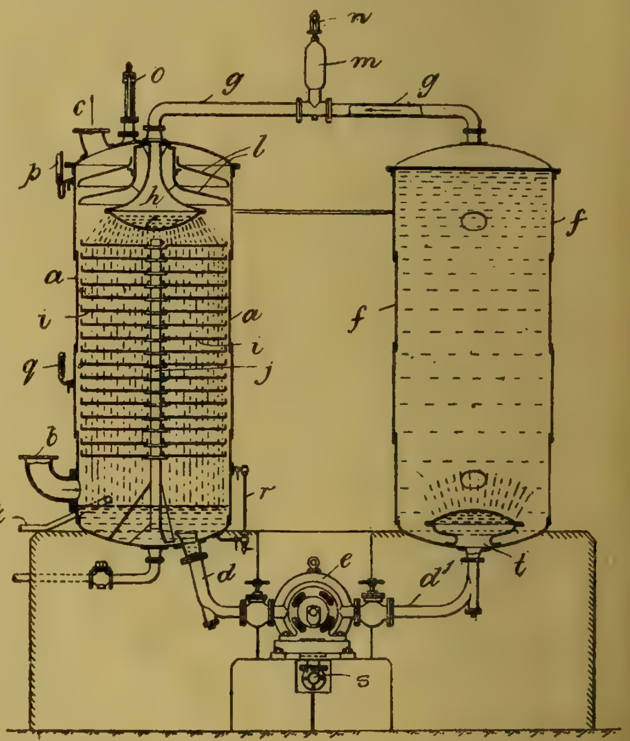
The working of this ingenious device would be better understood by a visit to Messrs. Beldam and Co.'s stand in the Machinery Hall, opposite the Osram Co.'s exhibit, where their representative, Mr. C. C. Speechly, would be pleased to explain the arrangement of the mechanism and the mode of operating the switches, etc., under the various conditions. We may mention that the above firm are also the London agents for the Ross-Schofield system of circulation in marine boilers, for which is claimed a saving in fuel, a reduction in boiler expenses, more and drier steam, and the prevention of corrosion, making zinc plates no longer necessary.

[P.S.—We are just informed that Messrs. Babcock and Wilcox have been awarded the Grand Prize for their tray conveyors, and that Messrs. Beldam Packing and Rubber Co. have been awarded a diploma for Gold Medal.]

(*To be continued.*)

UTILISATION OF EXHAUST STEAM.

In the utilisation of exhaust steam in connection with steam engines it has been suggested to allow the exhaust steam to come into contact with water in a vessel which communicates with another engine, and is subject to variations in pressure, so that the steam will be condensed and the water heated when an increase of pressure occurs, and steam will be generated when a decrease of pressure occurs.



In recent years apparatus in which condensation of exhaust steam and regeneration take place has been interposed between reciprocating engines and low-pressure turbines, the regeneration of steam serving to maintain a supply of steam to the turbines during short intervals when the exhaust steam from the reciprocating engines ceases.

The object of the following arrangement is to render apparatus wherein exhaust steam is condensed and regeneration of steam is effected more efficient.

Referring to the illustration the steam vessel *a* has an exhaust steam inlet *b* near the bottom and an outlet *c* for regenerated steam at the top; below the steam inlet is a water outlet pipe *d* leading to water forcing means, for example, an electrically-driven centrifugal pump *e*, for continuously withdrawing the water from the steam vessel *a* and passing it through the pipe d^1 into the lower part of the water vessel f, the top of which is connected by a pipe g to the upper part of the steam vessel a, into which the water passes through a perforated pipe or rose or spraying nozzle h. Between this nozzle and the steam inlet pipe are arranged a number of inclined or horizontal baffle plates i, perforated and saw-edged. These plates may extend in opposite directions so that the steam travels slowly upwards along a zig-zag path through a shower of water, but those shown in the illustration are circular in form and are mounted on a central column j supported from the bottom of the vessel. The edges of the plates may also be supported from the shell of the vessel. The plates may each have an enlarged opening at the side remote from the openings in adjacent plates to lengthen the path travelled by the steam; usually they would be of segmental form. The steam vessel is provided with an overflow pipe k to maintain the water level constant and check or back pressure valves are fitted in the water pipes d, d^1.

A number of perforated baffles l are provided to separate water and oil from the steam before it reaches the steam outlet pipe c. These baffles may be of conical shape arranged around the water inlet pipe above the perforated pipe rose or nozzle, as shown.

An air chamber m and relief valve n are fitted on the water pipe g or on the upper part of the water vessel f, and the steam vessel is fitted with a safety valve o, pressure gauge p, themometer q, and water gauge r.

There is a connection s from the water mains for the supply of water to the vessel f.

In order that the water passing into the water vessel may not be forced by the pump in a stream of comparatively small cross-sectional area through the body of water in the water vessel towards the outlet to the steam vessel, means are provided for causing prompt distribution of the incoming water throughout the area of the water vessel. In the arrangement illustrated the water is passed into a chamber t arranged in the bottom of the water vessel f and having a perforated top which is shown arched, curved or dome shaped after the manner of a perforated rose or cone of sufficient size to ensure an easy and distributed flow of water. Such a chamber may be formed by a perforated partition extending across the water vessel near the bottom. By the adoption of the chamber a temporary dwell is given to the entering water, and it is caused to spread out at the bottom of the vessel and to rise evenly up the vessel over the whole area and in a more uniform mass than would be the case if the rush from the force pump were not broken.

The joint patentees of this invention are Messrs. J. Musgrave and Sons Ltd., of Bolton, Mr. H. Cruse, and Mr. P. C. Pope.

INTERNAL-COMBUSTION ENGINES FOR MARINE USE.*

By W. E. Cummins.

We are not yet in sight of the gas engined battleship or Atlantic liner, but steady progress is being made with engines of small power, and the problem of larger powers is now being tackled by several engineers. The first question which arises is, Will the engine of the future be a gas turbine?

As there are, so far as the writer is aware, no practical examples of such a machine in use, the probability is that the reciprocating type of engine will be developed first, at any rate, until something practical is evolved in the way of a gas turbine. The first consideration is that of fuel.

The fuels at present used in connection with internal-combustion engines are coal, anthracite and bituminous, coke, crude petroleum, paraffin, petrol, and alcohol. For commercial marine use cheapness of fuel is essential, and the choice would naturally fall on coal, except in certain parts of the world near oilfields, where it would pay to use crude petroleum. Petrol is quite out of the question owing to its prohibitive cost. Coke, unless sold as a bye-product, would be too expensive. Alcohol may perhaps in the future be able to compete with petroleum.

The use of coal as a fuel involves, of course, the provision of a gas producer and its accessories, and in comparing a plant composed of engines and gas producers, with a plant using petroleum direct, either on the Diesel or vaporiser system, due account must be taken of the additional space required for the former plant, its extra cost, and the value of the extra space occupied, compared with the dearer fuel of the latter plant.

The most successful gas producers from the point of view of easy and reliable working are those using anthracite fuel. On account of the extra cost of this fuel, as compared with ordinary bituminous coal, it will be essential if the best fuel economy is to be obtained to have producers capable of dealing with all qualities of bituminous coals such as are now sold as steam coal. At the present time, owing to the trouble caused by the formation of tar and other difficulties, producers dealing with bituminous fuel are not entirely satisfactory, but no doubt in the near future the necessary improvements will be effected to enable ordinary bituminous steam coal to be used successfully.

The next question to be considered is, which type of internal-combustion engine will best fulfil the somewhat difficult conditions imposed by marine necessities?

These conditions are—

(1) Absolute reliability.

(2) Capability of continuous non-stop running for long periods.

(3) Capability of running in either direction and of being started with absolute certainty from any position of the cranks, without the use of barring gear.

(4) Capability of working economically at various speeds.

(5) Complete accessibility of all working parts for examination, overhauling, and repair.

With reference to the first two conditions, great advances have been made of late years in this direction.

Greater attention has been paid to arrangements for lubricating the various working parts satisfactorily, ignition methods have been improved, and details generally brought to perfection.

There are, however, some difficulties to be overcome yet mainly due to producer troubles and unclean gas causing deposits of tar and other impurities on the valves and internal working parts.

Coming to the third condition, viz., capability of running the propeller in either direction and of being started from any position without the use of barring gear, this brings us to one of the greatest difficulties experienced in adapting the internal-combustion engine to marine use.

There are two ways of tackling the problem. First, by running the engine in one direction only and interposing some kind of coupling between the crankshaft and the propeller shaft, by which reversing of the rotation of the propeller shaft may be effected, or second, by the direct coupling of crank and propeller shaft as in a steam engine and making the engine itself capable of reversing. Several methods of carrying out the first arrangement have been used and proposed, a few of which may be mentioned here.

There is the ingenious Paragon system of Mr. William P. Durtnall, in which a dynamo and motor are interposed between the crankshaft and the propeller, by which reversing and also speed variation is effected. For smaller powers bevel gearing has been used to effect the necessary reversing motion.

Other systems which have been suggested are the interposition of an hydraulic pump and motor between the crankshaft and propeller shaft, and Mr. Dunlop's system in which the connecting medium is compressed air; where reversing is effected by gearing some form of clutch is generally used, which also enables the engine to be started up with no load on. For small powers there is no vital objection, except that of complication, against clutches and spur gearing, but when larger powers have to be dealt with there are serious mechanical difficulties to be overcome, and these difficulties have induced engineers to study electrical and other methods of coupling.

In the writer's opinion, all these coupling devices are more or less temporary measures rendered necessary in order to adapt the internal-combustion engine as used for stationary work to the different conditions required for marine work.

Sooner or later, on the score of simplicity and cost, all gearing between the crankshaft and the propeller shaft will be abolished, the engine being coupled direct as in a steam engine.

The present systems, actual and proposed, may be considered as a stage on the road towards direct coupling. In the early days of steam marine engineering gearing was used between the crank and propeller shafts to keep down the speed of the engine to what was in those days a standard.

It was only a question of time to make the necessary modifications to the engine to enable it to run at the same speed as the propeller. In the same manner marine engineers will now no doubt set themselves the problem of making the internal-combustion engine into a satisfactory reversing machine with adequate provision for speed variation, thus dispensing with all gear and enabling the crankshaft to be coupled direct to the propeller shaft. Fortunately, in this case, the revolutions most suitable for the propeller are also suitable for the engine, and there is no need to make compromises as regards revolutions, or adopt reduction gearing as in the case of coupling up a steam turbine and propeller.

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*Paper read before the Institute of Marine Engineers, at the Garden Club, Japan-British Exhibition, June 25th, 1910.

As regards the fourth point, viz., capability of working economically at various speeds, the conditions to be fulfilled are certainly difficult, if the internal-combustion engine is to be made as flexible as a steam engine.

The principal difficulty lies in the relation between the revolutions and power required for driving a ship at various speeds. The horse power falls at a much more rapid rate than the revolutions, as the speed of the ship is reduced. In a steam engine this reduction of horse power can be effected by cutting off earlier, and thus decreasing the mean pressure.

In an internal-combustion engine any decrease in power outside of that given by reduction of revolutions must be effected by cutting out explosions, or varying the strength of the explosive moisture, or both. In mercantile marine work sufficient reduction of the power for the range of speeds required can be effected by either of the above methods separately or combined. We can now proceed to discuss the type of engine which will best lend itself to the stipulated conditions. The choice lies between double-acting or single-acting cylinders, two-stroke cycle or four-stroke cycle engines.

The adoption of double-acting cylinders, although used on gas engines of a certain type for land use, would in the writer's opinion be a risky proceeding. It entails arrangements for cooling the piston and piston rod by water circulation, and trouble might arise from the use of salt water for this purpose.

The two-stroke cycle has so many advantages over the four-stroke in fulfilling the conditions laid down that it would appear to be far and away the more suitable for marine work. In the first place, it will run equally well in either direction with adjustment of the ignition. This simplifies the reversing problem immensely. In a four-stroke engine reversing gear would be required fro the inlet and exhaust valves. Also, as the two-stroke has an impulse every revolution, the cutting out of an explosion will have just half the disturbing effect on the uniformity of turning as that of a four-stroke. There are several other advantages of the two-stroke over the four-stroke which may be enumerated here.

In the first place, a cylinder of certain size arranged as a two-stroke will give twice the power of a cylinder arranged as a four-stroke, provided the number of revolutions is the same. This means a large reduction in the weight and cost of the two-stroke for a given power. Also an engine of certain size arranged as a two-stroke will develop the same power as an engine with same size cylinders arranged as a four-stroke at half the number of revolutions. This is an important consideration in engines of small power, as a slow-running and more efficient propeller can be adopted with engines of same weight and cost as the four-stroke type.

In the second place, as the two-stroke engine exhausts through ports in the cylinder wall, the hot gases do not pass through a valve. In the four-stroke engine the gases pass through a mechanically-operated valve, and it has been found necessary in engines of quite moderate power to have this valve water cooled. This entails a lot of complication, including flexible water connection to the valve spindle. Here, again, there would probably be trouble if salt water were used for cooling purposes.

In the third place, the impulse every revolution gives a vastly improved crankshaft torque over that of the four-stroke engine, permitting of a lighter flywheel and crankshaft. It is difficult to get a large flywheel effect in a marine engine, owing to the very limited diameter of wheel possible and the small number of revolutions.

The flywheel effect varies as the weight, and as the square of the speed of the rim, consequently a small diameter wheel entails a large weight to give the necessary effect. An irregular torque is said to be detrimental to propeller efficiency, but at the same time it is important that the flywheel effect be as small as possible, so that the engine may be stopped and started as quickly as possible. Here, again, the two-stroke has the advantage.

(*To be continued.*)

Large Mild Steel Plate.—A large mild steel plate, the largest ever produced in this country, was recently rolled at the Grimesthorpe Steel Works of Cammell, Laird, and Co. Ltd. The ingot utilised weighed 120 tons and had dimensions 9 ft. by 18 ft. 1 in. by 3 ft. 10 in., and the charge was obtained from three Siemens-Martin furnaces. The ingot was slabbed down under a 4,000-ton press to 12 ft. 9 in. by 9 ft. by 40 in., re-heated and rolled into a plate 18 ft. by 10 ft. 9 in. by 25½ in. The finished weight was about 65 tons.

TRADE NOTES.

Owing to the rapid increase in their business as lift manufacturers, **Messrs. Smith, Major, and Stevens Ltd.** have for some time past found their Battersea premises very inadequate for their growing needs, and have been compelled to provide new works which are now in course of erection at Northampton. The new premises will embody not only the most modern manufacturing improvements, but will provide also for the greater comfort and health of the workmen and staff. The new works are expected to be ready for occupation in the autumn. It is intended to retain a portion of the staff and workmen in London.

We understand that **Messrs. Heenan and Froude Ltd.,** Manchester, have received a contract from the municipal authorities of St. Petersburg for a large installation of plant for sewage disposal, water purification, etc.

We have reason to believe that **Messrs. Caird and Co.,** Greenock, have received an order for two large intermediate steamers for the Lund Line.

Messrs. Cammell, Laird, and Co. have received an order for a new steamship from Messrs. J. Nourse Ltd.

Messrs. E. Green and Sons are supplying a fuel economiser to the St. Annes District Council.

Order for 1,000 k.w. Turbine.—**Messrs. Parsons and Co.'s** tender for turbo-generator and condenser has been accepted by the West Bromwich Corporation.

The **British Westinghouse Co.** have an order from the Bury St. Edmunds Corporation for a 200 k.w. Bellis-Westinghouse steam dynamo with pipe work and switch gear.

LAUNCHES AND TRIAL TRIPS.

Usworth.—This screw steamer, built by Messrs. John Readhead and Sons Ltd., for the Gordon Steam Shipping Co. Ltd., of London, was launched on July 6th from the West Dock Shipyard, South Shields, and is of the following dimensions: Length overall 333 ft. by 48 ft. beam by 23 ft. 10 in. depth moulded. The engines and boilers have also been constructed by Messrs. John Readhead and Sons Ltd., the cylinders being 23½ in., 39 in., and 64 in. diameter, by 42 in. stroke, with two boilers 180 lbs. pressure. The vessel is built to Lloyd's highest class and to their special survey, and has also been under the superintendence during construction of Mr. W. Gates, the Gordon Co.'s superintendent.

Bideford.—On July 4th the steel screw steamer Bideford, built by Messrs. Craig, Taylor, and Co. Ltd., Stockton-on-Tees, for Messrs. W. J. Tatem and Co., of Cardiff, was taken to sea for her trial trip. The vessel is of the following dimensions, viz.: 373 ft. by 51 ft. by 23 ft. 6 in. moulded. She is built of steel to the highest class in British Corporation under special survey. She is equipped with patent steam windlass with quick-warping ends, steam steering gear, eight steam winches, and multitubular donkey boiler, pole masts, and all the latest improvements for rapid loading and discharging. The engines have been constructed by the North-Eastern Marine Engineering Co. Ltd., Sunderland, the cylinders being 25 in., 42 in., 68 in., by 45 in. stroke, with two large steel boilers working at 170 lbs. pressure. During the whole of the trip everything worked with the greatest smoothness, and over a series of runs a speed of 10½ knots was maintained, the vessel at the time being fully loaded.

Forestmoor.—There was launched from the shipbuilding yard of Messrs. John Blumer and Co., North Dock, Sunderland, on July 4th the screw steamer Forestmoor for Messrs. Walter Runciman and Co., of Newcastle and London. She is of single-deck type, with poop, bridge, and forecastle, perfectly clear holds, and is specially adapted for the big timber trade and to carry a large dead weight on a light draught. Water ballast is provided in the double bottom, and also in after peak tank. The accommodation for captain and officers is on the bridge at the fore end, and for the engineers at after end of bridge. The discharging gear is thoroughly up to date in every respect. Engines will be fitted by Messrs. John Dickinson and Sons Ltd., and the winches and steering gear by Messrs. John Wigham and Son, of Hylton, and the windlass by Messrs. Emerson, Walker, and Thompson Bros. Ltd. This is the ninth steamer of similar type built at the North Dock for Messrs. Runciman and Co.

Messrs. Ferguson Brothers, Port Glasgow, recently launched a bucket and sand-pumping hopper dredger. The vessel has been built for the Dominion Republic, West Indies. She is the latest type of the modern dredger, and is capable of dredging either by bucket or sand pump as required. She is fitted with compound surface condensing engines.

Registan.—On July 14th the large steel screw steamer Registan, built by Messrs. Wm. Gray and Co. Ltd. for Messrs. Frank C. Strick and Co. Ltd., of London, had her trial trip. The vessel has been built to Lloyd's highest class, and is of the following dimensions, viz.: Length overall, 362 ft.; breadth, 46 ft. 6 in.; and depth, 24 ft. 9 in. Triple-expansion engines have been supplied by the Central Marine Engine Works of the builders, having cylinders 25 in., 40in., and 65in. diameter, by 42in. stroke, and two large steel boilers of the builders' well-known flanged shell type adapted for a working pressure of 180 lbs. per square inch, and worked under Howden's system of forced draught. The port openings in the cylinders are large to insure an easy passage for the steam and so obtain the maxim efficiency from it. The engines are fitted with a "Contraflo" main condenser, a "Contraflo" atmospheric type condenser being installed for the auxiliary machinery. A Weir's feed pump and heater are also fitted, and the engine room auxiliaries include a number of duplex pumps of the builders' "C.M.E.W." type. The leading feature of the condenser design is a new method of temperature regulation, by means of which the air-withdrawing capacity of the air pump can be so adjusted to the demand that the thermal efficiency of the engine is at a maximum under all conditions of working, this arrangement having a favourable influence on economy. The vessel attained a speed of 13·1 knots.

Rotorua.—Messrs. Wm. Denny and Brothers, Dumbarton, launched on July 9th the passenger and cargo steamer Rotorua, which they have built to the order of the New Zealand Shipping Co., London. The vessel was built under special survey of the British Corporation, and is of the following dimensions: Length, 484 ft.; breadth moulded, 62 ft.; and depth to upper deck, 35 ft. Like the combination steamer Otaki, built two years ago by Messrs. Denny for the same owners, the Rotorua will be fitted with a combination of reciprocating engines and Parsons turbines. In this type of machinery the steam is first admitted to each of two triple-expansion engines, which drive twin screws, and then passes to a centre turbine driving the centre screw before reaching the condenser.

Alice Dodds.—A steam trawler, built to the order of Messrs. W. H. and James Dodds, Aberdeen, was launched on July 9th by Messrs. Alexander Hall and Co., Footdee, Aberdeen. The dimensions of the vessel are: Length, 117 ft.; breadth, 22 ft.; moulded depth, 12 ft. 10 in. The vessel will be fitted with triple-expansion engines of 360 H.P.

Corncrake.—This new steamer, built at Troon by the Ailsa Shipbuilding Co. for the General Steam Navigation Co's Continental fruit trade, ran trials on the Clyde on July 8th. The vessel, which is of 1,260 tons gross, is 240 ft. in length, 35 ft. in breadth, and 16 ft. 6 in. in depth.

Princess Adelaide.—The Fairfield Shipbuilding and Engineering Co. Ltd. recently launched this screw steamer, built to the order of the Canadian Pacific Railway Co. for their passenger and package freight traffic between Seattle, Vancouver, Victoria, and Skagway. The vessel is similar in design to the Princess Charlotte, built by the Fairfield Co. in 1908, and is the sixth vessel constructed by them for the Canadian Pacific Railway Co. The dimensions of the vessel are: Length, 290 ft.; breadth, 46 ft.; and depth, 32 ft. 6 in. She will have a speed of 17¾ knots. Accommodation will be provided for 240 first-class and 960 second-class passengers. The propelling machinery consists of a set of four-cylinder triple-expansion engines, and steam will be supplied by six single-ended boilers.

The Ailsa Shipbuilding Co. Ltd. launched at Troon recently a twin-screw passenger steamer, built to the order of Messrs. John F. Campbell and Son, Glasgow, for South American owners. The dimensions of the vessel are: Length, 200 ft.; breadth, 32 ft.; and depth, 11 ft. 10 in., moulded to main deck. The vessel is built to class 100 A1 at Lloyd's for South American coasting. Accommodation is provided for 54 first-class and 24 second-class passengers. Steam winches, steam windlass, and steam steering gear will be fitted, and the vessel will be lit throughout by electricity. Twin triple-expansion engines will be fitted by the builders designed to give the vessel a speed of 12½ knots.

A steam trawler, built to the order of Messrs. Sellick, Morley, and Price, Milford Haven, was launched recently by the John Duthie Torry Shipbuilding Co., Aberdeen. The dimensions of the vessel are: Length, 121 ft.; breadth, 21 ft.; and depth, 12 ft. 9 in. The trawler will be fitted with triple-expansion engines by Mr. V. V. Lidgerwood, Coatbridge.

Duchess of Richmond.—On the 12th July this steamer, which Messrs. David and William Henderson and Co. Ltd., Meadowside Works, Partick, have built to the order of the London and South Western and London, Brighton, and South Coast Railway Co.'s, for their Portsmouth and Isle of Wight traffic, ran her trials on the Firth of Clyde. The dimensions of the vessel are 198 ft by 26 ft. by 9 ft. moulded, and she is fitted throughout in the most up-to-date style, including a complete installation of electric light. The machinery is of the compound diagonal type with cylinders 27 in. and 51 in. diameter, by 54 in. stroke, and the boiler is double ended of the multitubular make, working at a pressure of 130 lbs. During the day the machinery worked smoothly, and a speed considerably in excess of the contract was attained.

NAVAL NOTES.

The Canadian Naval Department is at present co-operating with the British Admiralty in preparing the plans and specifications for the first 10 vessels of the Canadian navy, and it is anticipated that in the course of a few weeks the department will be ready to submit these plans to shipbuilding firms for consideration, on which the tenders for construction may be based. In consequence of the fact that the designs of the new warships are never revealed by the Admiralty, there will be no public call for tenders or advertisement of specifications. Every reputable Canadian or British firm will, however, be given opportunity to tender, and the same procedure will obtain in Canada as has been the rule for many years in Great Britain.

Yarra.—The Yarra, the first of the three destroyers built on the Clyde for the Australian Navy, has just completed her 24 hours' continuous steam trials. The Yarra, which has been built by Denny and Co., of Dumbarton, did 27 knots per hour.

H.M.S. Newcastle.—The cruiser Newcastle recently completed her steam, gunnery, and manœuvring trials. On her full-power trial she made six runs over the measured course at St. Abbs Head, on the east coast of Scotland, during the progress of the eight hours' test, and the speed averaged just over 26¼ knots, as compared with 25 knots anticipated in the design, the power developed by the Parsons turbine machinery being 24,669 shaft horse power, 2,669 horse power in excess of the designed power. The coal consumption trials gave the following results: On a 22 hours' run at 14,038 shaft horse power and on the eight hours' run at 18,742 shaft horse power the coal consumption was about 1¾ lbs. per horse power per hour. Six runs on the measured mile on the former trial showed the speed to be 23·24 knots for a mean power of 14,051 shaft horse power, and on the latter trial 24·84 knots for 19,116 shaft horse power. These speeds are in excess of those anticipated. The trials of the two 6-in. and ten 4-in. quick-firing and five smaller guns gave satisfactory results. The Newcastle, it may be added, is 430 ft. in length, 47 ft. in breadth, and at 15 ft. 3 in. draught displaces 4,800 tons.

NOTICES OF MEETINGS, &c.

July 25th to 28th.—The Institution of Mechanical Engineers and the American Society of Mechanical Engineers. The joint summer meeting will be held at Birmingham. The following papers will be read and discussed: (1) "English Running-shed Practice," by Mr. Cecil W. Paget; (2) "Round-house Practice, or the Handling of Locomotives at Terminals to Secure Continuous Operation," by Mr. Frank Henry Clark; (3) "Handling of Locomotives at Terminals," by Mr. Frederick M. Whyte; (4) "Handling Locomotives," by Mr. Henry H. Vaughan, M.I.M.E.; (5) "American Locomotive Terminals," by Mr. William Forsyth; (6) "High-speed Tools and Machines to Fit Them," by Mr. H. I. Brackenbury; (7) "Toothed Gearing," by Mr. J. D. Stevens; (8) Report of Committee of the A.S.M.E. on Standard for Involute Gears.

July 28th to 30th.—The Institution of Mechanical Engineers and the American Society of Mechanical Engineers. The joint summer meeting will be held at London, when the following papers will be read and discussed: (1) "Electrification of Suburban Railways," by Mr. F. W. Carter; (2) "Cost of Electrically-propelled Suburban Trains," by Mr. H. M. Hobart; (3) "Economics of Railway Electrification," by Mr. William B. Porter; (4) "Electrification of Trunk Lines," by Mr. L. R. Pomeroy; (5) "Electrification of Railways," by Mr. George Westinghouse.

Coaling Records.—All coaling records in the history of the port of Hull have been broken during the past six months, and the dock authorities are now having an unusually busy time. It was officially reported recently that during the last half year more than 3¼ million tons of coal have been sent to Hull for transhipment, the bulk of it for Russia, Germany, Holland, and Sweden.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2267. Leaking Hydraulic Ram.—Will any reader kindly say whether it is possible for an unturned hydraulic ram, about 8 in. diameter, to be kept from leaking under a pressure of 1,000 lbs. per square inch, and if so, what kind of packing should be used?—AN OLD SUBSCRIBER.

Answer.—As to whether an unturned ram can be satisfactorily packed to withstand a pressure of 1,000 lbs. per square inch will naturally depend largely on the roughness of the surface. If the latter is very rough, and has sharp excrescences, I should say that no packing would be permanently satisfactory in spite of the comparatively large diameter of the ram. The wear on ordinary cup-leathers would probably be prohibitive, and recourse would have to be made to some of the patent packings now on the market. For instance, among the "Lion" packings there should be one which would meet "Subscriber's" case. (Other makes are probably quite as satisfactory; I only mention the above as being reliable, and made in many forms). A fairly elastic packing will be necessary; such is liable to be pulled or picked to pieces on a rough surface, but if a stiff, solid packing be used, either leakage will occur via the pitted parts of the ram surface, or excessive friction and wear will occur. Elastic packings are easily made for pressures up to 100 lbs. or even 200 lbs. per square inch, but for 1,000 lbs. per square inch there will be difficulty in obtaining satisfaction. Any successful packing will here have to be "automatic," *i.e.*, tightened by the water pressure. This, together with the necessity for flexibility, brings us back to the simple cup-leather. I should be inclined, before going to further expense, to try double or triple cup leathers for a time. If unsatisfactory, as they quite possibly would be, I should forward full particulars of the case, accompanied by a rough sketch, to several makers of good "patent" packings. Such firms will usually supply sufficient packing for a trial at greatly reduced rates, or possibly gratis. If running was still unsatisfactory, I should have the ram turned to a smooth surface. On the whole, and providing the ram is not excessively long, it would be cheaper and more satisfactory, in my opinion, to have the plunger surfaced at once, in view of the high pressure dealt with. The cost of a suitable "patent" packing will be high; probably ranging from 3s. 6d. to 7s. per lb.—"CITY."

2255. Sparking Plug Trouble.—Having under my care for a time a 14 H.P. Tangye suction engine and plant, I have had a great deal of trouble sometimes with my sparking plug being covered with oil deposit, while perhaps another time the plug would not want cleaning for perhaps a fortnight, being perfectly dry, the oil supply being always the same. I have had to clean it every morning last week because of this trouble. Do you think the quality of the gas has anything to do with it, for this happens with the same style of coal? I should be pleased if I could have some solution to this difficulty.—ATTENDANT.

2257. Welding by the Electric Arc.—I should be glad to hear of a practical book on the subject of welding by electric arc. In the absence of such a book, would any reader say whether a rotary transformer or a storage battery would be the better means of reducing a voltage of 220 continuous to the proper voltage for welding plates up to, say, ⅜ in. thick, and what current would be required?—DYNAMO.

2258. Boosters.—Will a reader kindly give me some working data for boosters for supplying the extra volts when charging accumulators from dynamos used on lighting circuits; also diagram of connections for same?—ATTENDANT.

2261. Manganese and Chrome Steel.—I shall be very much indebted to any reader for a reliable method for distinguishing manganese and chrome steel from ordinary cast steel, and from each other?—M. K. H.

2268. Dimensions of Engine.—Should esteem it a great favour if any reader could give me suitable dimensions for inlet, transfer, and exhaust ports for two-stroke engine 2¾ in. bore by 3 in. stroke, also compression ratios in cylinder and cylinder case. Do you know of any simple method of ascertaining these dimensions?—A. P. S.

MISCELLANEA.

OBITUARY.—The death has occurred of Mr. A. E. Izard, who for many years was closely associated with Mr. W. T. E. Gatehouse (of the *Electrical Review*) in matters musical.

GOLD MEDAL.—We are informed that Messrs. W. R. Sykes Interlocking Signal Co. Ltd. have been awarded a diploma for gold medal for their exhibits at the Japan-British Exhibition.

CHANGE OF ADDRESS.—On and after this date the Adjustable Cover and Boiler Block Co. Ltd. should be addressed at their larger and more convenient offices, Halton House, 20-23, Holborn, E.C.

OBITUARY.—The flying world has been robbed of one of its pioneers in the untimely death of the Hon. C. S. Rolls at the Bournemouth aviation meeting. Our sympathies are extended to his bereaved parents.

PERSONAL.—The members in the South-eastern District of the Institution of Municipal Engineers have elected Mr. Henry C. Adams, consulting municipal engineer, of 60, Queen Victoria Street, London, E.C., as their chairman for the second year in succession.

GLASGOW DRY DOCK.—At a recent meeting of the Glasgow Chamber of Commerce Sir John Ure Primrose stated that plans are in preparation for a dry dock at Glasgow to accommodate the largest Dreadnought. These are to be submitted to the Clyde Trust for approval at an early date.

CONCRETE FOR BARGE CONSTRUCTION.—The utility of concrete for barge construction will soon have practical tests. The first of three concrete barges for use in the Panama Canal was launched recently and the results are expected to fulfil expectations. The barges will draw 3¾ ft. of water.

GOLD MEDAL.—We are informed that Messrs. Robert S. Allan and Co., wood-working engineers, Victoria Buildings, West Street, Gateshead-on-Tyne, whose pattern-making machines are described in our series of articles on the Japan-British Exhibition, have been awarded a diploma for gold medal by the exhibition authorities.

WE are pleased to notify the appearance of No. 11 of the "Coal Trade Pamphlets." This deals with industrial diseases and Section 8 of the Workmen's Compensation Act, 1906, and gives in brief a list of diseases and occupations that are affected. The hints given are most appropriate and well worth the attention of workmen and other interested parties. The pamphlet is published by the *Colliery Guardian* at 1d. each.

THE *Age* (Melbourne) of 30th May states that the municipality of Melbourne intend to raise a loan of £300,000 to be expended on public works, including: Street paving, additions to the electric supply undertaking £86,000), storm water drainage, substitution of motor wagons for horse drays for carting stone and road material, Town Hall improvements, and market and abattoir extensions.—*Board of Trade Journal.*

CLYDE ELECTRIC CABLES.—Six new electric cables were recently successfully laid across the Clyde by the Clyde Valley Electrical Power Co. A good deal of damage has been done in the past to these subaqueous cables by passing ships, and in order to prevent this in future the river has been specially dredged from Yoker across to Renfrew to a depth of 30ft. below low-water mark, the cables being laid in the trough thus formed.

WIRELESS TELEGRAPHY.—At the House of Commons recently Sir E. Sassoon asked leave to introduce a bill "to render the installation of wireless telegraphy on passenger ships compulsory." The House would agree, he said, as to the necessity of such a provision on the ground of humanity, if not of expediency. The question of cost was negligible. In smaller ships the junior engineer might take charge of the apparatus, and in such ships the cost of apparatus would not exceed £200.

TRIALS OF AGRICULTURAL MOTORS.—The Royal Agricultural Society of England have arranged for the trials of agricultural motors to take place at the farm of Mr. C. Edward E. Cooke, Manor Farm, Bygrave, Baldock, Hertfordshire. The place of trial is about one mile and a half from Baldock Station on the Great Northern Railway, and about seven miles from Hitchin. Eleven entries have been received from six different firms, and the trials will commence at 9 a.m. on Tuesday, the 9th August next. A gold medal is offered by the society for the best agricultural motor, and for the purposes of these trials an "agricultural motor" may be described as any form of motor using either steam, oil, petrol, or electricity as its motive power, which (*a*) shall be capable of hauling direct in work a plough, cultivator, harvester, or other agricultural implement; (*b*) shall be capable of driving such agricultural machines as a threshing machine, chaff cutter, grist mill, etc.; (*c*) shall be capable of hauling a load along a road and on the land. The machines entered will be tested for efficiency in carrying out all three classes of work.

PATENTEES' CHRONICLE
OF
Applications for British Patents.

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*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

JULY 11th, 1910.

16469 Food, etc., cups for bird cages. Nichols.
16470 Petrol-electric vehicles. Stevens.
16471 Billiard cue. Freeman.
16472 Seed cleaning, etc. Pearse.
16473 Bon-bons, etc. Gill.
16474 Cycle crank driving device. King.
16475 *Printing machines. Sorg.
16476 Looms. Whalley.
16477 Advertising device. Jones.
16478 Anchor insulator. Thornson.
16479 Flexible square. Davies.
16480 Washing, etc., apparatus. Horsman.
16481 Window fittings. Healey.
16482 Wheels. Gorst.
16483 Construction of vehicles. Culverwell.
16484 Packing case for bottles. Orr.
16485 Electric circuit breaker. Littler.
16486 Electric interlocking switch. Paton.
16487 Cycle breaks. Austin.
16488 Sash manf. Lancelott.
16489 *Speed reducing gear. Vuilleumier.
16490 Bags, etc. Lowenthal.
16491 Snap fastening for jewel cases, etc. Hayes.
16492 Match strikers. Wilcox.
16493 Tobacco pipe. Keymer.
16494 Door hinges. Mathie.
16495 Hatpin. Graham.
16496 Yacht sails. King.
16497 Soda manf. Hargreaves.
16498 Sugar boiling. Boyd.
16499 Regulating device. Barron.
16500 Wheels. Kincaid.
16501 Friction clutch. Hill.
16502 Diary. James.
16503 Gas valves, etc. Breuning.
16504 Cycle side car. Fish.
16505 Roller skates. Dusen.
16506 *Wooden safes, etc. Adolphs.
16507 *Thrashing machines. Schulz.
16508 *Sewage treatment. Commin.
16509 Internal-combustion engine. Watkins.
16510 Garment fastening. Carber.
16511 *Furnace. Mundy.
16512 Pick sockets. Smith.
16513 *Gear cutters. Cutucci.
16514 *Temporary binders. Waldschmidt.
16515 Copying documents. Cameron.
16516 Zinc ore smelting. Hopkins.
16517 Throindigo manf., etc. Bloxam.
16518 *Chlorosulphonic acid manf. List.
16519 Heating stoves. Ashley.
16520 *Gas burners. Shaw.
16521 Railway carriage door. Feeny.
16522 *Furnaces. Serpek.
16523 Envelopes. Benns.
16524 *Tobacco pipe. Stein.
16525 *Engines. Reinecke.
16526 Eyeglasses. Timmel.
16527 Postcards. Payne.
16528 Curtain laths, etc. Ely.
16529 *Engine starter. Gardener.
16530 Heating apparatus. Nesbit.
16531 *Sausage skins. Hasselblad.
16532 Furnace. Lapusneann.
16533 *Cars. Maloney.
16534 *Elevator. Brookins.
16535 Locks. Stevens.
16536 *Grinding machines. Plaisted.
16537 Frictional driving device. Rollason.
16538 Reflectors. Berwick.
16539 Mirrors. Jeboult.
16540 *Alkaline metal manf. Heyden.
16541 Printing press. Walker.
16542 Typewriter keyboard. Shekell.
16543 Tyres. Adams.
16544 *Rubber heels. Havens.
16545 *Printing rules. Stevenson.
16546 Filter presses. Batley.
16547 *Motor car fenders. Spiegelberg.
16548 Music leaf turning device. Reed.
16549 *Boring device. Spengel.
16550 *Deep boring. Spengel.
16551 *Book leaf clip. Thomas.
16552 Boot heel protector. Hayes.
16553 Gun mountings. Dawson.
16554 Weight holder. Rees.
16555 Treatment of metals. Lockwood.
16556 Boot, etc., laces. Osmond.
16557 *Musical instrument. Hennig.
16558 *Folding chairs. Combe.
16559 Steering gears, etc. Moysey.
16560 *Colour transferring device. Rosier.
16561 *Rubber footwear. Maher.
16562 Lamp. Boltinkoff.
16563 Horse supporter clasps. Pumphrey.
16564 *Nut blank manf. Haddan.
16565 Glass cleaning device. Thomas.
16566 Culinary utensiles. Stone.
16567 *Gas cookers. Peters.
16568 *Lace manf. Nagel.
16569 Spring mattresses. Scarpini.
16570 *Furnaces. Pomeroy.

JULY 12th, 1910.

16571 Spring fastening. West.
16572 Toilet brushes. Cosby.
16573 Propeller. Stevenson.
16574 *Furnaces. Comet.
15675 Electric lighting device. Leason.
16576 Tyres. Turner.
16577 Antimony metal manf. Whitefield.
16578 Easels. Rhodes.
16579 Gas meters. Cheshire.
16580 Button cleaner. Eyre.
16581 Propelling airships. Hurd.
16582 Non-refillable bottle. Davies.
16583 Wood polishing device. Sprengborn.
16584 *Cooking apparatus. Taille.
16585 Cycle saddles. Lowenthal.
16586 Screw stoppering machines. Staneland.
16587 *Paper bags manf. Forrester.
16588 Chimney cowl. House.
16589 Gas ovens. Winkelmann.
16590 Constructing cycle tyres. Unwin.
16591 Kitchen stove. Letheren.
16592 Attachable trouser bottoms. Crowther.
16593 Sluice gates. Harrison.
16594 Thermometer. Dawson.
16595 Relating to tyres. Taylor.
16596 Gas purifying. Burshall.
16597 Draught excluder. Frankling.
16598 Carburetters. Every.
16599 Motor toilet holder. Davis.
16600 *Manf. of loop bands. Lewis.
16601 *Carpet sweepers. Kenyon.
16602 Forced draught in furnaces. Bennis.
16603 Firebars. Bennis.
16604 Mechanical stokers. Bennis.
16605 Lamp. Causton.
16606 Twist lace machine carriages. Jardine.
16607 Valve face grinding tools. Tyres.
16608 Making mortices. Chapman.
16609 *Locking bottles. Springer.
16610 Fastening heel pads. Merkle.
16611 Stand and shoe clip. Potter.
16612 *Saddle pads. Vogelbein.
16613 *Artificial sausage skin. Hasselblad.
16614 *Scales. Hutchinson.
16615 *Liquefying hydrogen. Heylandt.
16616 *Refilling bottle preventer. Black.
16617 *Pneumatic hammer. Gumbel.
16618 Cameras. Butcher.
16619 Roller skates. Spacie.
16620 *Musical instruments. Clark.
16621 *Sorting instruments. Pierpont.
16622 *Line casting machines. Walker.
16623 Pattern fastener. Pearce.
16624 *Fire extinguisher. Peters.
16625 *Gas meters. Valentine.
16626 Electro-magneto lock. Davies.
16627 Inhalers. Wœrnat.
16628 *Folding machines. Smith.
16629 *Bobins, etc. Pawlikowski.
16630 Vertical retorts construction. Woodhall.
16631 Delivery from gas retorts. Woodhall.
16632 *Tuberculosis cure. Lucius.
16633 Calorifiers. Jeffreys.
16634 *Grass cutters. Yates.
16635 *Playing cards. Jones.
16636 Machinery belt fasteners. Young.
16637 Light production. Kotoun.
16638 Toy. Burschtoft.
16639 Clutch mechanism. James.
16640 *Tourists' beds. Demoss.
16641 *Well drilling. Homburg.
16642 Valves. Saul.
16643 *Retailers. Gleason.
16644 Feather protector. Parton.
16645 Photographic view finders. Bullot.
16646 Water tube boiler. Suckling.
16647 Syringes. Pearson.
16648 Trouser stretcher. Chadwick.
16649 Testing vacuum brakes. Laycock.
16650 Easels. Macdougal.
16651 Kettles. Hengst.
16652 Chair. Lanagan.
16653 Power installation. Mavor.
16654 *Blowpipes. Jacobs.
16655 *Submarine escapes. Sims.
16656 Gas lighting. Rostin.
16657 Velocity indicator. Barton.
16658 Weighing machines. Twisleton.
16659 Lantern pictures. Strathus.
16659 Lantern pictures. Strathus.
16660 Cycle wheels adjustment. Stevens.

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16661 Hose belt fastener. Thomas.
16662 *Reamers. Smith.
16663 Ladies' veils. Mackenzie.
16664 Collar studs. Harries.
16665 Cylinder covers. Parkinson.
16666 Dextrine manf. Verity.
16667 Drawers. Murray.
16668 Dye manf. Green.
16669 Scrubbing brush. Mason.
16670 Fasteners. Mathewman.
16671 Shock absorber. Shaw.
16672 Animated pictures. Winkfield.
16673 Strap fastener. Griffiths.
16674 Guard razor. Bentley.
16675 Cigar holder. Bingham.
16676 Friction recording device. Longbottom.
16677 Incandescent gas lighting. Cuss.
16678 Step ladders. Russell.
16679 Dust removers. Marsh.
16680 Spraying nozzles. Ludford.
16681 Spraying nozzles. Ludford.
16682 Match striking device. Buckley.
16683 *Resilent tyre. Wilson.
16684 Pneumatic tyre. Tulloch.
16685 Water filter. Holdstock.
16686 Veils' fasteners. Angier.
16687 Fire control. Burr.
16688 Game. Wale.
16689 Pit cages. Todd.
16690 Ladies' fronts. McKinna.
16691 Brick manf. Smart.
16692 Gathering fruit. Randall.
16693 Preparing oxygen. Harger.
16694 Grate bars. Alexander.
16695 Cash registers. George.
16696 Magnetic compass. Lundell.
16697 Hose joints. Hilder.
16698 Wood working machinery. Gruban.
16699 Radiators. Ash.
16700 Feeding sheets. Hartmann.
16701 Treatment of animals. Blake.
16702 Pins for wearing apparel. Roalte.
16703 Music cases. Farmer.
16704 Self-adjusting ferrule. Elstob.
16705 Aeroplanes. Shepherd.
16706 Vibration reducing. Williams.
16707 Non-alcoholic drinks. Wagner.
16708 Railway wagons. Sharp.
16709 Electro-typing. Penrose.
16710 Fenders of automobiles. Crechrion.
16711 Obstetric device. Barnes.
16712 *Harness. Stevens.
16713 *Propelling vessels. Fenning.
16714 *Elevating device. Harrison.
16715 Cask cleaning. Harrison.
16716 Lathes. Lewis.
16717 *Turnip cutting machine. Lengemann.
16718 *Trouser clips. Pempel.
16719 *Scales. Brand.

16720 Non-slipping device for boots. Nikuforowicz.
16721 Railway carriage locks. Clifford.
16722 Toys. Brown.
16723 Blowing machines. Murphy.
16724 Secret application.
16725 Heating flues. Woodale.
16726 Wheels. Ogilvie.
16727 *Tool holder. Kasperson.
16728 Mixing printing inks. Bush.
16729 Mining drills. Rayner.
16730 Gauge pin. Nichols.
16731 Bone crusher. Smith.
16732 *Floating doll.
16733 *Wire strainer. Ford.
16734 *Tapping casks. Gridley.
16735 Street cleaning. Bloomer.
16736 Dough shaping. Callow.
16737 Paving device. Greenwood.
16738 Gas engines. Kirby.
16739 *Boilers. Harlinger.
16740 Joints protector. Lumsden.
16741 Pneumatic tyres. Wynne.
16742 Pressure indicators. Baird.
16743 Small automatic arms. Chevallier.
16744 Brewing. Wooldridge.
16745 Gas stoves. Hvdes.
16746 Locks. Estcourt.
16747 *Wire bound box clamps. Lake.
16748 *Axle support. Ames.
16749 Typewriter accessory. Yelf.
16750 Moulds. Stanley.
16751 Waterproof fabrics manf. Antill.
16752 Winding reels. Cooper.
16753 Separating apparatus. Burrows.
16754 Internal-combustion engines. Little.
16755 Electrolysing alkali amides. Ashcroft.
16756 *Fare checking device. Firmann.
16757 Valve mechanism. Hudson.
16758 Rubber substitute. Van Der Burg.
16759 *Steam towing machine. Metcalf.
16760 Winches. Metcalf.
16761 *Winches. Metcalf.
16762 *Gears. Seymour.
16763 *Alternating currents. Klein.
16764 Electrolytic treatment of halogen salts. Ashcroft.
16765 Treatment of metals. Ashcroft.
16766 Furnaces. Burkhardt.
16767 *Skiving machines. Buckingham.
16768 *Oil separators. Muchka.
16769 Heat retainers. Smith.
16770 Barometers. Seiberg.
16771 Terminal ornaments. Phillips.
16772 Pedal blocks. Browne.

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16773 Machine to teach flying. Billing.
16774 Knives. Kay.
16775 Sextants. Graham.
16776 Spools. Hollingworth.
16777 Carriage locks. Heys.
16778 Cloth making. Hartley.
16779 Milk silvering. Brown.
16780 Carriage locks. Fulton.
16781 Duplicating machine. Michaelis.
16782 Welding tapered tubes. Dunlop.
16783 Internal-combustion engines. Remington.
16784 Steam generators. Meeson.
16785 Dye vat. Cook.
16786 Hatpin. Elson.
16787 Valves. Mitchell.
16788 Displaying cut flowers. Scott.
16789 *Type casting machine. Pierpont.
16790 Flying machines. Macias.
16791 Sash fasteners. Britten.
16792 Boiler scale. Meeye.
16793 Bottle holder. Gruson.
16794 Blown glass. Marks.
16795 Spring valve lifter. Proctor.
16796 Internal-combustion engines. Hardy.
16797 Match strikers. Willcox.
16798 Haulage systems. Clark.
16799 Pencil sharpening. Getten.
16800 Gauge bars. Johnson.
16801 Joints. Helps.
16802 Aeroplanes. Blackburn.
16803 Baths. Sayer.
16804 Hurricane lanterns. Walker.
16805 Carrying chequer device. Wells.
16806 Curtain suspender. Challis.
16807 Chimney cowls. Cleminson.
16808 Hat boxes. Kaye.
16809 Beam coupler. Kiddy.
16810 Carriage locks. Tandevin.
16811 *Tyres. Burg.
16812 Door hinge. Parsons.
16813 Hooping looms. Orme.
16814 *Letter card. Webster.
16815 Hoists. Henderson.
16816 Game. Sarvant.
16817 Internal-combustion combine. Partass.
16818 Urinals. Adams.
16819 Internal-combustion engines. Henderson.
16820 Drinking troughs. Pitler.
16821 Dressing seeds. Pocock.
16822 Rotary reciprocal gear. Kinnell.
16823 Rotary lithographs. Waite.
16824 Milk holders. Cohen.
16825 Tweezers. Ashforth.
16826 *Explosion engines. Cotterary.
16827 Shallow draught vessels. Eupprates.
16828 Castors. Laxsen.
16829 *Type dies. Walker.
16830 Fastening arms. Lavertine.
16831 Tennis racquet. Webber.
16832 *Milking machines. Johannson.
16833 *Envelopes. Schoemann.
16834 *Packing machine. Giraud.
16835 *Reinforced concrete. Allen.
16836 *Mixing apparatus. Meer.
16837 Printing machines. Evans.
16838 Printing machines. Burroughs.
16839 Printing machines. Evans.
16840 Hooters. Kempton.
16841 *Electric lamps. Schwarz.
16842 *Pipe thrusting tools. Borcher.
16843 *Ordnance sighting device. Schneider.
16844 Electric apparatus. Simms.
16845 *Shake boxes. Rainforth.
11846 *Whip sockets. Ingram.
16847 *Feed bags. Evan.
16848 *Squares. Deardoff.
16849 *Wheeling chairs. Seary.
16850 *Extinguishers. Anderson.
16851 *Hatpin protectors. Ferguson.
16852 *Drill extractors. Weekes.
16853 *Wrigning machines. Rawlins.
16854 Steam whistle. Robson.
16855 Loose sheet binders. King.
16856 *Expanded metal. Salmon.
16857 *Manf. of liqueurs. Yourgel.
16858 *Engraving blocks. Bowers.
16859 *Stone cutting. Larson.
16860 Internal-combustion engines. Jackson.
16861 *Window frames. Gillar.
16862 Sulphide ore treatment. Ashcroft.
16863 Sulphide ore treatment. Ashcroft.
16864 Internal-combustion engines. Belton.
16865 Metallic bedsteads. Whotfield.

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16866 Disc signalling. Skinner.
16867 Carriage locks. Soakel.
16868 Road indicator. Green.
16869 Syphonic weirs. Adams.
16870 Rail sleepers. Welderg.
16871 Bedstead vase pummels. Parr.
16872 Legging fasteners. Rowson.
16873 Tinplate manf. Thomas.
16874 Packing cases. Lovett.
16875 Timing instruments. Tonks.
16876 Pocket knives. Newton.
16877 Automatic poultry feeder. Berthonel.
16878 Valves. Walmesley.
16879 Controlling compressed air. Copland.
16880 Duplicate forms. Evenden.
16881 Cutting heel lifts. Fowler.
16882 Manœuvring of steam ships. Weir.
16883 Rotary grinding apparatus. Loseby.
16884 Twiners. Bottomley.
16885 Paper making alarm device. Strachan.
16886 Flying machines. Stapley.
16887 *Automatic protection lanterns. Exner.
16888 Dirigible balloons. Wedlake.
16889 *Turbines. Howden.
16890 Cinder sifters. Currie.
16891 *Boot buttons. Didierjean.
16892 Tyre lever. Bradbury.
16893 *Motor spirit cans. Taylor.
16894 *Let-off motion for looms. Duckworth.
16895 Heating water. Wade.
16896 Photo frames. Cutler.
16897 Yarn wetting. Whyte.
16898 Carding engines. Crossley.
16899 Loom pickers. Ormerod.
16900 Notebooks. Allen.
16901 Pneumatic cushioning. Harris.
16902 *Spade attaching device. Akt.-Ges.
16903 Automatic musical instrument. Walker.
16904 Switch devices. Lichtenfield.
16905 Hydraulic clutch. Lamplough.
16906 Syphons. Thorne.
16907 Penholders. Logan.
16908 Bottles. Beavan.
16909 Roller skates. Lyon.
16910 *Perambulator wheels. Marks.
16911 *Mowing machine. Sulliger.
16912 Piano keyboard. Olbrick.
16913 *Transmitting power. Hide.
16914 Roller bearings. How.
16916 *Seamless metal chains. Klatte.
16917 *Car coupling mechanism. Willison.
16918 *Gripper mechanism. Middlesworth.
16919 *Paper feeder. Middlesworth.
16920 *Printing machines. Middlesworth.
16921 Conveyors. Doxford.
16922 *Rod-packing device. Robertson.
16923 Vapour engines. Guglielmo.
16924 Cameras. Whitehead.
16925 Curtain supports. James.
16926 Tube boilers. Forrestell.
16927 *Safety razor. Winter.
16928 Securing key in lock. Reiss.
16929 *Pneumatic hammers. Mossman.
16930 Bottle stoppers. Bricknell.
16931 Pulley blocks. Jess.
16932 *Cellulose solutions. Royer.
16933 Insulated rail joints. Sykes.
16934 *Decorative cards. Barnes.
16935 *Punching machines. Black.
16936 *Packing sweetmeats. Lovell.
16937 Controlling scenic railway. Mellis.
16938 Toothed gearing. Mepstead.
16939 Chains. Ashdown.
16940 Ticket stamping. Gibson.
16941 *Radiators. Schröder.
16942 Periscopes. Amstall.
16943 Files. Vernaz.

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16944 Stopping trains. Hodgkins.
16945 Propulsion of vessels. Johnson.
16946 Aeroplanes. Linzell.
16947 Intercommunication telephone. Romer.
16948 Rotary engines. Cherry.
16949 Wool treatment. Elsaesser.
16950 Pendants. Spooner.
16951 Heating buildings. Booth.
16952 Yarn sizing machines. Norris.
16953 Drying organic matter. Grossman.
16954 Step ladders. Farrand.
16955 Toy aeroplane. Jamieson.
16956 Slide valve engines. Lewis.
16957 Slide valve engines. Lewis.
16958 Cutting flowers. Fuller.
16959 Toilet paper. Bend.
16960 Washing textile fabrics. Robert.
16961 Lorry wheels. Talbot.
16962 Fishing rods. Kendrick.
16963 Transportation of tomatoes. Mouroux.
16964 Slide screens. Kempson.
16965 Safety razor. Upsell.
16966 Treating grain for brewing. Andrews.
16967 Collapsible cardboard boxes. Hutton.
16968 Conveyors. Ogilive.
16969 Motor vehicles. Saunders.
16970 Aerial machines. Garsed.
16971 Knife cleaners.
16972 Lead oxides. Pope.
16973 Gears. Montgomery.
16974 Carriage lock. Varnam.
16975 Pipe fillers. Barker.
16976 Rudders of aerial machines. Garsed.
16977 Separating materials. Hays.
16978 Paint cans. Hesketh.
16979 Alcoholic extracts manf. Ruzicker.
16980 Locking carriage doors. George.
16981 *Treatment of bituminous coal. Dixon.
16982 Aeroplanes. Maberley.
16983 *Bricks. Schopfer.
16984 Gas producers. Dunlop.
16985 *Rheostat devices. Adams.
16986 Petrifying strata. Koepe.
16987 Collective system. Zeiss.
16988 *Cutting of steam. Bouchouin.
16989 *Sorting conical tubes. Vene.
16990 *Fluid operated turbines. Boveri.
16991 *Brake for road vehicles. Fahhrowdwerke.
16992 *Atomisers. Parks.
16993 *Double beat valves. Donaldson.
16994 Water tube steam boilers. Mackie.
16995 Off-set printing machines. Evans.
16996 *Portable cases. Huberman.
16997 Speed regulating machines. Siemens.
16998 Cushioning means. Spengal.
16999 Non-skid tyre protector. Jones.
17000 Beer vat. Johnson.
17001 Mixing playing cards. Mitchell.
17002 Straw hats. Wright.
17003 Handling stranded cable. Doxford.
17004 Steam boilers. Gadsly.
17005 Tooth brushes. Osborne.
17006 *Belt pulleys. Peter.
17007 Preventing too rapid heating of vessels. Buckea.
17008 Truck wheels. Lewis.
17009 *Scale appliance. Lawrence.
17010 Braking induction motors. Rosenberg.
17011 *Lamp. Akt.-Ges.
17012 Letter cards. Rumpler.
17013 Securing hair in pulp. Kubelka.
17014 Screw wrenches. Horlin.
17015 Supporting device. Drungold.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

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The following Accepted Applications for Patents are open to Opposition up to August 22nd, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

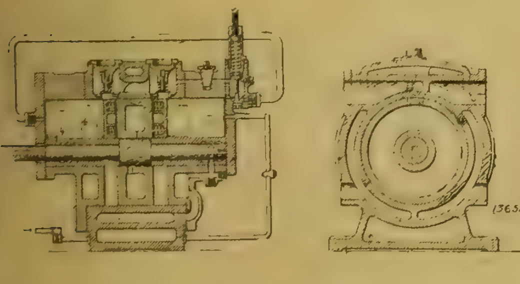
Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

654 **Cloake**: Apparatus for heating air. [Post-dated July 10th, 1909.] 2014 **Whiting**: Crossings for tramway rails and the like. [Post-dated August 26th, 1909.] 4712 **Snaith**: Slide valve for cylinders of steam engines. [Post-dated August 12th, 1909.] 5777 **Bell and Pletts**: Method of and apparatus for electrically heating air and other media. 5812 **Coldmau and Webb**: Mechanical players for musical instruments. 5994 **Physikalisch-Technisches Laboratorium Ges.**: Apparatus for heating curling tongs and similar implements. [Date applied for under International Convention, March 12th, 1908.] 6075 **Hampson**: Apparatus for separating dust, dirt, leaves, and other impurities from wool, hair, cotton, and other fibrous materials. 6094 **Hart**: Arrangement of means for regulating the conditions of the atmosphere of rooms and of articles therein as regards temperature and humidity. 6164 **Lake (Pino)**: Submarines. 8600 **Mayo**: Method of and apparatus for the extraction of grease and similar matter from and for treating wool, skins, textile, and other materials. [Cognate Applications. 17125, 1909, and 22615, 1909.] 8690 **Harris**: System and apparatus for making moulds for grooved pulley wheels or the like. [Post-dated September 28th, 1909.] 10562 **De Murrieta and Tully**: Method of and means for separating liquids from gases or vapours by centrifugal action. [Post-dated November 4th, 1909.] 10980 **Cuttill, Blackwell, and Cooper and Co. (Manchester)**: Apparatus for treating or cleaning cotton waste and the like. 11044 **George Hicks Harris (legal representative of the late A. K. Cox)**: Concentrating apparatus for separating metals, ores, and other substances in wet recovery processes. 11071 **Berger**: Non-refillable bottles. [Post-dated October 29th, 1909.] 11184 **Societe J. and A. Pavin de Lafarge**: Manf. of cement. [Date applied for under International Convention, June 13th, 1908.] 11269 **Major**: Mechanical power-producing motors. 11421 **Eijdman**; Process relating to the treatment of sea water. 11422 **Eijdman**: Evaporating apparatus. 12586 **Wright**: Folding furniture or camp furniture and the like. [Post-dated October 1st, 1909.] 13179 **Corbridge**: Syphonic flushing apparatus. [Post-dated December 3rd, 1909.] 13218 **Richardson**: Manf. and treatment of steel. 13439 **Eason**: Means of making metallic dental plates. 13509 **Wilson and Wilson**: Spark coils. [Cognate Application. 28699, 1909.] 13518 **Roper**: Channelling machines. 13554 **Gayley**: Method of and apparatus for drying air. 13561 **Boult (Ellis)**: Resilient wheels for vehicles. 13565 **Marks (Ges. fur Mechanische Gewinnung von Steintorf)**: Power press. 13571 **Burns**: Method of and means for testing the accuracy of the sights and the bores of guns. 13590 **Donovan**: Electric starting and regulating switches. 13602 **Williams**: Plant for conveying bottles. [Cognate Application. 22671, 1909.] 13628 **Letzel**: Starting device for explosion motors.

13653 Von Pittler: Rotary compressors and vacuum pumps or exhausters. [Date applied for under International Convention, December 9th, 1908.]

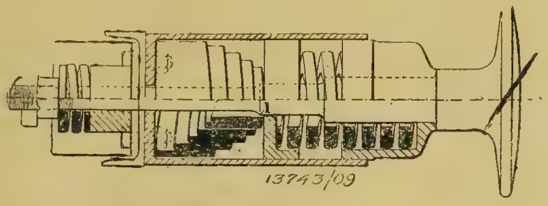
The present invention relates to rotary fluid-pressure machines which have a piston or pistons fixed in a disc or drum revolving in a casing, and an abutment or abutments which is or are movable so as to allow the piston or pistons to pass. The disc may have on its sides substantially level or plane faces, over which the pistons project with suitable curves of transition, which control the abutment slides movable axially in guides arranged in the casing and kept in contact with the disc by suitable means. The invention comprises a special method of regulating the working pressure of the machine, if used as a compressor or as a vacuum pump or exhauster, and devices serving for this purpose. According to this method the controlling device for the abutment slides is set out of action if the desired pressure or vacuum is exceeded, so that the engine runs without load.


13653/09

13684 **Lang**: Appliances for cleaving or cutting stone. [Cognate Application. 28414, 1909.] 13709 **Liddle**: Epicyclic gearing. 13716 **Webb, Brettell, and Adamson**: Apparatus for cooling air. 13719 **Gunton and Hickson**: Machines for trimming resilient and like pads for boots and shoes. [Cognate Application. 26930, 1909.] 13727 **Newton (Farbenfabriken vorm. F. Bayer and Co.)**: Manf. and production of new azo-dyestuffs. [Application for Patent of Addition to No. 5383, 1909. Samples furnished under Section 2.] 13740 **Herberts**: Display or advertising mechanism. [Cognate Application. 15562, 1909.]

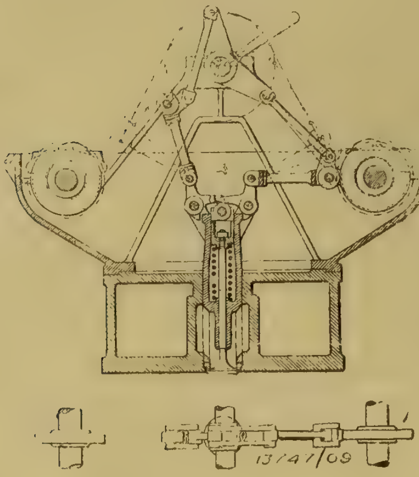
13743 Sheffield and Twinberrow: Buffers for rolling stock.

This invention relates to buffers for attachment to the headstocks of railway vehicles and of the self-contained type wherein the buffer head is formed integral with a central stem or spindle and two springs, a light one and a heavier one, or several springs are employed for absorbing the buffing shocks. The object of the present arrangement is to provide such a construction of buffers of this type as will result in the buffing shocks being taken up in a gradual manner, the resistance to buffing being at first slight and subsequently increasing rapidly towards the end of the stroke. The invention consists in arranging the first spring of the buffer as a comparatively light flexible spring, while the second spring is heavier and arranged to give an increasing rate of increase in resistance towards the end of its stroke, the springs being separated by an intermediate washer.


13743/09

13747 Schiemann: Mode of controlling internal-combustion engines and apparatus therefor.

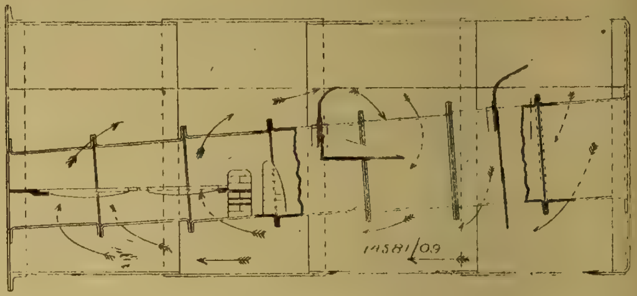
The invention relates to the control of the starting, running, and reversing devices of internal-combustion engines, more especially to those started by compressed air admitted through special starting valves. In such engines of the single-acting type it is generally necessary to cause the exhaust valve to open once in every revolution of the engine shaft while starting by compressed air and once in every two revolutions while running under the ordinary working conditions. The object of the present invention is to enable each of the changes in the operation of any valve in the conditions respectively required for starting and running in either direction to be accomplished by the single movement of a single lever which turns a controlling shaft through a definite angle and by means of levers and connecting rods acts upon links which operate the valves. In the present construction all the valves or other controlling devices of one cylinder or group of cylinders are operated appropriately for starting, forward running, or reversed running according to the angular position given to a controlling shaft, which through levers and connecting rods determines the position of links which operate the valves or the like devices. Each of the links is provided at one end with one or more rollers which are moved relatively to cams mounted on one or more regulating shafts, and in motors having two or more cylinders either similar cams act simultaneously on the mechanism of all the cylinders, or the levers or the like of each cylinder or group of cylinders are in gear partly with one kind of cam, partly with another kind of cam.



13755 Daniels: Cardboard and like boxes. 13784 Henderson (Wilson): Rotary slicing machine and tobacco cutter. 13790 Keller: Method of treating alkaline fluids after use in connection with bleaching processes in the manf. of cotton and cotton goods. 13797 Eikenbusch: Beehives. [Rights under Section 91 of the Act not granted.] 13830 O'Donnell: Systems of and apparatus for emptying, washing, and re-filling locomotive boilers. 13835 Wiberg: Adding machines. 13841 Daussy: Rims for the pneumatic-tyred wheels of motor cars and other vehicles. 13842 Ridings: Electric arc lamps. 13846 Marks (McClean Arms and Ordnance Co.): Cartridge-feeding mechanism for guns. 13856 Benz and Roe: Means for indicating the speed of self-propelled vehicles. 13865 Machtolf: Process for producing carbon black. 13881 Burge: Pivoted windows and the like. 13899 Depledge: Handle bars for cycles. [Post-dated December 14th, 1909.] 13907 Johnson (Badische Anilin and Soda Fabrik): Manf., production, and employment of anthracene colouring matters and of intermediate products. 13935 Marks (Print Weave Co.): Methods of photographically copying, enlarging, or reducing. 13957 Holmstrom: Apparatus for the production of printing blocks by etching. 13961 British Thomson-Houston Co. (General Electric Co.): Electric heating devices. 13965 Richards: Stability device for aeroplanes, hydroplanes, and propellers. 13972 Byerley: Rapid printing and enlarging machine for printing photographs by artificial light. 13982 Farquhar: Mouthpieces or ascension pipes of gas retorts. 13987 Page: Boilers or steam generators. 14010 Siemens Bros. and Co., Hird and Grimston: Searchlights or projectors. 14040 Preiss: Electric and other stoves designed to imitate an open fireplace. 14057 Mason: Mechanical players for pianos and the like. 14099 Gillie: Artificial horizons. 14125 Bachmann: Skates. 14133 Bates, Roberts, and British United Shoe Machinery Co.: Cementing machines for use in the manf. of boots and shoes. 14138 Marks (McClean Arms and Ordnance Co.): Cartridge-feed mechanism for breech-loading guns. 14179 Barnes and Barnes: Acetylene generators for motor cycle lamps. 14220 Peters: Heads of steering columns of cycles and the like. 14235 Scott: Machines for knitting ribbed fabrics. [Rights under Section 91 of the Act not granted.] 14279 Ashton: Means for preventing diffusion of dust raised by the wheels of vehicles or by the revolving brushes of road-sweeping machines. 14289 Pollen (Mergenthaler Setzmaschinen Fabrik Ges.): Means for assembling multiple face matrices in typographical composing machines. 14306 Justice (Plant): Nail-sorting and delivering mechanisms. 14312 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of dyestuffs. [Samples furnished under Section 2.] 14322 Prieur and Booth: Safety devices for operators of cinematograph or like machines. 14328 Day and Martin Ltd., and Jones: Boot-polishing stands. 14347 Rawson: Portable stoves for cooking purposes and the like. 14352 Georgi, and A. Reyrolle and Co.: Protective arrangements for electrical current distribution systems. 14372 Parnell: Treatment of ores. 14375 Williams: Corsets. 14434 Willows: Airships, aeroplanes, or aerostats. 14439 Williams: Treatment of sewage, foul waters, and the like. 14476 Mackenzie-Kennedy: Automatically balancing and maintaining the equilibrium and steering of all manner of flying machines. 14490 Reardon: Adapting small arms for miniature ammunition practice. 14547 Dallison: Differential or balance gearing. 14553 Barthez: Hydro pneumatic buffer or shock-absorbing device.

14581 Casmey: Means for promoting water circulation in steam generators.

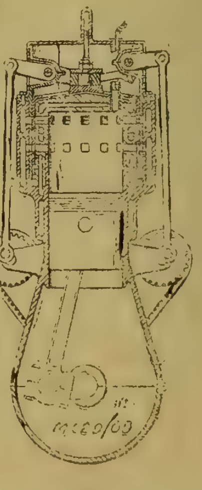
This invention relates to steam boilers of the Lancashire and Cornish type, and its object is to improve and increase the circulation of the water so as to obtain the advantages which arise from a rapid water circulation. In boilers of the type referred to, especially where these are of great length, the water at the lower part and at the rear of the boiler is often relatively cold, even after steam has been generated from the water more immediately over the fireboxes, the circulation taking place practically only over and close to the top of the firebox and to a comparatively short depth. According to this invention horizontal or approximately horizontal partition plates are provided in the water space of the boiler situated between the lowest water level and the level of the centre of the flue or flues, starting from or near to the fire bridge and extended rearwards to a distance not exceeding three-fourths of the distance from the fire bridge to the end of the boiler. A vertical partition, preferably loose, is placed transversely of the boiler at a short distance to the rear of the fire bridge and extending from the lower limit of the water level or thereabouts down to a horizontal line through the centre of the furnace flues.



14609 Justice (Plant): Heeling machines.

14629 McCollum: Valves and valve gear for internal-combustion engines.

The main object of the invention is to provide a valve gear which is rapid in the operation of opening and closing the ports and the effective area of the ports is a maximum. The valve employed is of the type which has both lateral and reciprocatory movements in order to control the inlet and exhaust, and according to the present invention such valve is arranged substantially coaxial with the piston. A

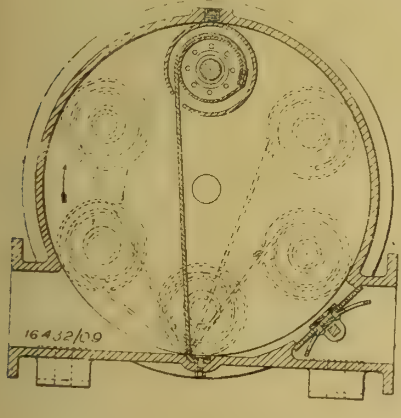


further feature of the invention is that such valve is provided with two sets of ports, one set adapted to register with a set of inlet ports in the cylinder and the other set adapted to register with a separate set of exhaust ports in the cylinder.

14645 Bot and Lallemand: Apparatus for aerial navigation. [Date applied for under International Convention, June 23rd, 1908.] 14670 Higgins: Machine for cutting thistles. 14853 Pybus: Binder or holder for magazines, periodicals, catalogues, and the like. 14877 Allsop: Ground for paint. 14886 Whitehead: Wrenches for pipes and the like. 14888 F. E. Adams Pressure Tool Co., and Adams: Machines for seaming and folding the edges of sheet metal for and the manf. of boxes, canisters, and the like. 14908 Crossley and Atkinson: Governing internal-combustion engines. 14980 Fassler: Rectification of alternating electric currents and devices for use therein. 15060 Andrew and Lack: Jointing material for cans, bottles, and the like. 15246 Savril Ltd., Irving and Wilson: Washing compound or soap. 15267 Mitchell: Tradesman carrier for attachment to bicycles. 15285 Davidson: Steam turbines. 15366 Clark and Judge: Turbines. 15442 Legge and Young: Devices for delivering and applying postage stamps, labels, and the like. 15443 Lloyd: Wrenches or spanners. 15562. *See* 13740, 1909. 15694 Koref and Nemecek: Cleaning of the carding surfaces of carding machines. 15758 Powell: Pivoted jaw tools. 16106 Hooper: Hearth-stand attachment. 16146 Cooper: Preparation of blanks for fold-up boxes for holding incandescent electric lamps. 16154 Timings: Manf. of drop handles and plates therefor. 16182 Kneen: Means and appliances for reducing the vibration transmitted to vehicle bodies. [Cognate Application. 1426, 1910.] 16221 Hoskins: Method of and means for securing or affixing together, or in position, tubular and rod members or parts of bedsteads, cots, ship's berths, furniture, railings, fenders, and other analogous articles. 16367 Dufwa: Flying machines.

16432 Roots: Rotary motor, pump, blower, or meter.

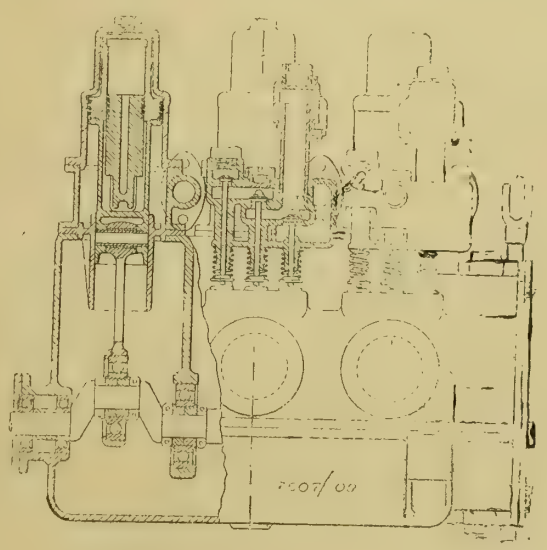
This invention relates to an improved motor, pump, blower, or meter. The construction consists, for whichever use or purpose it may be adapted, of two discs mounted axially, or approximately so, on shafts or spindles within a cylindrical casing, a crank pin or its equivalent to connect the two discs, and one or more flexible blades or diaphragms connected to the crank. The blades or diaphragms constitute the piston; one end of each is connected to the crank pin and the other to the inside of the cylindrical wall of the casing. Means are provided for keeping the flexible pistons taut while the surface or area is continually varying as the crankshaft pin or arm rotates within the cylinder.



16477 British Northrop Loom Co., and Hollins: Change controlling mechanism for jacquards employed in automatic weft-replenishing looms. 16532 Packman: Talking machines. 16825 Kobler: Duplex gauge cocks. [Date applied for under International Convention, October 29th, 1908.] 16860 Shaw: Lifting or elevating apparatus. 16889 Levy: Perambulator rugs. 16987 Ellis: Grain drier or cooler. [Date applied for under International Convention, July 24th, 1908.] 17009 Newton (Farbenfabriken vorm. F. Bayer and Co.): Machines or apparatus for forming celluloid and other similar support films for photographic purposes. 17054 Settle: Combination of encased springs on a telescopic principle to be fitted to the wheels of cycles, motors, and the like after the manner of spokes. 17069 Hughes: Syringes. 17086 Lock (Wood): Apparatus for casting stereotype printing plates. 17125. *See* 8600, 1909. 17128 Edwards: Device or means for binding or bracing the blades of cricket bats. 17206 Dymond (J. A. Topf and Soehne): Apparatus for steeping, germinating, and kiln-drying malt and the like, and for aerating and drying seeds, wheat, and the like. 17233 Wall: Frame for motor cycles. 17273 Allen: Cheese-making apparatus. 17291 Boultbee: Aeroplanes, flying machines, gliders, and the like. 17399 Phipps: Swath turners or hay collectors. 17503 Ainsbury: Presses for trousers, neckties, and other articles of clothing. [Cognate Application. 23045, 1909.] 17526 Neal and Burton: Lathes. 17530 Llewellin: Helical gears. 17564 British Thomson-Houston Co. (General Electric Co.): Rotary electric converters. 17596 Brooks and Holt: Cycle and motor cycle saddles.

17607 Lamplough, and Browne Engineering Co.: Compound steam motor.

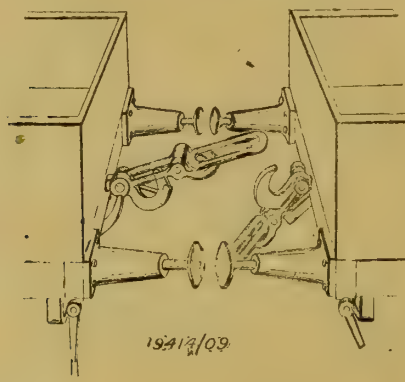
The invention relates to that type of double-expansion steam engine in which the high-pressure cylinder forms part of the low-pressure piston, and in which the high-pressure piston is fixed to the low-pressure cylinder. In other types of double-expansion steam engines it has been proposed to employ three valves and passages suitably arranged so as to control the two inlets and two exhausts, and such valves have been arranged in a line and have been operated by a cam shaft. The object of the present invention is to construct an improved steam engine of the type first mentioned by combining therewith the arrangement of valves above referred to. The improved engine comprises a low-pressure cylinder, a low-pressure piston, a high-pressure cylinder carried by the low-pressure piston, a fixed high pressure piston having an axial passage and carried by a casting fixed to the open end of the low-pressure cylinder, three valves and suitable channels arranged in the casting, and a camshaft to control the valves.



17653 Church and Haining: Dough-braking and like machines. 17741 Thompson: Pendant electric light fittings. 17930 McKenna (I. B. Kleinert Rubber Co.): Garment shields. 17958 Sefton-Jones (Boston Machine Works Co.): Links or connectors for tags, tickets, or the like. 18052 Bell: Washing machines. 18062 Campbell: Files for filing letters and other papers. [Application for Patent of Addition to No. 10638, 1909.] 18176 Martin: Process for the separation of complex ores. [Application for Patent of Addition to No. 4531, 1909.] 18178 Martin: Process for the separation of complex ores. [Application for Patent of Addition to No. 4531, 1909.] 18249 Standing: Security bolts for motor and other tyres. 18250 Standing: Appliance for manipulating security bolts in wheel rims. 18276 Neustadter: Means for mixing or guiding together the gas or vapour and air for use in internal-combustion engines. 18446 Howard: Detachable treads for pneumatic tyres. 18480 Eves: Hackling machines for flax and other long staple fibres. 18481 Daniels: Apparatus more particularly for dyeing wool. 18737 Schulze: Method of and device for driving internal-combustion engines working with heavy liquid fuels. [Date applied for under International Convention, August 14th, 1908.] 18774 Foulston and Foulston: Spring wheels for motor cars and other vehicles. 18982 Downing: Flying machines and the like. 19116 Hough: Treatment of pulping or other liquor suitable for separating cellulose resinous matter and ligneous material or residue and for utilisation of the resinous material. 18140 Bentham and Bardsley: Hand brakes for tramcars and the like. 19165 Maxwell: Stick or stake for training peas or similar plants. 19168 Turner: Fastenings for doors and the like. 19232 Riding and Boyle: Solderless joint for lead pipe. 19379 Rice: Two-stroke internal-combustion engines.

19414 Price and Bridge: Railway couplings. [Date applied for under International Convention, September 4th, 1908.]

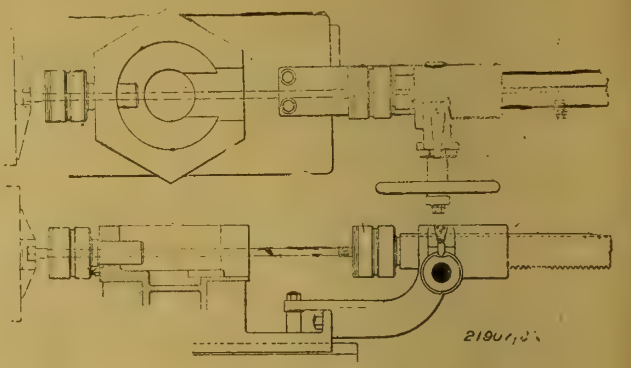
This invention relates to railway couplings of the type wherein the drawbar has a coupling hook, whilst a compound or cradled coupling link is adapted to be raised to a non-operative position by gearing operated from either side of the railway vehicle and is adapted to be held in such raised position by a ratchet which receives the pawl end of a lever, which is operated to release the pawl from the ratchet by means on the buffer head in such manner as to cause the link to fall into engagement with the hook on the next vehicle on the buffers of the vehicles coming together. According to the present arrangement a cradled coupling hook or shackle is pivotally mounted on the drawbar hook and is raised to a non-operative position by means of a bell crank on a cross spindle having operating handles, one member of which bell crank takes under the cradle, while the other member thereof is adapted to take against a counterbalanced detent by means of which the link is held in the non-operative position in such manner that the link may be raised by means of the bell crank and may be lowered either by the bell crank or automatically by the contact of the buffers of the vehicles.


19414/09.

19453 Lake (C. B. Cottrell and Sons Co.): Sheet delivery apparatus for printing machines. 19527 Huguenin: Transmission of power by means of magnetisable pulleys, bands, and the like. [Date applied for under International Convention, August 25th, 1908.] 19573 Boyd, and J. and T. Boyd Ltd.: Twisting frames. 19591 Currie: Solid tyres for motor road vehicles. 19628 Moss: Ploughs. 19686 Becher: Method of balancing piston valves for steam locomotives and other fluid-pressure engines. 19688 Hills: Muffs. 19710 Zerkowitz: Funnels for separating liquids. [Date applied for under International Convention, November 30th, 1908.] 19733 Neville: Apparatus employed for locking and unlocking the doors of railway carriages. 19736 Etna Lighting and Heating Co., and Beard: Globe holders of inverted incandescent gas and other lamps. 19766 Stapler: Manf. of solid perfume. 19988 Cross, Cross, and Marshall: Amusement device. [Cognate Application. 6529, 1910. 20026 Peck: Pleasure railroads. [Date applied for under International Convention, September 2nd, 1908.] 20043 Houghton: Puzzle or game. [Cognate Application. 20100, 1909.] 20095 Robertshaw: Portière rod brackets. 20100. *See* 20043, 1909. 20102 Webb: Means for opening and closing the doors of motor cars and other vehicles. 20243 Dawson and Buckham: Sighting apparatus for ordnance. 20276 Arnott: Carburetters of internal-combustion engines. 20915 Rechnitzer: Checking or comparing and calculating machines. 21119 Kindermann: Respirators. 21155 Skinner and Johnson: Power-driven hammers. 21207 R. and W. Wilson and Sons Ltd., and Clarke: Fastenings for uniform and other boxes. 21250 Ellis: Pneumatic and like tyres and appurtenances for use therein. 21373 Heissenberger: Razor-stropping devices. 21480 British Thomson-Houston Co. (General Electric Co.): Electrolytic condensers appliacable as lightning arresters or for other similar purposes. 21556 Hill and Baquie: Automatic pneumatic wheel for motor cars and other like vehicles. 21632 Brown: Construction of blade for cricket bats. 21649 Burnet, and Tudor Accumulator Co.: Jointing of rails for tramways and the like. 21678 Ralphs, Wickins, and Dalby: Boot-lasting and sole-tacking machines for "Veldtschoen" lasting. 21692 Herbert: Boot or shoe protector. 21749 Berdin: Stamping presses. [Date applied for under International Convention, October 19th, 1908.]

21907 Herbert and Vernon: Apparatus for screwing bars.

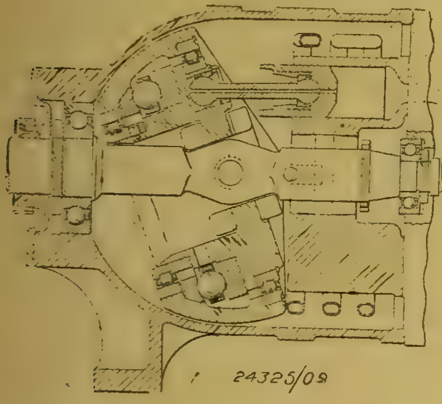
This invention relates to apparatus for simultaneously screwing both ends of a bar comprising one die head or the equivalent, the position of which in relation to the turret slide is for the most part constant, and another which moves during the operation of the apparatus and is adjustable. Such apparatus is used on turret lathes for the machining of boiler stays, etc.; in such a case the first die head is usually carried by the turret. The object is the provision of a simplified apparatus of this type in which the movement for the bringing of the second die head up to or from the work and also for its adjustment is the same. This movement is in, or in a line parallel to, the axis of the work, whilst in previous cases the die head has been movable angularly into and out of position, so that considerable simplification is effected. Accordingly the adjustment of the forward working position of the second die head and the movement for withdrawing it to allow the turret to rotate and for returning it to the same position as before withdrawal are accomplished by the same mechanism.


21907/09.

22017 Schaller: Process of producing bars, tubes, bands, wires, fibres, and the like of metal. [Date applied for under International Convention, June 12th, 1908. Application for Patent of Addition to No. 8751, 1909.] 22029 Denereaz: Socket and plug for electric lamps and other apparatus utilising electric current. 22111 Ketcheson: Method of treating fibrous or cellular materials. 22132 Dawson and Peddie: Sighting devices for small arms. [Request under Section 19 not granted.] 22340 McLarty: Paper bags with carrying cords. 22386 Henderson: Monoplane aerial machine. 22458 Krause: Metal filament lamps having filament carriers arranged elastically. [Date applied for under International Convention, June 10th, 1909.] 22527 Thornton: Manf. of hearthrugs and the like. 22538 Hardy, Vos, and Vos: Roller skate wheel. 22570 Langton: Extension ladders. 22612 Snell: Poultry houses and fittings connected therewith. 22615. *See* 8600, 1909. 22654 Green: Match boxes. 22671. *See* 13602, 1909. 22803 Meissner: Incandescent vapour lamp. 22857 Sleddon and Barnes: Oil separators. 22910 Reiners: Apparatus for projesting and enlarging pictures. 23045. *See* 17503, 1909. 23078 Burley: Cab signalling apparatus for railways. 23195 Wakefield: Generators of acetylene gas. 23255 Watton: Game of rings. 23299 Parkinson and W. and B. Cowan Ltd., and Cheshire: Torch traps for street and analogous lamps. 23363 Wilford: Road or railway automobile. 23430 Randle and Smith: Cake tins, meat tins, stew pans, and the like. 23449 De Gounevitch and Couaillet: Time-indicating devices. [Date applied for under International Convention, October 16th, 1908.] 23893 Douglas: Opening, closing, and locking gear for ventilators and the like. 23968 Secker: Stair-rod eyes. 23971 Bettney: Appliance for stopping rotation of gramophones and like machines. 24252 Ker: Fishing tackle. 24261 Burstall: Apparatus for extracting or separating suspended matter from gases, particularly tar from combustible gases. 24291 Burgess and Hepworth: Rock drills.

24325 Hoffmann Manufacturing Co., and Haskins: Ball or like bearings required to take angular thrusts.

Relates to rotary devices of the kind comprising a disc or member pivoted on and rotating with a shaft and subject to an angular thrust, and the object is to provide an improved form of bearing for such devices. Thrust bearings such as those where an angular thrust has to be taken by balls are liable to be destroyed by the angularity of the thrust through the balls or the like, damaging the races. To overcome this defect in the devices of the kind above described a combination of thrust and journal bearings is employed (either roller or ball), there being, for example, one journal bearing placed on each side of the thrust bearing and spaced as far apart from same as the parts to which they are applied will permit, and so arranged that when such parts are in an angular position (other than a right angle) to the shaft a proportion of the thrust will be taken by such journal bearings so that the main thrust bearing will be relieved of the greater part of the side strain.



24502 Ewing: Vehicle suspension arrangements. 24731 Brown: Machines for stoppering or sealing bottles and like receptacles. 24832 Christman: Device for removing feathers from fowls. 24933 Ransford (Oddur Manufacturing Co.): Type-casting machines. 25088 Alexander: Water heaters for hot-water heating apparatus. 25237 King: Moulding apparatus. 25386 Parker and Knee: Camera shutters. 25472 Chemische Fabrik Ladenburg Ges.: Disinfecting process. [Date applied for under International Convention, May 24th, 1909.] 25579 McKenzie and Holland Ltd., Haywood and Beauchamp: Indicator signals for railways and operating means therefor: 25583 Woods: Billiard cue rests. 25711 Geller: Manf. of paper and cardboard. 25878 Knutson: Automatic discharging apparatus for coal, grain, and the like. [Date applied for under International Convention, November 10th, 1908.] 25886 Inshaw and Inshaw: Apparatus for pilgering metal blooms, tubes, or rods. 25891 Miller: Cableway conveying apparatus comprising supporting rope carriers arrested by stops. 26002 Coates: Locks. 26026 Daniell and Hebden: Dyeing yarn or the like. 26041 Slee: Rotary engines. [Cognate Application 2825, 1910.] 26433 Douglas: Shirt with waistcoat attachment. [Date applied for under International Convention, November 16th, 1908.] 26444 Mitchell and Dudgeon: Means for supporting overhead electric wires and cables for railway, tramway, and like systems. 26570 Denny: Electric tumbler switches. 26579 Schwarz: Floor cleaning and polishing apparatus. [Date applied for under International Convention, November 17th, 1908.] 26606 Haney: Process for causing self-ignition in explosion engines. 26706 Korting and Mathiesen Akt.-Ges.: Electric arc lamps. [Date applied for under International Convention, November 23rd, 1908.] 26810 Mining Engineering Co., and Christiansen: Chucks for rock drills. 26930. *See* 13719, 1909. 27114 Werth: Apparatus for galvanising metal tubes, rods, and the like. 27128 Thompson (Firm L. and C. Arnold): Apparatus for making multiple-threaded wood screws. [Application for Patent of Addition to No. 9600, 1909.] 27143 Rowell: Typewriters. 27159 Vereinigte Dampfturbinen Ges.: Turbines. [Date applied for under International Convention, November 23rd, 1908.] 27236 Wuttig: Screw-cutting machines. [Date applied for under International Convention, April 17th, 1909.] 27383 Hofmann: Yarn carrier for warp yarn printing machines. 27396 Kemp: Two-stroke cycle internal-combustion engines. 27431 Cox: Apparatus for extracting the moisture from cops, cheeses, warps, cotton or wool, or the like after treatment in bleaching, dyeing, and similar processes. 27540 Bouchet: Portable automatic vulcaniser. [Date applied for under International Convention, November 27th, 1908.] 27685 Groll: Burring apparatus. 27775 Johnson (Chemische Fabrik vorm. Goldenberg, Geromont, and Cie.): Manf. and production of baking powder. 28060 Baumann: Grain hullers. 28082 Pieper: Vehicle propulsion and control. [Date applied for under International Convention, December 1st, 1908.] 28088 Sharman and Sharman: Insole for boots and shoes. [Post-dated January 17th, 1910.] 28217 Cowley and Leah: Machines or apparatus for polishing or otherwise treating floors. 28370 Martin: Radiators heated directly by gas. 28414. *See* 13684, 1909. 28452 Von Lepel: Oscillating discharge circuits. [Date applied for under International Convention, December 5th, 1908.] 28542 Cook: Lifting jacks. [Rights under Section 91 of Patents, etc., Act, 1907, not granted.] 28643 Droitcour: Inking mechanism of printing presses having particular reference to the means whereby the time and duration of contact between the ductor and fountain rolls can be varied. 28663 Mabbett: Tarpaulin or like support for railway wagons. 28699. *See* 13509, 1909. 28767 Richards and Bellingham: Valve mechanism for internal-combustion engines. 28769 Smith: Sanitary trap for sinks, lavatory basins, and the like. 28832 Peraux: Inner tubes for pneumatic tyres. 29054 Mehegan: Wall ventilators or air extractors. 29219 Stevenson: Safety devices for submarine boats. 29385 Friedrich: Process of manf. of a copper salt specially suited for preparing ammoniacal copper oxide. [Date applied for under International Convention, December 15th, 1908.] 29481 Fessenden: Wireless electric signalling, particularly applicable to free aerial vessels. [Date applied for under International Convention, February 11th, 1909.] 29507 Sefton-Jones (C. G. Roeder Ges.): Process for preparing planographic iron printing plates. 29559 Stephen: Manf. of artificial fuel. 29601 Von Rehbinder: Cold storage rooms. 29625 Still, and W. M. Still and Sons Ltd.: Gas burners. 29684 Bingham: Moving picture machines and apparatus for winding cinematograph films. [Date applied for under International Convention, May 17th, 1909.] 29772 Delis: Removable rim with spring tyre for the wheels of vehicles of all kinds. 29787 Busch, and von Wulfing: Preparation of albumenoid compounds of guaiacol sulphonates. 29801 Blos: Automatic telephone exchanges. 29852 Mumford: Tools for attaching fasteners to driving belts. [Date applied for under International Convention, December 26th, 1908.] 29885 Lake (Lockett Crimping Machine Co.): Machines for crimping leather for boot uppers and the like. 29962 Falk: Process for the manf. of white lead. 29975 Metz: Musical instrument. 30155 Rothwell: Dress hooks. 30309 McKean: Yarn-gassing machines. 30507 Schmid: Scouring of wool and woollen goods. 30574 Tucker, Clark, and A. G. Scott and Co.: Lever cans. 30591 Thiry: Clutches.

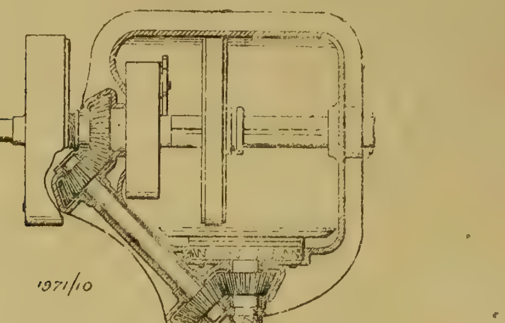
1910.

82 Schafer: Releasing mechanism for boring tools and the like. [Date applied for under International Convention, January 2nd, 1909.] 184 Gage: Machines for the cutting of slices of buttered bread and sandwiches. [Date applied for under International Convention, May 8th, 1909.] 298 Zivan: Fire escapes and the like. 350 Krause: Metal filament lamps having filament carriers arranged elastically. [Date applied for under International Convention, July 7th, 1909, originally included in No. 22458, 1909.] 663 Glidden: Ladders. 675 Troost: Firing devices for firearms. [Date applied for under International Convention, December 20th, 1909.] 718 Banchieri: Process and apparatus for the devulcanisation of indiarubber. 719 Banchieri: Process and apparatus for the devulcanisation of indiarubber. 767 Stegmeyer and Stegmeyer: Pegging lasts. [Date applied for under International Convention, January 13th, 1909.] 836 Kramp and Kramp: Door and the like checking devices. 1036 Dawson: Garment for ladies' wear. 1142 Societe Anonyme Etablissements Arbel, Forges de Douai, Forges de Couzon: Chassis for automobile or other vehicles. [Date applied for under International Convention, January 15th, 1909.] 1230 Stahlecker: Door fastening and signal. [Date applied for under International Convention, January 25th, 1909.] 1266 Pierpont: Type moulds. 1403 Broking: Apparatus for hardening or tempering knife blades. 1426. *See* 16182, 1909. 1428 Siemens Bros. and Co. (Siemens and Halske Akt.-Ges.): Damped electrical relays. 1433 Akt.-Ges. Brown, Boverie, et Cie.: Combined ahead and astern turbines. [Date applied for under International Convention, April 10th, 1909.] 1443 Dufwa: Flying machines. [Date applied for under Rule 13, July 13th, 1909.] 1482 Jackson and Scheibe: Control apparatus for vapour electric rectifiers. [Date applied for under International Convention, January 21st, 1909.] 1514 Demandre: Devices for making up and securing neckties

for use with double collars. 1650 Palmer: Safety devices for mining cages and the like. 1694 Dufwa: Flying machines. [Date applied for under Rule 13, July 13th, 1909.]

1971 Whiteman (Direct Drive Manufacturing Co.): Variable-speed gearing.

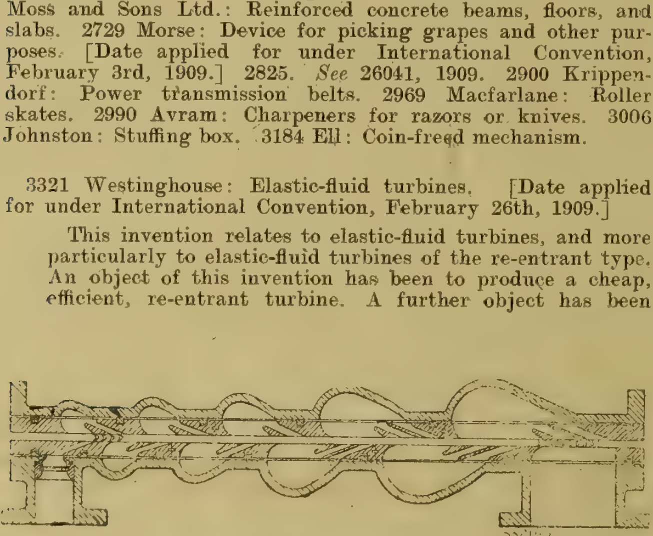
The object of the invention is the provision in a transmission gearing of the type having drive and driven shafts and a clutch having connections with the drive shaft and a friction wheel and means driven by the clutch for driving the friction wheel and other friction wheel mounted on the driven shaft and arranged to receive motion from the first-mentioned friction wheel, and comprises means automatically operated by the driven friction wheel for locking the drive and driven shafts together when the driven shaft attains its greatest speed.



2055 Johnston: Machine for filling tubes and the like. 2209 Blasberg: Puttee gaiter. 2377 Williams and Tortorice: Railway rail joints. 2430 Wanderer-werke, vorm. Winklhofer, and Jaenicke Akt.-Ges., and Buschmann: Paper feed device for typewriters. 2523 Levy Fils, A. Bernheim, et Cie.: Dobbies and jacquards of weaving looms. [Date applied for under International Convention, February 24th, 1909.] 2528 Firm J. Hirschhorn: Regulating device for Bunsen burners. [Date applied for under International Convention, February 16th, 1909.] 2549 Clark: Holdalls or bags. 2620 Lockfaw: Sheave blocks. 2642 Kuhlewein: Protecting covers for vacuum jacketed vessels. 2647 Saldana: Expression devices for automatic musical instruments. [Date applied for under International Convention, February 2nd, 1909.] 2651 MacFarland and Eaton: Sectional cutting dies. 2666 Moss, and William Moss and Sons Ltd.: Reinforced concrete beams, floors, and slabs. 2729 Morse: Device for picking grapes and other purposes. [Date applied for under International Convention, February 3rd, 1909.] 2825. *See* 26041, 1909. 2900 Krippendorf: Power transmission belts. 2969 Macfarlane: Roller skates. 2990 Avram: Charpeners for razors or knives. 3006 Johnston: Stuffing box. 3184 Ell: Coin-freed mechanism.

3321 Westinghouse: Elastic-fluid turbines. [Date applied for under International Convention, February 26th, 1909.]

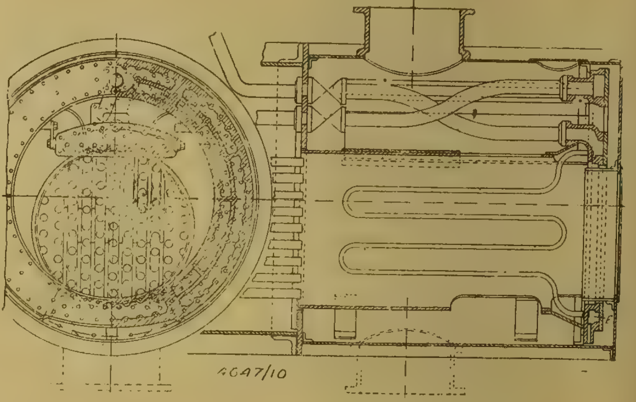
This invention relates to elastic-fluid turbines, and more particularly to elastic-fluid turbines of the re-entrant type. An object of this invention has been to produce a cheap, efficient, re-entrant turbine. A further object has been to provide means in a re-entrant turbine for reducing the leakage from stage to stage to a minimum. The motive fluid is admitted from a series of nozzles arranged on each side of the rotating wheel and the nozzle members are yieldingly held against the lateral faces of the wheel by steam pressure.



3398 Stein and Maas: Device for holding hinged doors and windows in various positions. 3458 Robinson and Dale: Roundabouts and like apparatus. 3603 Danzer: Cinematographic films or bands. 3751 Alefs: Hide and leather-working machines. 3807 Hunt and Moscrop: Buckets for lifting condensation water from steam-heated cylinders used for drying textile fabrics. 4181 Spiegle: Landing net frames. [Date applied for under International Convention, April 26th, 1909.] 4271 Teufel: Catamenial band. 4335 Bleichert and Bleichert: Grips for combined haulage and carrying ropes. 4496 Roscoe: Appliances to be used for nature or object drawing, and for analogous uses. 4515 Grace: Means and devices for tensioning the flexible or wire ties employed in the construction of flying machines, airships, and the like.

4647 Marshall: Steam superheaters.

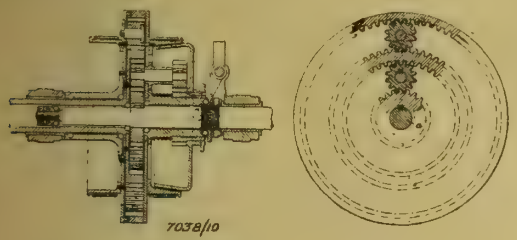
The object is to provide an efficient form of superheater which can be readily fitted in the smokebox of a loco or other type of tubular boiler. The superheater is applicable to a boiler having an uptake chimney or a downtake flue, and it is so constructed that it can be readily removed from the smokebox if necessary for repairs or cleaning, without interfering with any other parts of the engine or boiler. A bye-pass valve is arranged so that the engine can be worked with either saturated or superheated steam as may be desired. According to the present construction a hollow ring is providd divided into steam chambers connected by U-shaped superheater tubes through which the steam circulates, the lower chamber having a series of double U tubes leading to a final receiving chamber which forms an exit for the superheated steam.



4760 Graves and Parrott: Wheel rim. 5097 Keroff: Lace or like collars for personal wear. 5156 Dyve and Barton: Screen for protecting wall surfaces and the like during the cleaning of floors and the like. [Application for Patent of Addition to No. 6613, 1909.] 5160 Beyer: Holder for flying tops. 5332 Watts: Reinforced air tube for pneumatic tyres. 5426 Moore: Means of securing ear rings to unpierced ears. 5467 Howsley and Boot: Apparatus for facilitating the starting of internal-combustion engines. 5489 Kohn: Tanning processes. [Date applied for under International Convention, April 24th, 1909.] 5580 Wheeler: Rotary engines. [Date applied for under International Convention, March 18th, 1909.] 5664 Gessner: Machines for tentering and drying fabrics. 6125 Siemens Bros. Dynamo Works (Siemens Schuckertwerke Ges.): Regulation of electric frequency converters. 6201 Stern and Bouracier: Card game and apparatus therefor. 6500 Hussey: Drinking cups. [Date applied for under International Convention, November 15th, 1909.] 6529. *See* 19988, 1909. 6592 Off: Artificial teeth. 6627 Timmel: Spectacles. 6709 Drever: Device for carrying pictures and the like. 6816 Aron: Speaking tubes. 6893 Goebel: Paper and like winding machines. [Date applied for under International Convention, March 19th, 1909. Application for Patent of Addition to No. 22682, 1908.]

7038 Marquis Doumet de Siblas and Cottray: Variable-speed mechanism.

Refers to variable-speed mechanism of the kind comprising trains of gearing, and of the kind wherein brakes are employed to control the movements of certain members of the train in order to obtain differences in the velocity ratio between the driving and driven members. According to the present arrangement the gearing comprises a ring having thereon interior and exterior sets of teeth of which the interior set is engaged by a planet pinion in gear with a pinion on the driving shaft, and the exterior set is engaged by a second planet pinion in gear with a toothed ring carried on a rotary disc to which the planetary movement of the first-mentioned planet pinion is imparted. Brake drums and brakes are provided whereby either planet pinion may at will be restrained from planetary motion in order to select and put in operation different trains of gearing having different velocity ratios in the same direction. In combination with this arrangement a reversing gear is provided comprising a pinion fast with one of the above-mentioned planet pinions and in gear with a sun wheel fast with a clutch member adapted to be clutched to the brake drum corresponding to the pinion. When this clutch is engaged the direction of the driven shaft is reversed.



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VOL. 42. FRIDAY, JULY 29, 1910. No. 1,222.

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THE ENGINEER AND HIS OILS.

For some reason or other engineers, and particularly electrical engineers, have not paid marked attention to the physical properties of the oils employed by them, whether for lubricating purposes or for use as an insulator. It may be that they have regarded such studies as not coming directly within their province, when there were so many problems making a more urgent appeal, or possessing plainer evidence of profit and satisfaction, issuing as a result of their investigation. Electrical engineers, however, have gone to great pains in their investigations of such materials as transformer iron or steel rails, both in the laboratory and in actual everyday service, for these bulk largely in their work, while oils are apparently accepted and used without anything more than a superficial knowledge of their properties. There are directions in which the engineer, like everybody else, must take things for granted, because life is too brief to permit him to study everything with the application of the specialist. It would appear, judging from some remarks recently made before the Institution of Electrical Engineers, that there has been trouble resulting from the fact that electrical men take their oils too much on trust. The literature of rival makers, in which guarantees have been given of a flash point, specific gravity, viscosity, and degree of chemical purity, has led the engineer to order this oil rather than that. Tests of random samples were shown to be sadly misleading, for the contents of several drums forming a simultaneous consignment of oils vary very greatly in their chemical purity, and still more in their dielectric strength. The authors of the paper alluded to advanced a great deal of useful information, which is the more valuable in view of its scarcity in the past, in which were embodied the results of their researches (carried out for their own private information) of the electrical properties of switch and transformer oils in general, and the respective merits of well-known (but unnamed) brands in common use. They urged the systematic examination of oil before use, suggested standardised methods of testing, and described some of the physical and chemical changes occurring through use. The makers of the best oils even were said not to maintain a standard quality of excellence, but, in part, blame is allotted to the electrical engineer for failing to insist on uniformity of quality.

ELECTRICITY AS A HEATING AGENT.

If recent statements by electricity supply authorities represent actual tendencies, of which there is tangible evidence, and are not merely the expressions of pious aspirations, we are on the verge of an important forward movement in the matter of electric heating and cooking. The domestic gas stove has undoubtedly been a great thorn in the flesh of the electrical man for years, and in the absence of startling electrical developments, it is safe to say that it will take a great deal of supplanting. It has been the direction in which the gas-supply authorities have found a fruitful field, practically free from rivals, when they have been encountering competition on the lighting side of their business. It is noticeable now that the electricity supply people, when they are in a certain measure of tribulation because their consumers do not need so much current with up-to-date lamps, are inventing ways and means for more effectively invading the domestic stove and cooker field. They have got to secure an increased demand for energy somewhere, and if only the electrical apparatus were obtainable at a fairly reasonable figure, and if the consumer were charged at a reasonable rate for energy for use with it, and if one meter would suffice for all classes of energy, the prospect would not be bad. Now, as a matter of fact, there has, during the last year or two, been a bigger effort upon the part of electrical manufacturers to produce apparatus of less costly types, and to sell it at a lower rate of profit than we believe they secured when only the patron of luxuries was their customer. A comparatively small sum of money will go a long way now towards meeting the needs of the average domestic householder. There is, of course, the advantage of cleanliness and absence of smell, but the consumer of electricity will want to know whether it is going to cost more to cook with his electrical cooking apparatus than it does now with his gas. Unfortunately the public do not get on well with the present systems of charging for electricity, and if we have methods which mystify them or make them suspicious —well, we do not inspire their confidence. It has frequently been said that the consumer will be far more easily won if there is simplification in this direction. Some of the electrical authorities have resolved to take the bull by the horns, and instead of charging different rates per unit for electricity used for different classes of service, they are going to charge a combined tariff for heating, lighting, cooking, and motive power. One of the London companies, at least, has announced such a decision, so that consumers, without having to incur the expense of a separate wiring system or a separate meter, can have a supply available for all these purposes on a basis of tariff which, without increasing the cost of their lighting, will give them the additional electricity required for all purposes at 2d., and beyond a certain quantity at 1d. per unit. A considerable number of contracts have already been entered into on this basis. The experiment is an important one, and information as to the results attending it will be watched for with interest by engineers and managers of other supply systems.

Aerial Flight.—It is satisfactory to learn that the whole matter of flight, both by dirigible airships and aeroplanes, is being investigated by a scientific committee appointed by the Government, in the interest of the Army and Navy. This Committee has for its president Lord Rayleigh, F.R.S., and among its members are Dr. Glazebrook, F.R.S., of the National Physical Laboratory; Major-General Sir C. Hadden, representing the Army; Captain R. H. S. Bacon, for the Navy; Sir A. G. Greenhill, F.R.S., professor of mathematics, Woolwich; Dr. W. N. Shaw, F.R.S., as expert on air currents; Mr. Horace Darwin, F.R.S.; Mr. H. R. A. Mallock, of the Ordnance Committee; Professor Petavel, F.R.S., Manchester; and Mr. F. W. Lanchester, an authority on aeronautics. This Committee will make continuous experiments at the National Laboratory, near Teddington.

Shipbuilding in America.—During the year ended June 30, 1910, there were built in the United States, and offically numbered by the Bureau of Navigation, 1,502 merchant vessels of 347,025 gross tons, compared with 1,362 of 232,816 gross tons during the fiscal year of 1909, showing a substantial increase of 114,209 tons. On the Great Lakes 47 steel steamers of 146,896 tons were built, compared with 36 steamers of 88,426 tons. During last year 15 new steel ocean steamers were launched, the largest of which was the Wilhelmina, of 6,974 tons. The schooner Wyoming, 3,730 tons, built at Bath, Mass., is the largest wooden vessel ever built in the United States. The first square-rigged vessel launched since 1904 is the brigantine Viola at Essex, Mass. Of the year's output 67,268 tons were barges and canal boats.

Engineering Imports and Exports.—The Board of Trade returns for the six months ended June 30 show that the imports of iron and steel, and manufactures thereof, amounted to £4,342,401, or £525,080 more than for the same period of last year, while the exports reached £20,948,190, an increase of £2,647,508. The imports and exports of other metals and manufactures were £11,592,017 and £5,042,743, showing increases over last year of £559,562 and £1,013,571 respectively. The imports of electrical goods increased by £86,289, and the exports by £807,158, the totals for this year being £720,827 and £1,692,794. The imports of machinery amounted to £2,281,562, a decrease of £145,577, and the exports to £14,080,486, an increase of £180,493. The figures for machinery, when compared with the first six months of 1908, show decreases of £413,750 and £1,674,659.

Steel Industry for South Africa.—Certain proposals have been accepted for the erection of a local plant for the manufacture of steel from iron and steel scrap, and in connection with this the South African Steel Corporation Limited will shortly be registered with a capital of £200,000. The Corporation will be floated under the auspices of the Société Electro-Métallurgique Francaise—the owners of the Héroult furnace patents—and of Messrs. E. Allen and Co., of Sheffield and Johannesburg. The consulting engineers will be Sir Charles Metcalfe and Sir Douglas Fox and Partner. The Board of Directors will be resident in London, but the managing director will be Mr. Donald F. Campbell, the well-known steel expert, who is now on his way out from England, and who will decide upon a site for the works on his arrival. His decision will be governed mainly by power supply considerations. It is understood that electric power will be purchased from the new central power station to be erected on Tweefontein. The initial plant will consist of one five-ton Héroult furnace for the electric smelting of scrap. This, it is expected, will be producing steel from local scrap within 12 months. The first products will be drill steel, castings, railway castings, and axles. A feature will be made of drill steel, and among the 30 or 40 expert workmen who will be imported for the industry will be some of the best men from the leading Sheffield steelworks. Apart from these experts, it is thought that the rest of the labour required can be obtained in South Africa. Some criticism has been directed against the Héroult furnace on the ground of its novelty, but this is sufficiently answered by the fact that the furnace is now being used or erected in Sheffield by Messrs. Edgar Allen and Co., Vickers, Sons, and Maxim, and by Messrs. Thos. Firth and Sons. Steel of every description can be produced by the furnace, and, it is believed, at a cost that will compete with the imported article.

Express Cable Transmission.—On 20th July, at the Whitehall Rooms, a working demonstration of an express system of telegraphy was given by the inventor, Mr. Hans Knudsen, in the presence of a company of engineering and electrical experts. It is claimed that by the invention a cheaper cable communication throughout the Empire may be established. The main feature of the system is that instead of using, say, four impulses in order to transmit one letter of the alphabet, only one impulse is necessary. The message to be despatched is first transmitted to a paper strip by a machine worked by a keyboard similar to a typewriter. The impulses on the paper are transmitted by the cable to a receiving machine, which records similar impulses on a tape. The tape stops automatically at certain notches, and the message is read according to the letter opposite which each impulse is recorded. The system can be adapted to the present cables without any additional current, and, as only one impulse is used instead of four, as at present, a great saving of time is effected. The keyboard of the machine on which the tape is prepared can be changed at will, and by this means any attempt to "tap" messages can be baulked.

THE PRINCIPLES OF IRONFOUNDING.

By Prof. A. Humboldt Sexton, F.C.S., F.I.C.

(Continued from page 6.)

Crucible Furnaces.

In ironfounding, crucible furnaces are rarely used, though they are generally employed in alloy casting.

The metal is put into a crucible, which is put into a furnace or "hole," and the charge is melted down by the coke fire. The pots may have a capacity of from 50 lbs. to 500 lbs., but pots of more than about 120 lbs. are not easy to manipulate.

The fuel used is always coke, and the consumption of fuel is large, as a large proportion of carbon escapes to the chimney incompletely burnt as carbon monoxide. Crucible furnaces are so rarely used in the iron foundry that full details need not be given. They are only used for melting alloys or small quantities of metal for special purposes where it is desirable to guard against change during melting, and particularly against sulphur being taken up. Metal melted in a crucible undergoes very little change; there is a slight oxidation, but less than in cupola melting if the operation is carefully conducted. Fig. 77 shows a section of a solid fuel-fired crucible furnace.

Direct Castings.

Large castings, such as ingot moulds for steel casting, cast in hæmatite irons, are often cast direct from the blast furnace. This saves remelting, but has the disadvantage that the character of the iron is somewhat uncertain. This does not fall within the range of the work of the ordinary founder.

Patterns.

In all varieties of foundry work the molten metal is poured into a prepared mould, and there allowed to solidify. The methods of making the mould are various, but in all ordinary cases the first step is to make a pattern in wood or some other material, which is then bedded in a plastic moulding material of some kind, withdrawn, and thus a cavity or mould is left into which the molten metal is poured.

The making of the pattern, therefore, becomes a matter of very great importance, as on it will depend the final form of the casting.

Material of the Pattern.

The material of the pattern will vary with circumstances; it may be wood, metal, or some suitable composition.

Wood is the material generally used, on account of its abundance, its cheapness, and the ease with which it can be worked into any required form.

A wood suitable for making patterns should be of very fine grain, so that it will take a good smooth surface, and it should not warp or split readily, for the pattern may need to be preserved, and its condition as to dryness may therefore undergo great change. No wood is absolutely free from the tendency to warp as it dries, and the pattern must be so made as to reduce this tendency to a minimum; but the less liable the wood is to warp the easier will it be to make a good pattern. The wood should not be too hard or it will not be easy to work, and it should not be too soft or the finished pattern will be too easily dented or damaged. It should not be too porous or absorbent, as, if it is, it will absorb moisture from the sand, thus leaving a dry layer near the surface, which will either pull away with the pattern or fall away when it is removed, and this will not leave a clear mould.

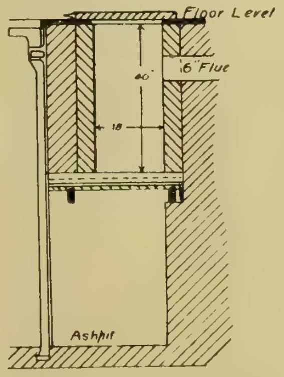

Fig. 77.—Solid Fuel-fired Crucible Furnace.

The wood from any particular kind of tree, if carefully selected, is wonderfully uniform in its properties, so that certain woods have come to be largely used for pattern making.

The wood most generally employed for ordinary work is pine, since it is light, a serious consideration if large patterns are being made, and it does not warp or split readily; but it is soft, and is therefore easily indented and damaged, so that patterns made from it require to be carefully handled. Canadian red pine is often used, and white American fir spruce is a favourite with some. Mahogany is a good wood, but is costly; the Spanish variety is said to be best, that from Honduras next in utility, and African mahogany not so good. It is very hard and dense, possessing close grain; it shrinks less than most other woods on drying, and warps and twists very little.

Cherry wood is hard and close grained, and yields excellent patterns; while teak is light, porous, and very easily worked.

Patterns made of absorbent woods must be well painted or suitably protected, otherwise they will not "draw." Poplar, sycamore, maple, oak, and some other woods are so absorbent that they will not "draw" unless the surface is well protected, whilst ebony and box are as unabsorbent as metals.

The wood used must always be well seasoned, that is, "air dried."

The tree as it grows contains a very large quantity of water, it is cellular in structure, and the cells are full of liquid, particularly in the case of the young wood, but in the older wood the walls become thickened by the deposit of woody material, and the amount of water present is very much less, as shown in the section of a tree stem (fig. 78). When the tree is cut down, and the timber is left exposed to the air, the water slowly evaporates, and as it does so the wood contracts. The outer layers, which constitute the younger wood, contract the most, and thus contracting over the unyielding centre leads to the cracking so often seen in a seasoned tree stem. Owing to the structure of the stem, the warping of planks cut from it may be very irregular, the plank often bending out of shape due to the shrinkage, as shown in the diagram (fig. 79). It must be borne in mind that wood is never in such a condition that further change is impossible; if it be too dry it may absorb water, and thus expand, producing changes in the opposite direction. A well-seasoned wood is one which, in the position in which it is to be used, will undergo no further change, but it is impossible that wood can be so seasoned as to meet all possible conditions.

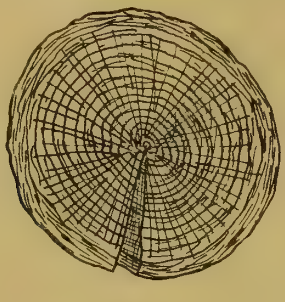

Fig. 78.—Section of a Tree Stem.

As in pattern making the wood is used in a fairly dry condition, the patterns must always be stored in a dry place, but in one to which air has free access.

Wood is usually seasoned by leaving it for a long time exposed to the air in a place sheltered both from rain and sunshine. The drying may be hurried by artificial warmth, but as a rule this is not good, as the quicker the drying the greater is the tendency to warp and crack, and also to the setting up of internal stress, which may lead to cracking, often at unexpected and inconvenient times.

When a pattern is to be painted, a good hard drying paint should be used, and the surface should be well finished with sand paper, and finally with pumice stone or very fine glass paper, so as to make it as smooth as possible. A final coat of very thin paint is given, and then a layer of black lead or some other suitable material, *e.g.*, good varnish, which may be used in place of paint. The object is to give a perfectly smooth surface, which is impervious to water, and this can be done in many ways, as there is no particular method which is absolutely the best. Many pattern makers have a special formula of their own, which they sometimes consider to be of great value, but as a rule they are of little importance. It is quite obvious that the required result can be obtained in many ways, and any method which gives the desired result is good. Any pattern maker who has a method which he has found to give good results should adhere to it, unless he can simplify it by omitting useless ingredients.

When a pattern is to be used many times, it is better not to use the original, as it might get damaged before it is done with, and thus the cost of making a new pattern might be entailed, but to use it for the purpose of making a number of patterns for use.

These are usually cast in iron or bronze; they can be used a large number of times, and as several can be made, many moulders can be at work at once.

It sometimes happens that a casting may be of such a form that it will certainly warp in cooling. It is not always possible to avoid this by the most careful design, in cases where the casting consists of a flat thin portion and a more massive part, so that the shrinkage will be irregular. To avoid this, the pattern must be given a warp which will just counteract the irregular contraction. To do this with the wooden pattern is difficult, so the method adopted is usually to make the wooden pattern in the usual way, then to make a casting in some white alloy, usually an alloy of lead with tin and antimony, which is soft enough to be bent. This white metal pattern is bent sufficiently to correct the distortion due to contraction, and is used to make an iron pattern from which the castings can be made. This is frequently necessary in casting stove fronts and similar articles.

Some ornamental articles are much more easily modelled in a plastic material than cut out of solid wood, and in this case the patterns are made of "Plaster of Paris," *i.e.*, stucco, as it is usually called, or of "papier mache."

Mouldings are easily run in "stucco" direct by means of a template, but more elaborate articles are sometimes moulded in clay, and then a plaster cast is made to serve as the pattern.

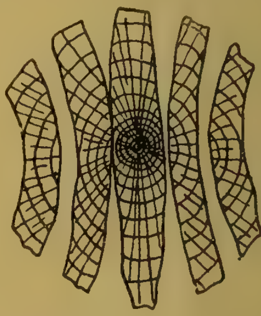

Fig. 79.—Shrinkage of Wood.

Plaster of Paris absorbs water very readily after it has been dried, and it is therefore always saturated with oil before it is used.

Other materials, of course, may be used. The object is to make a model which can be reproduced by casting.

Preparation of the Pattern.

A wood pattern may, if the article be small, be made out of a single piece of wood, but except for very small articles it is always made up of several pieces, and it is in the building up of the pattern that the skill of the pattern maker will be called into play. The pattern may be in one, or in several pieces to be removed from the mould separately. The portions will be united by means of screws or glue, as may be most convenient, and of course will be so made that no screw holes show. It is essential that the pattern should "draw" from the mould, and for this purpose it may be necessary to make portions detached.

It is impossible here to go into any detail as to the making of patterns; full particulars will be found in the books on pattern making.

When metal patterns are used, the surface usually has to be prepared, so that it will draw " clean." In the case of iron patterns, the surface is usually rusted with a little hydrochloric acid (spirit of salts), ammonium chloride (sal ammoniac), or some other agent by which the surface is attacked, and then exposed to the air. The rust is then partially removed, cleaned with a scratch brush or otherwise, and the metal well blackleaded before use, or it may be rubbed over with melted beeswax and then polished. Brass and gun-metal patterns are slightly roughened by treating them with acid or ammonium chloride, and are then blackleaded.

SHRINKAGE.

The mould will be made to the size of the pattern; this will be filled with molten metal, but as the metal solidifies and cools it will contract, so that the actual casting will be smaller than the pattern, and the mould must be a small amount larger than the pattern, so that the pattern can be withdrawn. As a casting of definite size is required, allowance must be made for the shrinkage and the clearance, and in general the pattern is made larger than the casting.

As the shrinkage of iron varies with the chemical composition of the metal and the rate of cooling, which depends largely on the size of the casting, no absolute rule can be given. As a rule the larger the casting the slower will be the cooling, and the less the contraction, but at the same time the smaller will be the proportion which the increase due to clearance bears to the actual contraction.

In very small articles no allowance is usually made, the clearance, which is about $^1/_{32}$in., compensating for the contraction. For ordinary castings an allowance of from $^1/_{10}$in. to $\frac{1}{8}$ in. for each foot is allowed, the latter for large and the former for small castings; but it is obvious that the actual allowance, if accuracy is to be attained, must vary with the character of the iron.

When metal patterns are made, there must be an allowance for double shrinkage, as of course the metal pattern will be a little smaller than the wooden one.

WEIGHT OF CASTINGS.

It is often necessary to know the weight which a casting will have. This can be calculated quite readily from the weight of the pattern, by taking into account the relative† specific gravities of the material of the pattern and of the casting.

The following table will be found useful:—

A pattern weighing 1 lb., made of—	Will weigh when cast in				
	Cast Iron.	Zinc.	Copper.	Yellow Brass.	Gun Metal.
Mahogany	8	8	10	9·8	10
White Pine	14	14·5	18	17·5	17·8
Yellow Pine	13	12·6	16	15·5	16
Cedar	11·5	11·5	14·5	14	14·5
Maple	10	9·8	12·5	12	12·4

This table is given in nearly all the books on founding, but as will be noticed, it is inconsistent in some places; it is, however, nearly correct enough for general use. If the cubic capacity or volume of the pattern is known, the weight of the casting can be very easily calculated; conversely, if the specific gravity is known, then the cubic capacity is easily obtained from the weight.

For example, if a pattern of sycamore wood having a specific gravity of ·6 weighs 2 lbs. 2 ozs., then the weight of the casting in iron made from it will weigh 34 × 7·2 ÷ ·6 = 34 × 12 = 408 ozs. = 25·5 lbs., if the average specific gravity of cast iron be taken as 7·2; hence one cubic foot weighs 450 lbs., or one cubic inch 0·26 lb.

When the volume of the casting is known or can be easily calculated, as in the case of rectangular and circular bars, the weight can be derived from the fact that one cubic foot of water weighs 1,000 ozs. (*i.e.*, 62·5 lbs. approximately) at 60 deg. Fah., when its specific gravity is taken as unity, since the weight of any material will be 1,000 ozs. multiplied by its specific gravity. Thus, for example, if a test bar 3 ft. 6 in. long by 2 in. × 1 in. is cast in iron, what will be its weight, viz., the volume of the bar in cubic feet multiplied by 7·2 × 1,000 ozs., or the volume in cubic inches multiplied by ·26 lbs., *i.e.*, 3·5 × 2 × 7·2 × 1,000 ÷ 144 = 50,400 ÷ 144 = 350 ozs. = 21 lbs. 14 ozs.; alternatively = 42 × 2 × 1 × ·26 = 21·84 lbs.

(*To be continued.*)

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† The specific gravity of a substance is its weight compared with an equal volume of water.

GRAB AND BUCKET CONTROLLING APPARATUS.

IN connection with apparatus for the opening and closing of grabs, and discharging buckets, etc., when operated by cranes, transporters, or similar appliances, it is usual to fit in conjunction with the main barrel or drum of the hoisting winch an auxiliary drum coiling up a rope attached to the grab, bucket, or other appliance, the power necessary for rotating the auxiliary drum to coil up the rope being obtained either by means of the counterbalance weights, which are guided in a frame carried on the structure of the machine, and which are raised by the descending grab or load, and in turn descend and rotate the auxiliary drum to take up the slack in the auxiliary rope when the load is lifted by the main drum, or by means of a coiled spring with which the auxiliary drum is fitted, this spring connecting the drum with the framework in such a way that the descending load coils up the spring, and when the load is raised, the spring, uncoiling, rotates the auxiliary drum to take up the slack rope. These devices are limited in their application, because, in the case of both the counterbalance weight and spring arrangements, provision has to be made for coiling up the auxiliary rope through the whole range of the lift of the load, and when this is great the counterbalance frame becomes weighty and cumbersome, or the spring becomes unduly large, and the tension on the rope caused by the spring varies considerably according to the extent to which the spring is coiled.

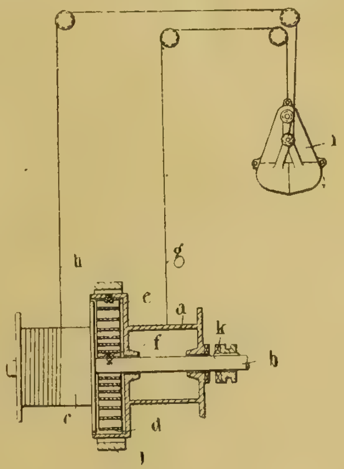


FIG. 1.

When the counterbalance or spring is applied to some types of transporter, its working range has to be great enough to coil up, not only the slack rope due to the height of lift, but in addition all that due to the longitudinal motion of the traveller or load carried along the overhead track.

The object of the arrangement we are describing is to provide simple and effective means whereby the amount of deflection or coiling of the spring, and consequently the size of the latter, may be very greatly reduced and the whole mechanism considerably simplified.

The arrangement consists in providing between the main drum and an auxiliary drum a spring element through which the latter drum is adapted to be actuated by the former, the spring being so aranged that, when the main drum is winding in, the spring allows of a varying ratio of speed between the main and auxiliary drums until the slack has been taken up, after which the spring acts as an ordinary transmission element, maintaining an equal speed or a constant speed ratio between the drums; and when the ropes are to be paid out, both drums rotate together, or at a fixed ratio, until the grab is to be opened or the bucket discharged or a similar operation effected, the auxiliary drum being then held, whereby the spring is unwound or unflexed or even disengaged altogether.

In carrying out this method in one manner as applied to a device having a grab, an auxiliary drum is mounted loosely either upon the same shaft as the main hoisting drum or on a separate shaft connected by gearing or adapted to rotate at a suitable speed relatively to the hoisting drum. A coiled or other suitable spring is fitted so that one end engages with a catch upon the auxiliary drum and the other end engages with a catch upon the shaft, or is connected with it in such a way that the action of rotating the main drum to lift the load tends to coil up or deflect the spring, which in turn carries round with it the auxiliary drum, and coils up the slack of the auxiliary rope.

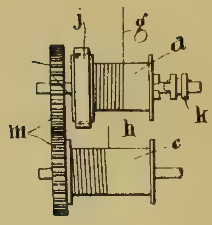


Fig. 2.

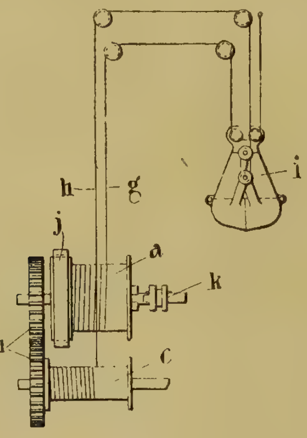


Fig. 3.

As applied to a device having a grab, as shown in fig. 1 in accompanying illustrations, an auxiliary drum *a* is mounted loosely upon the same shaft *b* as the main hoisting drum *c*. A coiled or other suitable spring *d* is fitted so that one end is attached to the auxiliary drum *a*, say, by means of a screw *e*, as shown, and the other end is similarly attached by another screw *f* to the shaft *b*. The action of rotating the main drum *c* to lift the load tends to coil up or deflect the spring *d*, which in turn carries round with it the auxiliary drum *a*, and coils up the slack of the auxiliary rope *g*.

The rope *h* from the main drum *c* is connected to the closing mechanism of the grab *i*, and the rope *g* from the auxiliary drum *a* to the frame of the grab. A brake *j* is fitted to the auxiliary drum *a*, and a clutch *k* of any suitable form may be fitted to enable the drum *a* to be connected positively to its shaft *b* or left free to be driven through the spring *d*. To lift the grab *i*, the main drum *c* is rotated and coils up its rope *h*, and at the same time rotates the auxiliary drum *a* through the spring *d*, whereby the slack in the auxiliary rope *g* caused by the grab *i* being raised is also coiled up.

The spring *d* may be adjusted so that when coiling up the auxiliary rope *g* in this way it maintains a predetermined tension in the rope. To open the grab *i*, the brake *j* on the auxiliary drum is applied, and the main drum rotated so as to pay out the rope *h*. The grab is now suspended by the auxiliary rope *g*, and the paying out of the main rope *h* allows the grab to open. When open to the required extent, if the auxiliary drum *a* is connected by the clutch *k* to the shaft *b*, and the brake released, it rotates in harmony with the main drum, and the grab may be raised or lowered while still open.

If the grab is now lowered on to the material to be grabbed, the clutch *k* is disengaged and the main drum *c* rotated to coil in the rope *h*, the grab will close and then be lifted, and the auxiliary drum *a*, again driven by the spring *d*, will coil in the slack in the auxiliary rope *g*.

In the modification shown in fig. 2, the main and auxiliary drums are mounted on separate shafts and connected by toothed gear wheels *m*. The action is, however, identical with that already set forth with regard to fig. 1.

Instead of the auxiliary rope being directly connected to the frame of the grab, as shown in fig. 1, it may be passed (see fig. 3) round sheaves attached to the frame and returned to the jib head or other support, thus acting on the grab with a double purchase, and serving to prevent the grab from spinning while suspended. In this case it is evident that the auxiliary rope *g* must be paid out or taken in at double the rate of the main rope *h*. This is effected by making the auxiliary drum *a* of double the diameter of the main drum *c*, or by connecting them together by gearing adapted to cause the drum *a* to rotate at twice the speed of the drum *c*. In some cases the purchase of the auxiliary rope *g* on the grab *i* may be multiple, the diameter of the drum or the gearing connecting them being arranged to give the correct relative speed travels to the ropes *g* and *h*.

The mechanism before described, of which Mr. William Alexander and Messrs. Appleby Ltd., Westminster, S.W., are the joint patentees, may be used with other appliances, such as turnover or drop-bottom skips and the like; for example, the main rope being attached to the body of the skip and the auxiliary rope to a mechanism on the skip for operating the latch, so that it may be lifted when desired and the skip allowed to turn over, or the main rope may be attached to the bottom of a drop-bottom skip and the auxiliary rope to the body, or they may be arranged to operate any form of opening or rotating cage or the like.

ALUMINO THERMIC METHOD OF WELDING.

Amongst the various processes adopted in connection with steamship repairs may be specially noted the alumino thermic method of welding, which for marine work ranks in importance with others in use, such as the electric and autogenous systems. The process has beeen sanctioned by the British Corporation for the Survey and Registry of Shipping, Glasgow, for repairs to various parts of the steamers classed with them.

The use of the "Thermit" compound is to produce molten steel at an extremely high temperature, which when run into a suitable mould surrounding the broken parts to be welded, will, owing to the high temperature of the steel, fuse the metal with which it comes in contact, and combine with it to form a solid homogeneous mass. The welding compound consists mainly of a mixture of powdered aluminium and iron oxide. This mixture when ignited in one spot possesses the property of setting up a chemical reaction, and combustion, once started, spreads rapidly throughout the whole mass without any other supply of heat or power. The reaction consists of the aluminium combining with the oxygen of the metallic oxide, and becoming aluminium oxide, called slag, and separating out a pure superheated liquid metal of the nature of mild steel. The temperature created by the reaction is about 5,400 deg. Fah.

The average analysis of "Thermit" steel shows:—

	Per cent.
Carbon	0·05 to 0·10
Manganese	0·08 „ 0·10
Silicon	0·09 „ 0·20
Sulphur	0·03 „ 0·04
Phosphorus	0·04 „ 0·05
Aluminium	0·07 „ 0·18

If placed in a crucible and ignited, it will be found that "Thermit" gives half its weight in molten steel and half its weight in slag. The metal being the heavier, settles at the bottom of the crucible, and the molten slag, which occupies three times the space of the steel, floats on the top. For this reason the crucibles used are of a conical shape, made of a sheet-steel casing, lined internally with a special mixture of burnt magnesite and bituminous cement, and capable of withstanding very high temperatures. As the greatest wear of the crucible occurs at the bottom, they are fitted with a magnesia stone, having a hole, into which is fitted a smaller magnesia stone or thimble, which forms the outlet for the molten metal. Crucibles of this type are made of various sizes to hold from 5 lbs. to 10 cwt. of "Thermit" compound. They will withstand a number of reactions, and when worn can be re-lined.

The liquid metal, at a very high temperature, when run between and around the ends to be joined together in a suitable mould, fuses them and makes a thoroughly sound weld. Over and above this, the excess "Thermit" steel forms a ring or collar welded around the fracture, and extending for a few inches on either side of it, which ensures the repaired part being stronger than the original.

A dry sand mould must be made to surround the fractured parts, the proper design of which is of paramount importance. The facing sand used must be of a very refractory nature. A mixture consisting of one-third fire clay, one-third silica sand, and one-third ground burnt fire brick, mixed dry and moistened just enough to tamp well, usually gives good results; if the above cannot be obtained, a mixture of one part fire clay and two parts sharp sand should be used.

The moulds should be as porous as possible, and made by a moulder accustomed to steel foundry practice.

As practically no two repairs are alike, the expense of making wooden patterns and two-part moulds may be avoided by making the pattern of yellow wax, as follows:

The parts to be welded are fixed in the desired position with $\frac{1}{2}$ in. to 2 in. space between the ends, depending on the size of the section to be welded; a wax pattern is formed to the size of the "Thermit" band required, the mould box placed in position, and the moulding sand rammed; the runner, riser, and drain hole being formed by wooden patterns as usual.

The shape of the band or collar welded on must resemble in cross section approximately the segment of a circle, the thickest part being directly over the fracture, and sloping gradually to the edges. It should overlap the edges of the fracture from 1 in. to 4 in., depending on the size of the parts to be welded.

A good preheating torch, constructed for burning gas and compressed air, or petrol and compressed air, should be used. When neither of these are available, however, a good paraffin heating burner can be used, but it is essential that the parts to be welded are brought to a bright red heat, and that the mould be perfectly dry.

The heating torch should be applied gradually at the commencement, in order to prevent damaging the mould by a too rapid drying.

A simple torch—where gas and compressed air are available—can be made from a length of $\frac{3}{4}$ in. tubing, one end reduced to $\frac{1}{2}$ in. if necessary, the other fitted to a branch piece connected to flexible tubing from gas and air supply (air pressure from 3 lbs. per square inch).

By regulating the supply of gas and air, a powerful heating flame can be obtained.

For the preheating of large pieces to be welded, where the welding has to be carried out at customers' works, a portable preheating outfit, mounted on a truck, may be used. This consists of an air compressor driven by a petrol motor, giving a supply of air at a pressure up to 30 lbs. square inch, and a preheating tank containing a supply of petrol. By a mixture of the compressed air and petrol, a very hot flame is obtained, powerful enough to heat even the largest sections.

As soon as the preheating is finished, the drain hole in the crucible is filled with a dry sand core plug, and the "Thermit" compound ignited by means of a small quantitiy of special ignition powder, composed of barium peroxide and powdered aluminium, placed at the centre on the top of the compound, and ignited by a wind vesta. After igniting the compound, the reaction is complete in 15 to 30 seconds. After the reaction about five seconds may be allowed before tapping for small quantities of the compound; for larger quantities a few seconds longer may be allowed, until the boiling action has entirely subsided.

The tapping pin should then be smartly knocked upwards, allowing the moltel metal to fill up the mould and riser, and the slag which follows, to overflow on to dry sand. The metal on the riser should be kept fluid as long as possible by stirring with a wood batten and feeding with loose "Thermit" thrown on top. The slag should be removed with an iron bar.

The foregoing process, of which we have only given a general outline, has been successfully applied to fractures and repair work of various kinds, such as damaged rudders, stern posts and tubes, dredger buckets, and solid welding of tramway rails, etc., and is not only an interesting addition to the processes previously in use in the welding domain, but should prove of economic utility wherever applied for repair purposes generally.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 21st July, 1910.

Barrow.—*First class:* G. Elliott. *Second class:* M. Gibson, F. Pearson.

Cardiff.—*First class:* S. T. Goodman. *Second class:* S. Davies, T. E. Heslop, A. W. J. Hoy, G. I. Thomas.

Glasgow.—*First class:* W. Borland, A. A. Robson, H. T. Maclarty, A. M. Hall, H. M. Hunt. *Second class:* H. W. Craig, J. F. Ward.

Leith.—*First class:* J. Bone, R. Chapman, A. Waddell, P. C. McDiarmid, R. McG. Innes. *Second class:* J. S. Bromley, A. E. Goodyear, H. Liddle, J. R. Tait, D. Mercer.

Liverpool.—*First class:* W. C. Stephen, W. Patterson. *Second class:* J. Campbell, G. H. Daymond, J. E. Peters, R. A. Wainwright.

London.—*First class:* E. J. Doig, W. Woolcock, J. H. H. Holm, W. H. Evans. *Second class:* J. H. Bullock, J. Robertson.

North Shields.—*First class:* T. S. Robson, T. W. Harle. *Second class:* A. Burnett, J. Harbottle, J. R. Hayward, T. W. Tose.

Southampton.—*First class:* C. E. Jenkins, C. G. Du Santoy, W. A. Clarke.

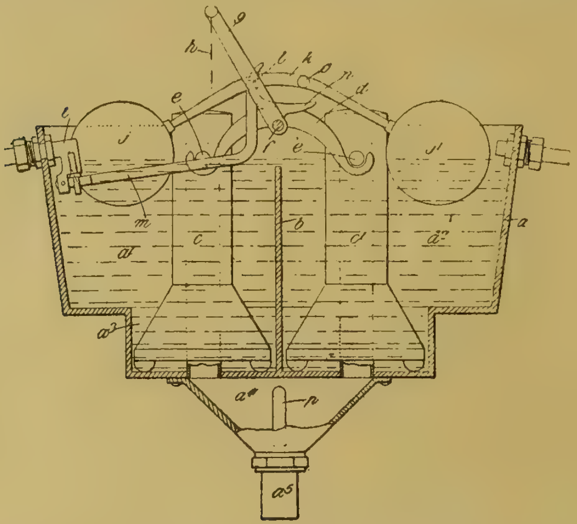
West Hartlepool.—*First class:* R. E. Johnson, T. W. Wannap, T. E. Gregory. *Second class:* C. Clark, C. S. Fenton, A. L. Larsson.

The Midland Institute of Mining, Civil, and Mechanical Engineers.—At a meeting held on the 28th ult. at the Danum Hotel, Doncaster, a paper was read, entitled "Some Experiments on Explosive Gases and their Bearing on Colliery Explosions," by G. R. Thompson, B.Sc., A.R.S.M.

NEW CONSTRUCTION OF FLUSHING CISTERN.

A NEW construction of flushing cistern which represents a considerable advance on devices of this character has recently been designed by Mr. C. L. Newland. The principal feature of the apparatus is the arrangement whereby a secondary flushing can take place immediately after the first, so that the disadvantage of waiting for the cistern to refill is overcome.

The ordinary cistern *a* is divided off by a partition *b* into two water chambers a^1, a^2. Each chamber is provided with a well a^3 at the bottom, and with a syphon tube of the usual form. The syphon-tube plungers are inwardly depressed on their top side to assist or direct the water down the syphon tubes. The plungers are each separately operated by a swinging hanger or rocker, comprising a pair of arms *d* (only one of which is shown), that are mounted on a common sleeve, and provided at each end with a bearing for engaging pins or studs *e* on the plungers *c*, c^1. The hangers or rockers are so arranged that they leave the plunger pins *e* on the plunger not being operated, and they are fixed to a suitable shaft or spindle *f*, preferably having a limiting stop. On the shaft or spindle *f* carrying the hangers or rockers is placed a lever *g* for the purpose of operating the hanger *h*. The lever *g* is so fixed to the spindle or shaft *f* that it has a certain amount of free movement or lost motion, which is checked in both directions by a suitable limiting stop.



New Construction of Flushing Cistern.

To control the water supply to both the compartments there is employed a single ball valve *i*, operated by a pair of balls *j*, j^1, which are mounted on the ends of a rocker arm *k*, turning about a pivot *l* at the end of the main valve lever *m*. The balls *j*, j^1 are adapted to float on the surface of the water, one in each compartment a^1, a^2, thus ensuring a sufficient opening of the valve *i* upon the falling of the water in either compartment, as not until both are quite full is any appreciable or sufficient lifting effect exerted by the balls on the valve lever *m* to close the valve *i*.

A two-armed member *n* is mounted on the shaft *f* operatively connected with the lever *g*, and its object is to throw the lever *g* in position for flushing the water from either of the two compartments which may contain the water at the time. The movement of this member is brought about by a pin or roller *o* which projects laterally from the arm *k* and engages one or other of its extremities, according to the position of the balls *j*, j^1. Thus, in the position shown in the illustration, when both compartments a^1, a^2 are supposed to be full, the pin *o* in its upward movement has, by engagement with the upper arm of the member *n*, thrown the lever *g* over to the left-hand side, so that when the chain *h* is pulled, the right-hand plunger c^1 will be first raised to empty the water from the compartment a^2. When this compartment has been emptied, the ball j^1 will drop and turn about the fulcrum formed by the floating ball *j*, and the pin *o* will engage the lower arm of the member *n* and cause the lever *g* to be thrown over into its other or right-hand position, ready for emptying the other compartment a^1.

The syphoning tubes both discharge into a common well a^4, from which the water is carried off by the ordinary flowpipe a^5. To completely safeguard against any possible syphoning of one flush by the operation of the other flush, there is provided a small air tube *p* that is connected with the well a^4 of the cistern at its back, and extends downwards within the well for a short distance. Upon the syphons operating, air is drawn in by this tube *p* to take the place of the falling water and prevent the water from being sucked or drawn down by the partial vacuum which would otherwise be created in the flow pipe and well.

BOILER EXPLOSIONS.

ABSTRACTS FROM RECENT BOARD OF TRADE REPORTS.

Explosion of a Boiler.

Report of Formal Investigation No. 1,923.—The explosion occurred at paper mills at Caldercruix. The boiler was of the vertical cylindrical type with dished ends, and was used for boiling rags or hair for use in the process of paper making, steam being supplied from the mill boilers. It was 9 ft. in internal diameter by 9 ft. 4 in. high. The shell was composed of two strakes of wrought-iron plates with four plates in each strake, and the ends, which were dished to the extent of 12 in., and flanged at the edge for attachment to the shell, were made of five plates arranged in three strakes. The thickness of the shell and ends varied from $^{5}/_{16}$in to ⅜ in., and all the joints were of the single-riveted lap description, the rivets being ¾ in. in diameter, pitched about 2 in. apart. The boiler was fitted with the following mountings: One dead weight safety valve 3¾ in. diameter, loaded by one cast-iron weight to 14·5 lbs. per square inch. One 4 in. steam stop valve. This and the safety valve were fitted to a short cast-iron pipe on top of the boiler. One 4 in. filling cock, one 4 in. emptying cock, one ⅛ in. gas cock. Inside the boiler a vertical wrought-iron pipe 2 in. in diameter led from the steam inlet to within 8 in. of the bottom of the boiler, and outside this there was a cast-iron vomiting pipe 6 in. in diameter with a stool at the base secured to the bottom of the boiler, which reached to about 6 in. from the top, where a dash plate was placed. Perforated cast-iron plates to form a floor were fitted at the level of the bottom door opening. A 4 in. Auld's reducing valve was fitted to the pipe supplying steam to this boiler and two similar ones, and a gauge graduated to 30 lbs. was connected to the pipe on the reduced side. The explosion was of an extremely violent character, the lower strake of shell plating being ripped off and projected through a 14 in. brick wall to a distance of about 41 ft. The top part of the boiler being free, ascended nearly vertically through the floor over the boiler room and the roof above that, and returned upside-down to a position about 15 ft. from where it originally stood. Both the east and south walls of the boiler house were thrown down, and the building generally wrecked. The safety valve and connections were projected upwards and fell through the roof at a distance of 63 ft., while parts of the sides of the cast-iron frame of the lower door were projected into a neighbouring boiler of similar construction and having plates ⅜ in. thick, some pieces passing completely through both sides. The explosion was due to over-pressure of steam. The boiler safety valve had got jammed and failed to lift. The reducing valve had also become inoperative. One person was killed and three were injured by the explosion.

Explosion from a Manhole Door.

Report of Preliminary Inquiry No. 1,924.—The explosion occurred on the main boiler of the steamship Ivy while she lay in the River Elbe at Hamburg. The boiler was made of steel, and was of the ordinary single-ended type, 13 ft. in diameter by 10 ft. in length. There were three furnaces of the Purves section, each 3 ft. 3 in. in diameter and 6 ft. 9 in. long. The usual mountings were fitted, and included two spring-loaded safety valves loaded to blow off at a pressure of 160 lbs. per square inch. Two manholes were provided in the lower part of the front end plates, between the furnaces; they were of elliptical shape, the greater axis being 14¼ in., and the lesser 10½ in. The doors were made of a steel plate, ⅝ in. thick, to which was riveted a flanged spigot piece ¾ in. in thickness, the dimensions of the latter being 13¾ in. by 10 in. Each door was fitted with two studs 1½ in. diameter and 8 in. between centres, riveted over on the inside of the doors. The end plate of the boiler was not flanged at the manholes, neither were compensating rings provided. A piece about 3 in. in length of the flat asbestos ring forming the joint of the port bottom manhole door was forced out, thus allowing the contents of the boiler to escape into the stokehold. The explosion was due to the joint not being properly secured. The plate forming the jointing surface round the manhole had become worn and weakened by corrosion, and owing to the springing of this plate when the door was screwed up, the joint was not gripped with equal tenacity all round, and the clearance of the spigot being also excessive, a piece of the joint where not properly gripped was blown out. Two persons were injured by the explosion.

Explosion from a Tube in a Steam heated Oven.

Report of Preliminary Inquiry No. 1,925.—The explosion occurred at the bakery of the Crompton Co-operative Provident Society Ltd., at Shaw, Lancs. This class of apparatus is known as Mason's loop tube combination draw-plate and peel oven. It has two compartments, one built over the other; the lower space or draw-plate oven is 10 ft. long by 6 ft. wide, and the top space or peel oven is 9 ft. 9 in. in length by 6 ft. 3 in. in width. The general structure is of brick, the walls being double and 20 in. in width, built of 9 in. bricks with a 2 in. intervening space filled with silicate cotton. The crowns of the compartments are formed of fire-brick slabs resting on steel tee-bars, and the sole of the upper space is of tiles resting on steel plates. The lower space is fitted with a balanced door, which opens vertically, and is of sufficient size to allow the draw plate to be worked, and the top space has the ordinary hinged door. The furnace, which is at the back of the structure, is 2 ft. long by 18 in. wide, and is fitted with the usual hinged door. The ashpit is made to hold water, and has an opening of 12 in. by 6 in., fitted with a double door which slides on a bar. Two flue dampers are supplied, one for each compartment, and each space is fitted with a steam damper and a mercurial thermometer. Altogether 55 tubes are employed to heat the two spaces, each tube being a separate unit, and forming a complete circuit. The tubes are divided into four sets, two sets being used in each space and allocated as follows: 23 to the crown and eight to the bottom of the draw-plate compartment; 14 to the crown and 10 to the bottom of the top compartment, the latter set being placed below the sole and surrounded by a sand filling. The tubes are made of solid drawn steel ⅝ in. in bore and $1^1/_{16}$ in. in external diameter, and so arranged that their lower portions pass through the furnace. One of the tubes burst with such violence that the furnace door was broken and part of the brickwork of the flue dislodged. The explosion appears to have been due to the severe working conditions to which the tubes were subjected, the material of which they were made being no longer able to withstand the pressure. No one was injured by the explosion.

VENTILATION AND DUST REMOVAL IN COTTON MILLS.—IV.

[CONTRIBUTED.]

(Continued from page 79.)

ELECTRICAL GASSING MACHINES.

FROM very early times it has occurred to inventors and others that the use of electrically-heated means for "gassing" or removing fluff from yarn would avoid many of the difficulties relating to ventilation and dust removal, and be attended by other advantages as compared with ordinary gassing frames.

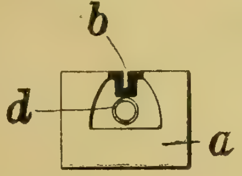


FIG. 18.

In 1884, Robert Threlfall, of Ripley, Yorkshire, obtained a Patent, No. 11,583, of that year, in the specification of which he states: "Hitherto a gas or other flame has been generally employed for removing the fluff or loose or projecting fibres from silk, cotton, and other threads or yarns. This mode of burning off such fluff has been frequently attended with much damage to the material caused by the smoke from the burning gases coming in contact with such material and spoiling the colour. The products of combustion are also very injurious to the health of those employed in attending to the operation."

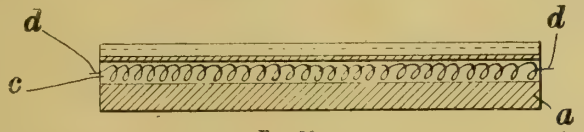


FIG. 19.

Threlfall proposed to employ an electric current to raise a ring-like or other piece of platinum to incandescence, and to pass the yarn over the surface of the same.

The subject of electrically gassing or singeing yarn does not, however, appear to have received very serious attention until the year 1906, when Messrs. Kaisser and Riche, of Lille, applied for a Patent, No. 26,954, of 1906, for the form of electrical gassing burner shown in end elevation and longitudinal section at figs. 18 and 19. It comprises a block *a* of refractory material, having a trough *b* along one side, through which the yarn travels whilst being gassed. A passage *c* is formed through the block *a* to receive a resistance coil *d*, which, when an electric current is passed through it, is said to raise the trough *b* to incandescence.

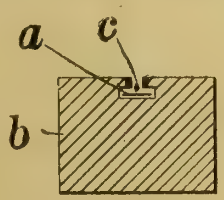


FIG. 20.

In a modified form of burner by Kaisser, illustrated at fig. 20, and described in his patent specification No. 27,128, of 1906, a strip of platinum *a* coated with iridium or rhodium is placed within a groove in the refractory block *b*. The yarn *c* to be gassed is conveyed along the top of or in close proximity to the strip *a*, which is raised to incandescence by the current passed through it.

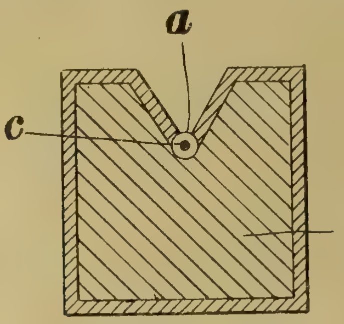


Fig. 21.

A further modified form of electrical burner is shown in cross-section at fig. 21, which is taken from the patent specification No. 10,088, of 1907, of Victor Courtecuisse, of Lille. The inventor states that he has found that where the yarn is passed through an electrically-heated trough or tube, the gassing is very inefficiently performed unless the tube is of very small diameter. He therefore employs a long split tube *a* of small diameter, supported within a block of fireproof refractory material *b*. The yarn *c* passes through the tube.

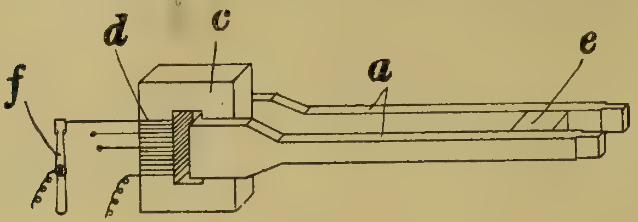


Fig. 22.

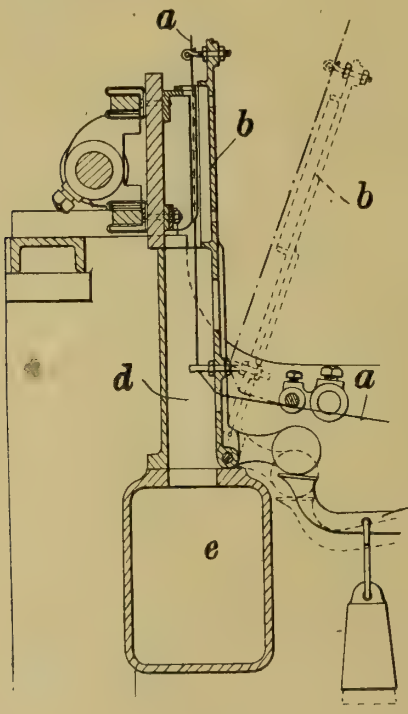


Fig. 24.

Gustave Gin, of Paris, has several patents for electrical gassing burners and frames, his earliest being No. 4,550, of 1907, which he obtained in conjunction with Victor Courtecuisse, of Lille. In the patent specification there are described and illustrated various forms of long metallic split tubes, which provide the incandescent electrical conductor through which the yarn travels in an axial direction. The patentees state: "An indispensable condition to be realised in all the arrangements is to assure the perfect straightness of the conduits in which the threads pass. If the incandescent surface is backed with a refractory mass, the coefficients of expansion and of elasticity whereof are different from those of the metal, the latter becomes warped; and if the two extremities of the tube are fixed, the tube takes a form having longitudinal undulations, incompatible with the straightness of the thread which is passing through it. It is therefore desirable:—

"(1) That the tube or heating device be free in the air, and be only in contact at its extremities with solid material.

"(2) That only one of the extremities of the heating device be fixed, the other being free in order to permit free expansion."

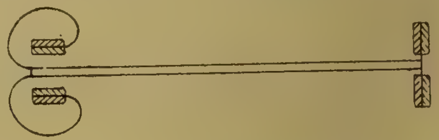


Fig. 23.

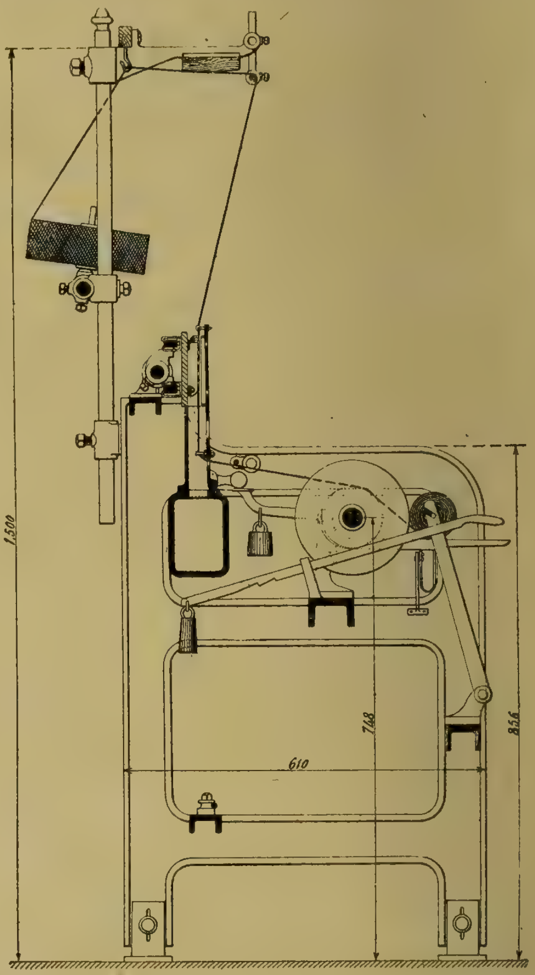


Fig 25.

An electrical gassing burner for use in cloth singeing is described in Gin's patent specification No. 5,856, of 1906, from which fig. 22 is taken. The inventor, in his specification, says:—

"It has been demonstrated by experiment that common wires cannot furnish a sufficient quantity of heat for singeing at high speed, and that it is necessary to make use of thick metallic bars heated to incandescence by a very intense electric current. Any of the metals or their alloys which are not readily fusible and not easily oxidised at a high temperature may be employed for making these singeing bars; nickel, ferro-nickel, and silicic nickel are recommended in particular. But in view of the great intensity of the current employed, and the feeble electric resistance of the singeing bars, it would be necessary to have recourse to low-tension current generators having conductors of considerable cross-section and expensive connections. In order to obviate the difficulties indicated, I form the singeing bars as the secondary circuit of a transformer, the primary circuit of which is fed by a current of normal tension. In this way an induction furnace is obtained having some analogy to those which are employed in electro-metallurgy."

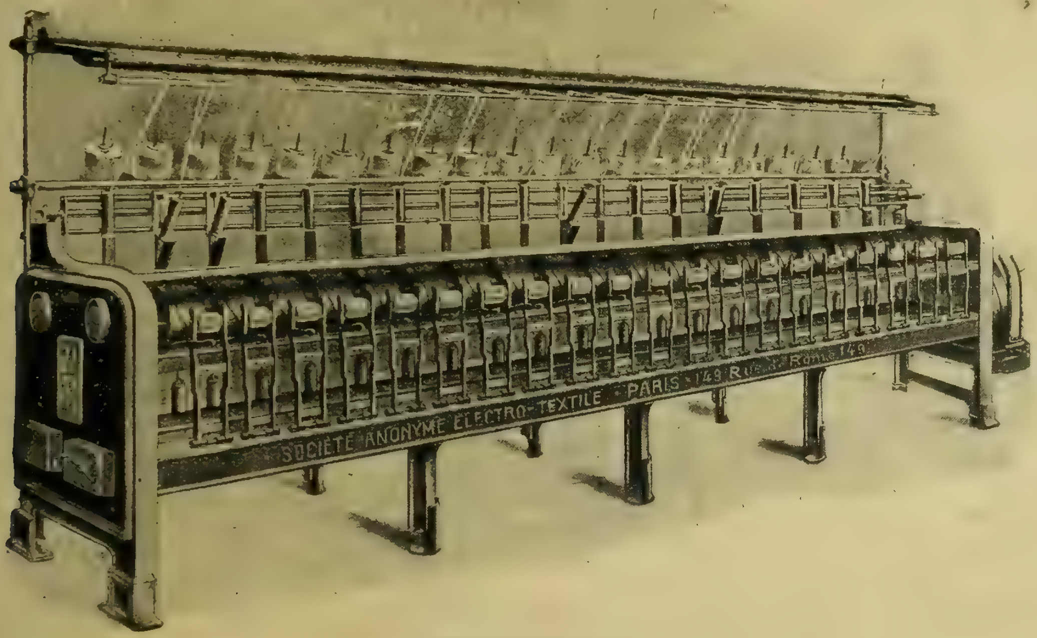


Fig. 26.—ELECTRICAL GASSING FRAME.

Referring to the drawing, the burner comprises a bar *a* bent to stirrup shape as shown, one end embracing one side of the electro-magnetic core *c*, the other side of the core being surrounded by the winding *d*. The electric circuit through the bar *a* is closed by an adjustable metal block or bridge piece *e*, against which the bar ends are pressed. By moving the bridge *e* away from or towards the free ends of *a*, the incandescent area is varied to suit the width of cloth being singed. By means of a switch *f*, the number of turns of the winding *d*, and consequently the intensity and the tension of the secondary current, can be varied so as to obtain in the bars any temperature that the nature of the fabric to be singed permits.

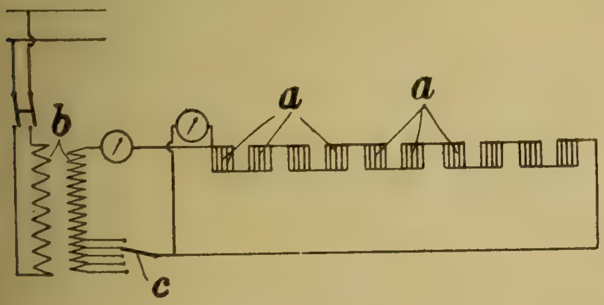


Fig. 27.

In order to provide a form of burner which will allow of practically free expansion and contraction of the platinum or other incandescent tube or strip, Gin has proposed in his patent specification No. 17,223, of 1908, to form the burner from a tube having a longitudinal slit for the insertion of the yarn, and having one or both of its ends bent outwards to a circular form for connection to the fixed electrical terminal pieces. The form of burner is clearly shown at fig. 23, which is taken from the specification.

A further patent of Gin's, namely, No. 22,917, of 1908, relates to an electrical gassing frame having a combustion chamber with ventilating means such as are found in the Arundel frame previously referred to. In the illustration of the Gin machine shown at fig. 24, the yarn *a* is carried by guides on a pivoted arm *b*, operated from the stop lever *c*. With the parts in the position shown in full lines in the figure, the yarn will be singed and the charred fluff drawn off along the channel *d* to the duct *e*. It will thus be seen that ventilation of each individual burner is provided for.

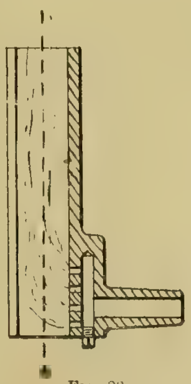


Fig. 28.

The Gin patents are being worked by La Société Anonyme Electro-Textile, of 149, Rue de Rome, Paris, who have placed an electric gassing frame upon the market, and state that at the end of 1909, 1,500 electrical burners were in use in the gassing of cotton, wool, silk, etc., some of the installations having been running over 12 months. Fig. 25 is a section through this firm's electrical gassing frame, and fig. 26 a general view of a complete frame.

The electrical burners are rendered incandescent by a current of two to five volts and 20 to 30 amperes, either continuous or alternating. A system of control for the latter current is shown at fig. 27, where the current is supplied to the groups of burners *a* in series, the burners of each group being in parallel; *b* represents the transformer. The curent is regulated by the rheostat *c*, so as to vary the temperature of the burners to suit the counts of yarn being gassed and the gassing speed.

The advantages claimed for the "Gin" electrical gassing frame are many, including:—

"(1) More efficient heat production than with gas.

"(2) Greater regularity of the gassing.

"(3) Coloured yarns can be gassed without discolouration.

"(4) The temperature of the gassing burner can be very readily varied.

"(5) Efficient gassing at high speeds.

"(6) Efficient ventilation."

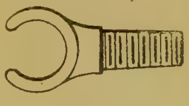


Fig. 29.

In the Arundel, Asa Lees, and Gin gassing frames, illustrated at figs. 11, 12, 15, 25, and 26, the gassing burner is enclosed within an outer casing, through which the yarn passes whilst being gassed. It will therefore be seen that no disturbing currents can affect the gassing operation as with the open-type burner. Further, if the yarn passes over a scraper or guide within the combustion chamber, to which an exhaustion action is applied as in the Arundel and Gin frames, the charred fluff will be effectually removed from the yarn and carried away.

The earliest proposal for employing a combustion chamber around the gassing burner is found in Fletcher and Quinn's patent specification No. 3,629, of 1884. Figs. 28 and 29, taken from the latter, clearly illustrate the proposal, fig. 28 being a sectional elevation and fig. 29 a plan view.

The patentees state in respect of their burner and combustion chamber or shield, as they term it, that the latter acts "as a chimney to draw the flame and also to steady the same by shielding it from draughts, whereby a hot flame of greatly increased length is obtained."

(*To be continued.*)

REPAIRING FURNACE CRACKS.

One of the commonest forms of boiler trouble is the cracks which develop in the furnaces and combustion chambers. One never knows what a crack will do. Sometimes it will lie quiescent indefinitely; at other times it will extend steadily in length and will often leak freely.

The usual method of preventing a crack from extending is to drill a small hole in the plate beyond the limit of the crack, but in line with it. The crack then extends forward and finally reaches the drilled hole, which will effectively stop further progress.

To mend a crack, a very common way is to rivet a patch over it. This, however, introduces the evil of double thickness with dirt between, and such patches are very apt to become burned. Another method is to cut out a large section of the plate adjacent to the crack and rivet a patch over the opening. This still leaves a double thickness at the overlap, but patches of this order are the only means available if there is tension on the plate.

Where a plate is not in tension, it is sometimes quite allowable to use an entirely different scheme, a form of repair that has proved very successful. A hole is drilled about ⅝ in. in diameter just beyond one end of the crack, and is tapped out with a fine thread. In this tapped hole is screwed a plug, and a second hole is drilled, partly in the plate and partly in the plug. This second hole is threaded and plugged and the operation is continued until the whole of the crack has thus been drilled out and plugged. The plugs are then cut off flush with the surface of the plate and filed down smooth. Thus each plug is partly cut away and is keyed fast and prevented from turning by the adjacent plugs. Such repairs have been known to last indefinitely. But it must be borne in mind that only under compressive stress is this mode of repair practicable, for it has no holding together effect, the plugs merely serving to stop the crack and hold in steam.

Cracks often occur in the vertical parts of combustion chambers or on the part of the furnace where it joins the combustion chamber. Doubtless these plates are sometimes badly strained in the bending processes, and internal stresses are set up in them. Such plates are often better after being plugged than before they cracked, for they are no longer under such severe stress. Annealing is the process require to eliminate these stresses, but it is to be feared that such annealing is often neglected or is insufficiently performed, so that a fracture is often only a sign that the stress has been relieved.

In a homogeneous material such as mild steel, a crack once started will extend even beyond the area of the stress which caused it. Hence the need of drilling well beyond the point to which the crack can be traced. The crack will not pass the drilled hole if the stress has been relieved sufficiently by opening the worst part of the crack.

All repairs should be carefully carried out with discretion, and the method just mentioned was first brought to the writer's attention by a marine engineer of considerable experience, who had successfully employed it for a number of years.

To repair a cracked furnace or other exposed part in tension by means of riveted patches is inevitable, but such patches are often very unsatisfactory, for they introduce the evil of double thickness, and almost invariably there is burning of the overlap. A patch put on without cutting away the plate beneath is even worse, for it forms a blister of a most severe nature.

It was the practice at one time to stiffen weak furnaces by riveting to them closely-fitting hoops of iron, but almost invariably these would give trouble. The vertical portion was maintained comparatively cold by the circulation of the water (and the horizontal part was nearly as hot as the plate to which it was riveted. The expansion of this section caused great stress in the edges of the vertical web, invariably causing it to corrode. To remedy this evil the strengthening hoop was made of angle iron nearly 2 in. larger than the furnace to which it was fixed. This was firmly wedged into place and held to the furnace by tap bolts with nuts on the outside. By this method, water is allowed to come in contact with all parts; there is considerable elasticity combined with the arched support of the hoop, and there is no differential expansion of the parts of the hoop to cause wasting, as in the case of the closely-attached hoop.—W. H. Booth, in *Power and the Engineer.*

Large Bridge in Canada.—The Canadian Pacific Railway Co.'s bridge over the St. Lawrence River at Lachine, about 10 miles above Montreal, is to be re-constructed. This bridge is on the direct line of the Montreal-New York traffic, as well as the Canadian Pacific Railway traffic from Montreal to the Maritime Provinces. It was designed and built in the early eighties, and was then considered a masterpiece of railway bridge construction. It is a single-track structure more than two miles long, including approaches, and it is altogether too light for present-day loads. The new structure will have double lines, and will accommodate the heaviest traffic. The contract has been awarded to the Dominion Bridge Co., of Montreal, whose works are practically on the site of the bridge.

CHART FOR SOLVING SOME STEAM ENGINE PROBLEMS.

ONE of the most commonly recurring calculations made by designers of steam engines is the solution of the equation

$$p_m = f\left\{ p\left(\frac{1 + \log_e r}{r}\right) - p_b \right\}$$

Typical problems that continually require to be answered by its use are: The change in the mean pressure, or the power, with a given alteration in the steam-chest pressure; the increase in mean pressure, or the power, when a non-condensing engine is altered to condensing; the necessary change in the expansion to give a required increase in mean pressure, or power. The easier and more expeditious the method of solution the greater will be the time and energy left the designer for other work.

For effecting the objects indicated the chart shown has been arranged. It is quicker than the slide rule, and the results are accepted with confidence, for there are no parallel risks to misplaced decimal points or a wrong setting of the slide. The chart is employed daily by several designers, who say they find it very useful.

In the above equation,

p_m = absolute mean pressure in lbs. per sq. in. referred to the L.P. cylinder.
p_b = absolute back pressure in lbs. per sq. in. on the L.P. piston.
p = absolute pressure in lbs. per sq. in. at the stop valve.
r = nominal ratio of expansion.
f = the diagram factor.

In drawing the chart the back pressure was assumed to be 3 lbs. per square inch for condensing engines, and 18 lbs. for non-condensing engines. These figures allow 3 lbs. per square inch for the resistance experienced by the exhaust steam in the passages, which allowance in most cases is not far from the truth. The nominal ratio of expansion r is the ratio that the volume of the low-pressure cylinder bears to the volume of the high-pressure cylinder up to the point of cut-off, neglecting clearances.

The diagram factor f is the ratio that the actual referred mean pressure (abs.) bears to the mean referred pressures that would be obtained if the steam were expanded hyperbolically r times in the low-pressure cylinder from a pressure equal to that at the stop valve, and assuming no losses due to wire drawing, late admission, compression, etc. For most types of steam engines the diagram factors are well known. Several average values are given here:—

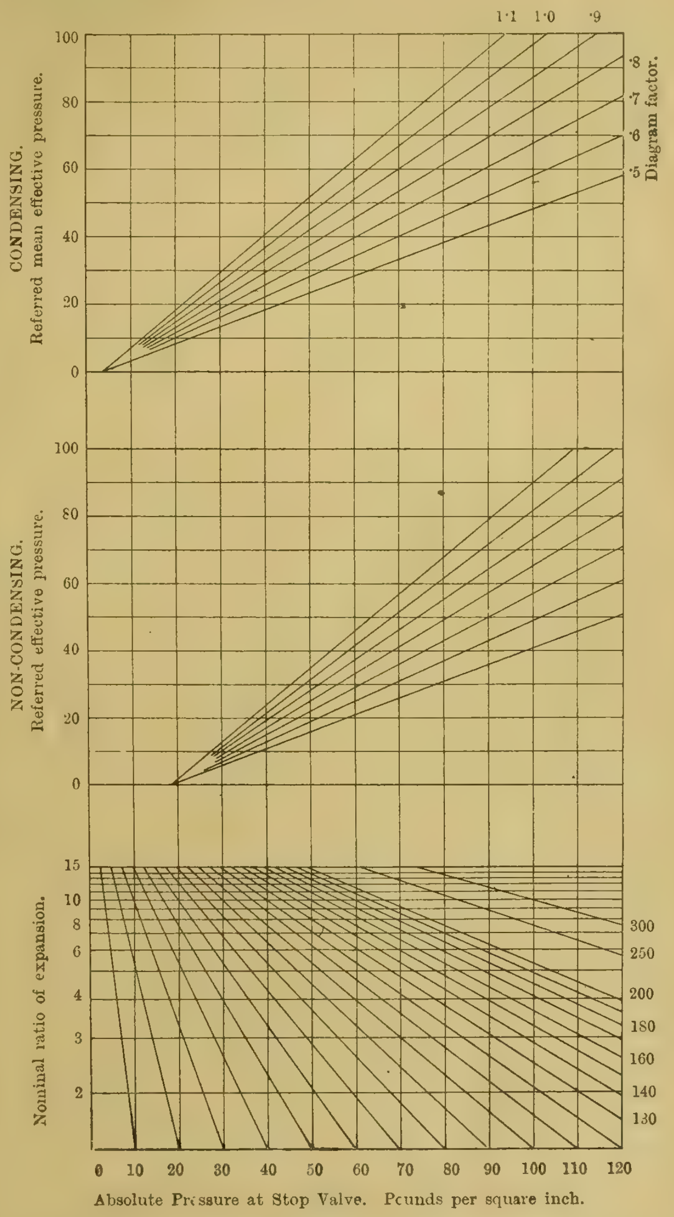
·78 for a simple engine with D valve.
·63 for compound engine with receiver, unjacketed.
·70 for „ „ „ jacketed.
·72 for tandem compound, no receiver, unjacketed.
·63 for triple expansion engine, unjacketed.
·66 for „ „ jacketed.

A more complete list will be found in Innes's "Problems in Machine Design."

If the diagram factor is not known for any engine, it can always be obtained if indicator diagrams and the particulars of the engine are available. Having obtained the diagram factor for an engine of a given type, it is useful in making calculations on other engines of the same type. A diagram factor is practically constant for similar engines working under similar conditions, but it varies a little with pressure, and it is slightly different for condensing and non-condensing engines. The variations are slight, however, so that for a given kind of engine with a fixed cut-off, clearances, and compression, the diagram factor may be taken to be a constant for most practical purposes where great accuracy is not necessary. Also for small changes in the cut-off, the factor may be assumed unvarying.

The chart has been designed to connect all the variables in the equation, and show their relationships for all cases occurring in practice. Thus all the practical problems that can be solved by means of the equation can be solved by using the chart. To illustrate the use of the latter some examples are given:—

Example 1.—Given that the nominal ratio of expansion in a triple-expansion condensing engine is 12, the pressure at the stop valve 150 lbs. by gauge, the diagram factor ·68, find the mean referred pressure on the low-pressure piston.



Answer.—On the chart find the point where the oblique line passing through 165 lbs. abs. stop-valve pressure (= 150 lbs. by gauge + 15 lbs. atmos.) cuts the horizontal line corresponding to the ratio of expansion 12. Project this point vertically to the inclined condensing sheaf of lines, and stop at the line for the diagram factor ·68. Now project along horizontally to the vertical line at the extreme left of the chart, and read off the required mean referred pressure, 30·5 lbs.

Example 2.—In a compound non-condensing steam engine the nominal ratio of expansion is 6·5, and the diagram factor is ·7; find the necessary pressure at the stop valve so that the mean referred pressure may be 38 lbs. per square inch.

Answer.—Project the point on the line of referred mean pressures representing 38 lbs. (non-condensing) horizontally to the line representing diagram factor ·7, then vertically downwards, and estimate the point where the horizontal line representing ratio of expansion 6·5 would be cut. That line of the set of inclined lines, representing stop-valve pressures, which passes through the point of intersection will give the required pressure at the stop valve at 164 lbs. abs. per square inch.

Example 3.—It is found from the indicator diagrams of a condensing steam engine that the mean referred pressure is 43 lbs. per square inch. If the nominal ratio of expansion be 7, and the steam-chest pressure 145 lbs. abs., what is the diagram factor?

Answer.—Find where the horizontal line for ratio of expansion 7 cuts the inclined stop-valve pressure line 145 lbs. Project up to the horizontal mean pressure line 43 lbs. (condensing). The point of intersection will be on the inclined line representing the required diagram factor 74.

Example 4.—Given a non-condensing engine with stop-valve pressure of 130 lbs. abs., ratio of expansion 6, and diagram factor ·7, what will be the percentage increase in power if the engine is fitted with a condenser, everything else being kept the same?

Answer.—The percentage increase in power will equal the percentage increase in mean pressure. By the method of Example 1 we find the mean pressures are 29·7 lbs. per square inch, non-condensing, and 40·2 lbs. per square inch condensing. The percentage increase in power is therefore:—

$$\frac{40{\cdot}2 - 29{\cdot}7}{29{\cdot}7} \times 100 = \frac{10{\cdot}5}{29{\cdot}7} \times 100 = 35 \text{ per cent.}$$

Example 5.—The power of a non-condensing high-speed engine is 100 I.H.P. The pressure at the stop valve is 145 lbs. absolute. The diagram factor is ·72, and the ratio of expansion 6·5. What is the necessary alteration in the ratio of expansion to increase the power to 110 I.H.P., the other conditions remaining the same?

Answer.—Find as in Example 1 the mean pressure. This comes out at 33·1 lbs. per square inch. Increase this 10 per cent, *i.e.*, to 36·3 lbs. per square inch. Project the point for mean pressure 36·3 lbs. along horizontally to the inclined diagram factor line ·72 (non-condensing), then downwards to the stop-valve pressure line 145 lbs. absolute. The point of intersection will be on the horizontal line giving the required ratio of expansion, 5·3.

METHOD OF GOVERNING INTERNAL-COMBUSTION ENGINES.

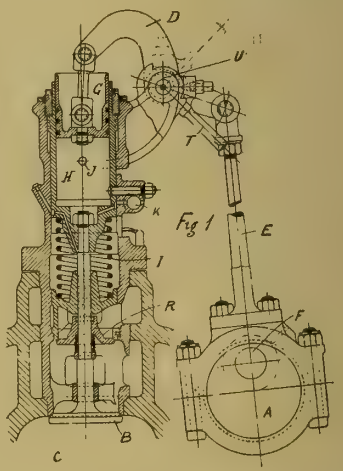
A recent patent of Messrs. K. I. Crossley and J. Atkinson, of the firm of Crossley Bros Ltd., the well-known makers of gas engines, etc., describes an arrangement whereby internal-combustion engines, operating on the four-cycle or two-cycle principle are governed in such a manner that the power exerted by the engine is automatically controlled by the governing mechanism, so that it corresponds with the load to be carried. With the object of giving a brief description of the apparatus employed, reference is now made to the illustrations, fig. 1 being a section through the admission valve of an Otto-cycle engine, fig. 2 a view showing an alternative arrangement, and fig. 3 a section on A B, fig. 2 and fig. 4 an end elevation of fig. 2.

On the half-speed shaft of the engine a cam or an eccentric A is mounted as shown in fig. 1 for the purpose of opening the main admission valve B placed on the top of the combustion chamber C, and it is operated vertically to admit the charge. A double-ended lever D is applied to the valve B, one end of this lever opening the valve and the other end being connected to a rod E which operates it. The eccentric A is placed on the half-speed side shaft F of the engine, and operates the double-ended lever in the proper manner. The lever D does not operate the admission valve B directly, but is connected to a piston G which works in a short cylinder H attached to the valve B. The valve B is closed by a spring I, and as the piston G moves downwards it compresses air in the short cylinder H until the pressure overcomes the spring I and opens the valve, the strength of the spring and the movement of the piston being so arranged as to cause the opening to be properly timed; when employing an eccentric on an Otto-cycle engine a considerable portion of its throw cannot be used, so the earlier portion of the stroke of the piston G is made inoperative by the leakage hole J. The continued downward movement of the piston causes the opening of the admission valve B, and its return allows the spring to close it at the proper time. When the admission valve is operated in this manner the engine would give full-powered impulses, and to reduce the intensity of the impulses a governing leakage hole K is provided fixed to the air cylinder H under control of the governor. Opening this leakage hole K more or less will slightly retard the opening of the admission valve B, will reduce its lift and materially expedite its closing, thus regulating the charge admitted to the cylinder, and more or less reducing the power developed by each impulse in accordance with the load on the engine. If the leakage hole K is full open and sufficiently large, the admission valve will not be opened at all.

The leakage valve K consists of a small cylindrical plug L (see figs. 3 and 4) sliding freely in a short cylinder M, so as to open or close a small hole N leading to the air cylinder H. In the arrangements shown in fig. 1, the admission valve B is combined with a gas valve R in the usual manner.

In the arrangements shown in fig. 2 it is assumed that there is a separate gas valve which may be operated in any well-known manner, preferably by a "hit and miss" arrangement.

Instead of an eccentric on the side shaft, a cam O (see fig. 2) may be used, and the admission valve B is placed horizontally. By using a cam in the position shown, one end of the double lever D may be directly operated by the cam, the upper end of the lever D being also directly attached to the piston G; as a cam may be made of any desirable form, it may be so constructed that there is no material lost motion of the piston G; at the same time it is desirable to place a leakage hole J, uncovered by the piston G when at its outer position, so as to ensure atmospheric pressure in the cylinder H at this time. As the cam only operates in one direction, a spring P is used to ensure the full outward stroke of the piston G; in other respects the movement of the piston G controls the opening and closing of the admission valve B in the same way as in the other arrangement.



In starting an engine, the air may escape from the small air cylinder H owing to the slow movement, and an attachment S (as shown in figs. 2 and 4) is added to positively open the admission valve a short distance so as to ensure the admission of a charge, this attachment being put into gear or out of gear by means of the small handle T. It is shown in gear in figs. 2 and 4, the projection S coming into contact with the front of the short cylinder H, to which the valve is attached when at its instroke; moving the handle T over 180 deg. throws the catch S out of gear. An arrangement for the same purpose is shown in fig. 1, in which instance the lever D is fulcrummed on a small eccentric U, which is shown in the working position, a handle T being used to move the eccentric U into the starting position shown in dotted lines, in which positions the bolt securing the piston G comes into actual contact with the head of the spindle of the valve B, and ensures its being opened.

Fig. 2.

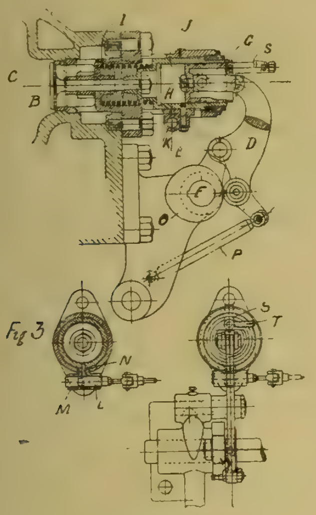


Fig. 4.

The arrangement can be applied to engines having more than one cylinder by providing similar valves to each cylinder, the one governor being connected to each of the plugs L.

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"The Law and Practice Relating to Patents and Designs." (Patent and Designs Acts, 1907-8). By David Fulton, of the Middle Temple and Northern Circuit, Barrister-at-Law and Assoc. Memb. Inst. Civil Engineers. Fourth Edition. London: Jordan and Sons Ltd. Price 15s. net.

The many reforms which have occurred within the last few years, in the Law and Practice relating to Patents and Designs, have rendered parts of many well-known works on the subject more or less obsolete.

Immediately on the passing of the Act of 1907, several of the authors issued supplemental volumes setting out the novel features in the Act, and expressed opinions as to their application or effect, many of which opinions have since been verified or confirmed. The revision of a law book immediately after the passing of a new measure must necessarily entail much of a speculative nature, and Mr. Fulton, in presenting his new edition after an interval of several years, is in the strong position of being able to expound the novel sections by the aid of the experience gained by following the practice and numerous cases which have been tried. He cites cases of extreme importance to the manufacturer, such as those affecting the "working" clauses of the Act, upon which so much comment was made in the press when this new phase in British Patent Law was contemplated. Mr. Fulton has, in his usual concise manner, set out clearly what is expected from a patentee under these clauses.

He has, similarly, taken all the other novel features in the law, both as regards patents and designs, and treated them under respective headings. The book, although bound in one volume, being divided into two parts, *i.e.*, Part 1, Patents; and Part 2, Designs. By eliminating all reference to trade marks, he has been able to avoid any increase in the bulk of the volume, and in these days of heavy tomes this is no small consideration to the manufacturer or practitioner, who desires an authoritative, but yet handy, book of reference, in which he can quickly find information on the point in question, and obtain it in clear and concise language.

A very useful feature of the work is embodied in the form of an appendix containing 12 short precedents of agreements, assignments, licenses, mortgages, etc., relating to the working and disposal of letters patent.

From the very recent date of many of the cases quoted, and of which extracts are made, we can confidently state that the present edition of Mr. Fulton's work is quite up to date, and it should be welcomed by those who wish to keep pace with the times in patent and design matters.

"Brazil: Its Natural Riches and Industries." Vol. I. Paris: Librairie Ailland and Co.

There is perhaps no other state in South America or in the Western Hemisphere which is riper for development than that of Brazil. Moreover, in relation to its size, there is evidence that it is extremely rich in its natural resources, and it only needs the introduction of capital in order to make it one of the greatest industrial countries in the whole world.

It is the natural home of the rubber tree, woods of commercial value are in abundance, and minerals are only waiting development.

The various industries hardly touch the fringe of expansion, and along with this it must be remembered that importations of railways and machinery must take place.

Everyone interested in the opening up of new fields for British products and manufactures should make a point of familiarising themselves with the requirements of countries abroad, particularly those where the scope is greatest, such as Brazil.

Books Received.

"General Foundry Practice." By W. Roxburgh, M.R.S.A. London: Constable and Co. Ltd. Price 10s. 6d.

"Official Gazette of the United States Patent Office." Vol. CLVI., No. 1. Published by Authority of Congress, Washington.

"Elementary Experimental Electricity and Magnetism." By W. T. Clough. Methuen. Price 2s. 6d.

"Proceedings of the British Foundrymen's Association, 1908-1909." London: The *Foundry Trade Journal and Pattern-maker.*

Memorial to Late Hon. C. S. Rolls.—At the annual meeting the Aerial League of Great Britain on the 21st July it was stated that the league had decided to push forward details for the establishment of a practical school of aeronautics to be called the Rolls Memorial School, and that negotiations were in progress for the acquisition of a site near London for a flying ground and building.

FLOATING DOCK FOR BRAZILIAN NAVY.

Messrs. Vickers, Sons and Maxim Ltd., of Barrow, have recently completed the 22,000 ton floating dock, which they have constructed for the Brazilian Government, and an illustration of which is given below. The dock is to be used for accommodating the three Brazilian battleships of the Dreadnought type. The dock is the largest which has been built in Great Britain, and was launched in three sections, weighing: First section, 3,250 tons; second section, 3,600 tons; and the third section, 3,300 tons; making a total of 10,150 tons of steel work.

The dock is of the double-sided self-docking type, and consists of a pontoon on to which are built two parallel side walls, and the whole construction is divided lengthwise into three sections of unequal length by vertical joints extending round the whole of the dock. The pontoon is a rectangular structure, strengthened by longitudinal and transverse girders, and plated all round, with the exception of the part of the deck which extends directly under the side walls. Each of the sections is about 165 ft. long, rectangular in plan, and the general construction is the same; the two end sections, however, have their outer ends built as a bow terminating in a 25 ft. working platform carried on girders. The bottom plating runs transversely in the home and rider strakes, and is lap jointed. The deck plating is similar, with the exception that the ends of the plates are butt jointed with inside covers, the bottom plating being connected to the plating of the sides and points by angle bars. The pontoon has a cambered deck, and is divided into six water-tight compartments by five longitudinal bulkheads made of varying heights to suit the camber of the deck. The central portion of the deck under the keel blocks is flat for a width of 10 ft. Transversely the pontoons are divided into 50 bays, 16 in the central section and 17 in each of the end sections, by transverse girders. The water-tight transverse bulkheads consist of plate bulkheads vertically plated. Two seams each side of the central bulkhead are double riveted, the remainder being single riveted, and fixed to the top and bottom plates by angles extending all round the dock, joggled over the chines and up into the walls, where they form the rings for the wall bulkheads. The central bulkhead is stiffened vertically by girders on one side and frame angles on the other, coming in line with the top and bottom longitudinal frames. The plate girders forming the bulkhead dividing off the joint chambers, although similar to the water-tight bulkheads, are made somewhat heavier. The girders are also plate girders, but not water-tight, the corners being cut off where they would otherwise lap between the ring angles. The plates are further lightened by cutting large manholes in them, and air holes are also cut near to the bottom and top rings. In the compartments situated under the wall, lattice girders are employed for strengthening purposes.

FLOATING DOCK FOR BRAZILIAN NAVY.

The deck and bottom plating are further stiffened by a series of framings, which extend fore and aft over the length of the pontoon, coming in line with the vertical frames on these girders, to which they are attached by gussets at their corners and angle diagonals. In addition to the lattice girders under the wells, intermediate transverse ordinary frames are provided between them, and are extended upwards, forming the frames of the walls. Their vertical member on the back of the wall plating form the side frames of the pontoon. The central bulkhead is attached to the top and bottom skin plating and to the transverse bulkheads by double angle rings, and between the transverse girders is stiffened by vertical breathing plates attached to it at the top by double and at the bottom by single angles. The longitudinal framings are provided with vertical curtain plates, attaching the vertical frame to the deck frames and strengthening the deck generally. These specially-stiffened frames are arranged on all frames lying between the inner intermediate bulkheads and the first three frames outside the same. The stiffening of the deck for local loads extends over the whole of the central section of the dock, and up to the second water-tight bulkhead from the end of each terminal section. Beyond this area, at the extreme ends of the dock, the specially-stiffened frames outside the intermediate bulkheads are omitted. Outside this area the framings are of a similar character, but the upper vertical stringer is replaced by diagonals and gussets. The intermediate longitudinal bulkheads are formed of vertical plates, to which, and to the top and bottom plating, they are attached by a single ring with butted joints. These bulkheads are stiffened by horizontal girders, their ends being attached to the transverse girders by angle lugs. The dock is plated by a prolongation of the deck plating, and is supported in line with the central bulkhead, and the first longitudinal frame each side by a plate girder, and on each side of these, in line with the longitudinal framings, is in the form of a lattice girder.

In order to facilitate the complete withdrawal of all water from the pontoon, troughs consisting of two Z bars and a plate, forming a gutter, which extends to within about 3 ft. of each end of each pumping division of the pontoon, are riveted to the bottom of same. The ends of the troughs are closed by the Z bars, which are forged to shape. The bottom plating of the pontoon is pierced by limber holes, in order to allow the water to drain into the troughs.

The flooding and pumping mechanism is controlled from a central valve house situated in the starboard-wall. The Westinghouse electro pneumatic system is adopted for operating the valves, and an indicator is provided which shows the level of water in each of the compartments. Three powerful pumps are situated in each side wall, connected to two main drains extending throughout the whole length of the dock, and any one of these pumps can be used alone to empty its own half of the dock.

The boilers, engines, and dynamos are situated on a 'tween deck, 20 ft. below the top deck. There are seven boilers, six steam pumps for fire and wash-down service, and two dynamos for lighting purposes and to supply current to work the fans, motors, etc. A distilling plant to supply fresh water and electric ventilating fans have also been installed. A gangway at one end connects the two side walls, and two travelling steam gantry cranes, each capable of lifting five tons, have been fitted, one on each wall.

The principal dimensions of the dock are as follows: Length overall, 550 ft. 6 in.; overall length of pontoons, 500 ft. 6½ in.; width, 136 ft.; depth of pontoon at centre, 18 ft. 3 in.; length of side walls, 450 ft. 6 in.; and height of side walls above pontoon deck, 45 ft. 6 in.

THE JAPAN-BRITISH EXHIBITION.—IV.

(Continued from page 114.)

Messrs. The Beldam Packing and Rubber Co., 93—94, Gracechurch Street, London, E.C.—Since our issue dated the 22nd inst., in which we described the "Willett-Bruce" steamship whistle control apparatus, we have received from the above firm a block showing the general construction of this useful and effective piece of mechanism, a specimen of which may be seen at work on their stand in the Machinery Hall at the Exhibition.

On entering the Machinery Hall from the main thoroughfare the visitor's attention is immediately arrested by the large and varied array of textile machinery on view.

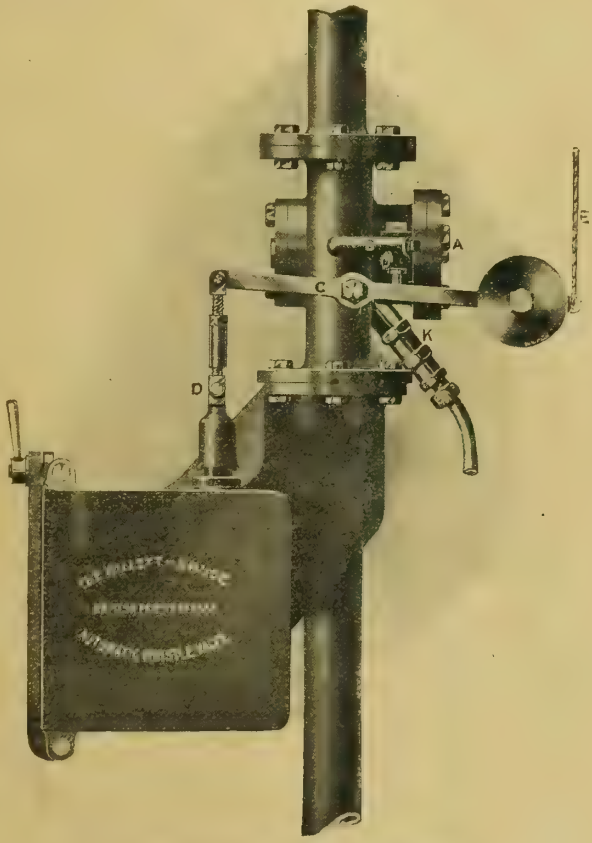
As illustrating the intense interest attaching to this section of the Exhibition, on Thursday, the 21st July, a visit was paid to the White City by 420 Japanese bluejackets from the warship Ikoma. The Ikoma has come as a special envoy from the Japanese Government to honour the Exhibition. The sailors were especially interested in the models of warships and machinery in motion, but they could scarcely be dragged away from the Lancashire cotton machines. It would be quite impossible in the limited space at our disposal to do adequate justice to the various exhibits. All are alike good, and we can only give in this issue a brief description and reference to one or two of the leading firms who are exhibiting their specialities in the department allotted to the textile machinery industry.

Messrs. Platt Brothers and Co. Ltd., of Oldham, have two large stands with a floor space of 6,216 square feet, and are showing machinery in motion for ginning, opening, carding, combing, preparing, and weaving cotton goods. The machinery exhibited is driven by line-shafts, which receive their motion from electric motors supplied by Messrs. J. P. Hall and Co. Ltd., Oldham. The following is a complete list of the machines on view:—

Seed cotton opener; hand gins; saw gin; single-action gin; double-roller gin; hopper bale breakers; automatic hopper feeders; Buckley opener and lap machine; lattice feeder; single Crighton opener, cylinder part; exhaust opener and lap machine; single scutcher and lap machine for 45-in. laps; cotton waste opening and feeding machine; single card, 45 in. by 50 in., 106 S.S. flats; sliver lap machine, 20 cans, 11-in. laps; Heilmann's comber, 8 boxes, 11-in. laps; drawing frame, 3 heads of 3 dels., 18⅛-in st.; slubbing frame, 40 spindles, 20½-in. staff; intermediate frame, 60 spindles, 19¾-in. and 26⅜-in. st.; roving frame, 80 spindles, 20½-in. st.; warp ring frame, 48 spindles, 2½-in. dist.; weft ring frame, 56 spindles, 2¼-in. dist.; ring doubling frame, 108 spindles, 2¾-in. dist.; S.A. cotton mule, 168 spindles, 1¾-in. dist.; plain calico loom; calico loom with dobby and Eccles' box motion; old carding and spinning machines.

In connection with the first named, it is interesting to note that all woolly seed cotton is found to be more or less matted together by the interlacing of the fibres, particularly the shorter stapled varieties as American Uplands, several varieties of East Indian, and some of the Levant cottons.

This machine is constructed to disentangle such seed cotton, and, in doing so, the fibres on each seed are straightened, enabling the gin to take hold of them more readily, thus increasing the production of ginned cotton considerably.



Willett-Bruce Steamship Whistle Control.

The machine is made with a fan for up-draught only, and can be supplied either with or without delivery lattice.

The patent hand-power Macarthy cotton gin shown is suitable for ginning any kind of seed cotton without injury to the staple. Two persons are required to attend it; one to turn with both hands at the flywheel, and the other to turn the crank handle with one hand and to feed with the other, the production being about 4 lbs. to 6 lbs. of cleaned cotton per hour according to class.

If the machine is required to work by power, the crank handle is taken off and a 16-in. pulley substituted.

The patent self-feeding single-action (single roller) Macarthy gin for power is adapted more particularly for ginning long-stapled seed cotton, such as Egyptian, Sea Islands, etc., for which it is specially recommended. It separates the seeds without crushing them or in any way injuring the fibre.

Their patent double roller cotton gin with oscillating lever is well adapted for separating cotton from its seeds, more especially such as have the husk or shell covered with short fibre (technically called woolly seed), of which American Uplands is the chief variety. Of this kind of cotton the production would be about 80 lbs. per hour, but with cotton that does not adhere so tenaciously to the seed the machine would give a proportionately greater result.

This gin has been found specially advantageous for those descriptions of short stapled cotton in which it is difficult to separate the fibre from the seed in consequence of the tenacity with which it adheres to the seed, such cotton, for example, as grown in Madras, Bengal, British Burmah, Persia, China, and West Coast of Africa. The outturn of cleaned cotton from these descriptions varies very much, being sometimes not more than 40 lbs. per hour; for other classes, the production may be taken as stated above.

The hand and power saw gins shown are similar in construction and suitable for ginning American and other similar varieties of cotton.

The hopper bale breaker or cotton pulling machines are arranged to deliver cotton direct on to the lattice of the hopper feeding machines, thus dispensing with mixing bins.

The automatic hopper feeding machine has now become an integral part of every modern cotton mill plant, and in the machine shown the difficulties arising from irregularity in feeding, consequent upon the varying height and density of the cotton in the hopper, have been most effectively overcome.

The foregoing refers to only a few of the simpler forms of the useful and effective machinery exhibited by Messrs. Platt Bros. A visit to their stand to see the more complicated pieces of mechanism, in the form of cotton mules, spinning frames and looms, etc., in motion would amply repay the visitor for the time expended.

Messrs. Dobson and Barlow Ltd., Bolton, are well represented with a comprehensive and varied collection of spinning machinery. The area covered by their exhibits measures 6,126 square feet, and contains the following machines, which are representative of nearly every type of cotton-spinning machinery sent out from their works, particularly on the preparatory side. They embrace one hand-power saw gin, of 10 saws, with condenser; single-action Macarthy gin; hopper bale breaker; hopper feeder and porcupine opener, vertical cylinder, horizontal exhaust opener, and lap part; double horizontal opener, with hopper feeder and hopper bale breaker; single scutcher; roving waste opener; revolving flat carding engine; sliver lap machine; draw and lap machine, for six deliveries; combing machine, having 8 heads; drawing frame, with 3 heads; slubbing frame, 32 spindles; intermediate frame, 40 spindles; roving frame, 48 spindles; self-acting mule, 240 spindles; ring spinning frame, weft, 72 spindles; ring spinning frame, twist, 64 spindles; ring doubling frame, 64 spindles; quick-traverse drum winding frame, 26 drums; quick-traverse gassing frame, 32 drums; upright-spindle winding machine; yarn-bundling press; high-speed braiding machine.

The carding engine shown is quite up to date in working arrangements, and equal to all the demands that can be reasonably made upon this class of machine. For the benefit of those in the trade, let us say at once that it is for 38-in. laps, is 38 in. on the wire, has a 50-in. cylinder, 26-in. doffer, a 9½-in. taker-in, and 109 flats (44 constantly at work fed by one lap). It has an improved wedge setting arrangement for the cylinder pedestals, and five setting point adjustment for the flexible bends. The taker-in is arranged so that its accessories are adjusted simultaneously, a method that applies to the doffer and its accessories. The card is also fitted with an improved top flat grinding motion, and an improved doffer slowing motion, for the purpose of slowing or stopping the doffer when necessary, as for piecing up the sliver. There is a star wheel eccentric motion for driving the flats, which ensures perfect tension and alignment of the flats, and an improved slow driving motion for stripping brush. There are self-lubricating high-speed doffing combs and a door-locking motion, which prevents the cylinder door from being opened until the cylinder has ceased to revolve, and which also prevents the cylinder from starting until the door is closed.

Messrs. Dobson and Barlow's ring spinning frames are designed to spin twist on wood bobbins or paper tubes, and weft on wood pirns or paper tubes; also to spin silk, worsted, wool, and other fibres. The one under notice is built to spin 20's twist from American cotton, and is a type of machine which is spinning cotton most successfully. The rollers can be arranged to be self-weighted, dead-weighted, or lever-weighted. There are turnover cap bars, improved knocking-off motion to stop the machine when the bobbins are full for weft frames, and all the gears, wheels, creels, beams, plates, rollers, and motions are in keeping with a first-class machine. The anti-balloon plates are fitted to one side, and improved separator plates are provided likewise.

The self-acting mule and all the other items of this enterprising firm's exhibit are well worth seeing, both by the layman and those engaged in the textile or kindred industries.

Messrs. Robert Hall & Sons, Bury, have a fine collection of power looms and machinery on exhibition, of which the following is a summary:—

12/4 tapestry and velvet carpet loom, Hall's patent improved wire inserting motion, for weaving up to 3 yards wide, tapestry carpet, and velvet squares (supplied also in narrower and wider widths); drop box loom, 4 shuttles, Eccles box motion, 42-in. reedspace, B H 4 patterns, overpick for checks, dress goods, etc.; quick speed, strong calico and twill loom, 36-in. reedspace, B H 3 patterns, 4 shafts, inside tappets, overpick; quick speed underpick loom, B 1 patterns, for plain goods, with A.M. warp let-off motion, 42-in. reedspace; extra heavy belting loom, G E patterns, for weaving the heaviest camel hair, cotton and hemp main driving belts up to 40 in. wide, weight 12 tons; heavy belting loom, No. 1 F patterns, for weaving cotton, camel hair, and hemp belts up to 6 in. wide, weight 3 tons; narrow fabric loom, 14-in. reedspace, for weaving smallwares, banding, girths, etc.; circular or revolving box motion, 6 shuttles, 36-in. reedspace, B 2 patterns, overpick for weaving dress goods, ginghams, checks, etc.; Turkish towel loom, with Hall's patent eccentric drop box motion for 4 colours, with automatic cross border dobby, all motions automatic, for up to 28-in. wide Turkish towels with fancy borders; 3/4 tapestry and velvet carpet loom, with improved wire inserting motion for weaving up to 27-in. wide tapestry and velvet stair carpets, rugs, etc.; hosepipe loom, improved, double beat of slay, positive shuttle motion; automatic shuttling loom, No. 1 heavy patterns, 42-in. reedspace, suitable for weaving ducks, sailcloths, and canvas (patent); hank bundling press, 4 strings, for 5-lb. and 10-lb. bundles; improved tubular or solid cop winding machine, to wind weft yarns on to the bare spindle, producing solid cops (arranged to wind from hank, cop, or bobbin, and for various lengths and diameter of cops); improved weft-winding machine, No. 5 patterns, suitable for the finest counts and most delicate yarns, thread stop motion to wind on to wooden pirns, paper tubes, and to make solid cops; portable or travelling vice, Hall's strong patterns.

Other specialities manufactured by Messrs. Hall and Sons are: Brussels carpet looms and machinery; solid woven camel hair and cotton belting looms and machinery; calico looms, with winding, warping, and sizing plant; hank sizing, drying, and brushing machines; shearing, raising, and cloth drying machines of all descriptions; quilting, toilet, and Alhambra looms; sponge cloth cross weaving looms; velvet, fustian, and bedtick looms; Terfloth's patent automatic combination cross border dobby, for tablecloths, napkins, etc.; circular box and drop box looms; weft and warp winding machinery of all descriptions; cotton blanket looms with large shuttles; sectional warping and balling machines; sailcloth looms up to 200-in. reedspace; cotton and woollen felt looms up to 29-ft. reedspace; dobbies and jacquards of all sorts; automatic and ordinary hand looms for cottage industry, lunatic asylums, prisons, and weaving schools; all sorts of weaving, preparing and finishing machinery for woven fabrics.

The firm above referred to are to be congratulated on the quality and volume of their exhibits, which are amongst the most interesting and instructive, as well as useful, in the textile section of the Japan-British Exhibition.

Amongst other exhibitors we have to mention **Messrs. Joseph Stubbs, Ltd.**, of Manchester, who have a complete range of machines used in the modern system of making doubled yarns. Also **Messrs. Wilson Brothers Bobbin Company Ltd.**, Garston, Liverpool, who are showing a varied collection of their bobbins, tubes, shuttles, picking sticks, and other accessories.

Messrs. Greenwood and Batley Ltd., of Leeds, are exhibiting machinery which shows the working of the screws and fallers employed in the preparation of waste silk and ramie.

(*To be continued.*)

INTERNAL-COMBUSTION ENGINES FOR MARINE USE.*

By W. R. Cummins.

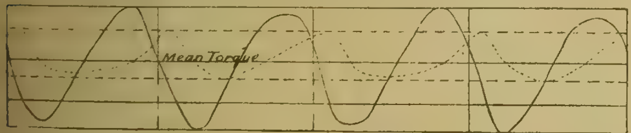
(*Concluded from page 116.*)

In order to show the excessive torque variation in a four-stroke engine, the diagram, fig. 1, has been prepared in which a comparison has been made between a four-crank four-stroke engine and a two-crank two-stroke engine.

Since the advantages of the two-stroke engine compared with the four-stroke appear to be so obvious, one naturally asks the question why this type has not already displaced the four-stroke. The four-stroke engine was first in the field, and thus had a good start in securing the market. The two-stroke engine, of course, requires a pump to force the charge into the power cylinder. In some of the earlier types of two-stroke engines this pump was separate and worked by a connecting rod from the crankshaft.

This system is used on the Oechelhauser engines as now made. The use of a separate pump has been urged as an objection against the two-stroke engine, the argument being that the four-stroke is so much simpler, as the power cylinder also performs the function of the pump of the two-stroke engine.

Four-cylinder Four-stroke Engine: Maximum torque 80 per cent greater than mean, minimum torque 106 per cent less than mean, range 186 per cent.
Two-cylinder Two-stroke Engine: Maximum torque 46 per cent greater than mean, minimum torque 28 per cent less than mean, range 74 per cent.



Full line shows turning moment or torque for four-cylinder four-stroke engine with uncushioned reciprocating parts, dotted line shows torque for two-cylinder two-stroke engine with reciprocating parts cushioned.

Fig. 1.

A large number of makers of two-stroke engines of small power now use the front end (*i.e.*, the end nearest the crankshaft) of the power cylinder as a pump. This, of course, simplifies and cheapens the engine. The principal difficulty, however, experienced with most types of two-stroke engines is that of pre-ignition. It is a very usual practice to use the incoming charge to expel the hot gases through the exhaust ports, the result being that if a high compression pressure be used the charge is liable to be fired by the hot gases remaining in the cylinder after the piston has covered the exhaust ports. It is not practicable to expel the whole of the hot gases, as the volume of the charge admitted would require to be such that there would almost certainly be a loss of some of the charge through the exhaust ports. Pre-ignition may and does occur occasionally in four-stroke engines, as in ordinary designs there is always the volume of the combustion space left filled with hot gas, but there is more time for this gas to get cooled down before compression begins than in the case of two-stroke engines. The result is that two-stroke engines are generally run slower and with less compression than four-stroke, their advantages being thus to a large extent discounted. The remedy for these faults lies, of course, in providing for scavenging the power cylinder by cold air before the admission of the new charge.

Many methods have been proposed and used to effect the complete removal of the hot gases before the new charge is admitted. Two systems are in use, viz., the vacuum system and the pressure system. The first system aims at creating a partial vacuum in the cylinder at the end of the exhaust stroke by a pump or other means. Other systems create a partial vacuum in the exhaust pipe and allow cold air to pass through the cylinder and flush the combustion space. This latter system is adopted by Messrs. Crossley Bros., who use a long exhaust pipe, by which they obtain a partial vacuum by the intermittent action of the exhaust. When the air inlet valve is opened air flows into the combustion space and expels the hot gases through the exhaust valve. The pressure system by which cold air is supplied under a slight pressure appears to the writer to be the more effective system. It is this latter system which is carried out successfully in the Oechelhauser two-stroke engine. In other two-stroke engines, such as the Day and a large number of similar type used in America, the crank chamber is used as a receiver for the explosive mixture, the front end of the power cylinder being used as a pump.

On the instroke the piston draws explosive mixture into the crank chamber through a valve, and compresses the mixture to a few pounds pressure on the outstroke. The exhaust ports are arranged on one side of the power cylinder and the inlet ports on the opposite side. The exhaust ports open first and relieve the pressure in the cylinder. The inlet ports are then opened and the mixture flows into the cylinder, displacing the exhaust gases through the exhaust ports.

A rib is cast on the piston opposite the inlet port to deflect the incoming mixture away from the exhaust port in the hope of preventing the charge from escaping to the exhaust. This system has several drawbacks, notably the use of the crank chamber as a receiver, owing to the difficulty of making it absolutely gas tight, the chief trouble being the leakage past the shaft when the bearings are worn.

Owing to the risk of pre-ignition, due to the large volume of exhaust gases which cannot be expelled without the chance of losing a good deal of the incoming mixture, the compression pressure and speed of these engines must be kept very low. They have, however, the merit of extreme simplicity, being practically valveless.

The next point the writer wishes to raise is that of cushioning the weight and inertia forces of the reciprocating parts. It is a point which should appeal to all marine engineers. In steam engines the compression is adjusted in such a way that the reversal of the load on the crank pin when turning the dead centre shall be as gradual as possible near the end of the stroke, the reciprocating parts requiring a certain definite force to bring them to rest. This force depends upon the weight and number of revolutions, and the same force is required to start them up again on the return stroke. This force is irrespective of and additional to any pressure on the piston. If the piston is not cushioned, this force is expended on the crank pin and the main bearings, and to no purpose, as it cannot exert any turning force on the crankshaft. All it can do is to pound the bearings. If, however, the piston is cushioned, say, for example, the compression pressure is such as will just balance the inertia forces, then the crank pin will turn the centres without shock. It is not usual in internal-combustion engines to provide means for cushioning the reciprocating parts. It is true they are cushioned on the compression stroke, but in a four-stroke engine that is only one stroke cushioned in four, and in a two-stroke the instrokes only are cushioned. The magnitude of these forces is not always realised, so an example may be given here.

Taking a cylinder 20 in. diameter and 24 in. stroke at 160 revolutions, the force required to stop and start the reciprocating parts is on the top centre 7½ tons and on the bottom centre 5 tons approximately, which is equivalent to 53 lbs. per square inch on the piston at top centre, and 35 lbs. per square inch on bottom centre.

These unbalanced forces acting on the crank pin and main bearings no doubt account for a great deal of the mechanical inefficiency of the gas engine as compared with a steam engine. The writer suggests that engines for marine work should be cushioned by means of an air cylinder.

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* Paper read before the Institute of Marine Engineers, at the Garden Club, Japan-British Exhibition, June 25th, 1910.

If a two-stroke engine is adopted it will be only the downstrokes which will need to be cushioned, the upstrokes being cushioned by the compression of the charge in the power cylinder.

For a two-stroke engine a pump cylinder is necessary for dealing with the mixture, and this same cylinder can be utilised for cushioning on the downstroke. If this pump cylinder is made as an extension of the power cylinder, the objections as regards cost and space occupied by a separately driven pump are overcome, and the three operations of pumping the mixture into the power cylinder, supplying a scavenging charge and cushioning the reciprocating parts on the downstroke, can all be performed by this one-pump cylinder.

A further advantage gained by cushioning with an air cushion is that the reciprocating parts are started up again on the return stroke, and the engine is to a certain extent made double acting. With uncushioned reciprocating parts the crank pin has not only to stop the motion of the moving parts at the end of the stroke, but also to start them up again. When, however, cushioning is carried out, the crank pin is relieved of this duty.

In ordinary internal-combustion engines every endeavour is made to cut down the weight of the moving parts in order to save the crank pin and bearings from these inertia stresses. Now the indicator diagram of this class of engine has a very high initial pressure due to the explosion, and a very rapid fall of pressure due to expansion and cooling of the gases. As the explosion takes place at the beginning of the stroke the crank pin has very little effective leverage to produce torque on the crankshaft, the result being heavy pressure on all the brasses, with very little effective work performed. If, however, the inertia forces are large—suppose, for instance, they are equivalent to a pressure on the piston one-half of that produced by the explosion—then the load on the bearings would be reduced to one-half of what it would have been if the moving parts had no inertia. This would give a much more effective distribution of the load on the crank pin, relieving it of the heavy initial stress due to the explosion, which would otherwise come on it, and retarding the effect of the initial pressure on the piston until the crank and connecting rod are at a more favourable angle for producing torque on the crankshaft. Another advantage of the cushioning is that a certain portion of the negative work of compression can be effected by the cylinder itself without any help from the crankshaft, as the work stored up in the cushioning air during the down power stroke is given back to the piston on the up compression strokes. If the air cushion pressure required to balance the inertia of the moving parts were equal to that of the compression, then the whole of the work of compression could be effected in the cylinder, without the intervention of the crankshaft. This should tend to increase the mechanical efficiency of the engine, as the transfer of work by means of the alternate compression and expansion of air should be more efficient than the transfer by means of the crankshaft and connecting rod.

We have next to consider whether there is any loss of efficiency involved in this alternate compression and expansion in the cushioning cylinder. If the air is compressed and expands adiabatically and there is a leakage, the only loss of efficiency is that due to mechanical friction of the piston. There will be a certain loss of efficiency if the compression is not adiabatic—that is to say, if there is a continuous loss of the heat developed by compression. This, however, should be very small, as, in the first place, the alternations of temperature due to compression and expansion will be very rapid, and there will be very little time for the heat in the body of the cushion air to be transmitted to the walls of the cylinder and through them to the external atmosphere. In the second place, the greatest temperature will be developed at the end of the stroke, when the surface exposed is at its minimum, and thirdly, the average temperature of the surfaces, assuming them to follow the temperature of the air, will not exceed about 200 deg. Fah. with a compression pressure of 50 lbs.

The next question to be considered is that of starting and reversing. If there is no clutch between the crankshaft and the propeller shaft, a considerable amount of stored energy in some form will be required for the operations of starting and reversing, and when considering this question the method of working the auxiliary machinery should also be considered with a view of adopting the same plant for both purposes.

The choice of the motive power for the auxiliary machinery, viz., water pumps, bilge pumps, ballast pumps, service pumps, winches, steering gear, windlass, refrigerating machinery, and ventilating fans and electric lighting lies between steam, electricity, and compressed air. The use of steam would be a step backwards and would not be suitable for starting and reversing purposes. Electricity would be suitable for all pumping work, refrigerating machinery, fans, electric lighting, and steering gear, but it has not yet been adopted to any extent for deck machinery, for which compressed air would no doubt be suitable. These are difficulties in using compressed air expansively, but these can be overcome by re-heating the air before use. There is plenty of waste heat for this purpose.

The writer's suggestion is that the starting and reversing gear should consist of a high-speed internal-combustion engine, coupled direct to an efficient air compressor which would deliver into a receiver, from which air would be taken for manœuvring the engines and working the deck machinery and any other auxiliaries suitable for compressed air. For the remainder of the auxiliary machinery a high-speed internal-combustion engine, coupled to a dynamo supplying current for lighting purposes and for all the other auxiliaries, the air compressor would be running only when working the cargo and manœuvring in and out of port, the compressed air receiver containing sufficient air for emergency purposes.

The only other question remaining for discussion is the number of cylinders to be adopted and their disposition, having regard to limits of size and facility of handling. By adopting the two-stroke engine, with its impulse every revolution, twice the power can be obtained from a cylinder of the maximum diameter allowable than from a four-stroke cylinder. Tandem cylinders are inadmissible, as they would entail a piston rod exposed to the hot gases of the explosion, and double acting cylinders are unsuitable for the same reason, so that for large powers the number of cylinders will need to be increased to keep wthin the limits of the maximum possible diameter.

For ordinary mercantile work the stroke may be made relatively long and the revolutions should be made as high as possible consistent with propeller efficiency. For engines of small power the number of cylinders should, of course, be as few as possible, and the minimum number will be fixed to a great extent by the question of facility in starting and reversing.

The conditions are that the engines must be able to start in either direction by simply turning on the compressed air. By utilising the bottom end of the pump cylinder for cushioning the advantage is gained that air can be admitted under the cushioning piston to give an upstroke, which is additional to the downstroke given by admitting air to the power cylinder. The minimum number of cylinders with this arrangement would be two; with a four-stroke engine uncushioned the minimum number would be four. To get the best turning movement and balance with the two cranks they should be opposite one another, but this would not be the best position for certainty of starting up, as they might both be on the dead centre. Under normal conditions, however, when the ignition is cut off for stopping the engine, the action of the cushion air on the downstroke and the compression on the upstroke will make the engine stop with both pistons at half stroke. There is a remote contingency that they might stick on the dead centre, and for small engines a simple barring gear could be provided for this emergency. For engines of larger size three cylinders with cranks at 120 deg. would make an ideal arrangement. The engine would start in either direction irrespective of the position of the cranks, although under normal conditions, the engine would stop with one of the pistons at about half stroke.

In using compressed air in this way for starting and reversing, it is important to have the starting valves on the cylinders controlled automatically for two reasons, viz., to ensure that the correct valves are opened to give the desired direction of rotation, and to prevent waste of the compressed air such as would result, for instance, if air were admitted to a cylinder when the exhaust ports were uncovered, when there would be a straight blow through to the exhaust pipe. The reversing gear must also work the ignition timing apparatus which will make the necessary correction for ahead and astern running.

The writer has not attempted in the limits of this paper to go fully into details, but has merely outlined a few ideas for the criticism of the meeting. In conclusion, therefore, he ventures his opinion that—

1. The internal-combustion plant of the future for marine work will consist of bituminous fuel gas producers, supplying gas to two-stroke cycle engines.
2. That crude petroleum will be used where it can compete in price with coal. It will operate in two-stroke cycle engines of the Diesel or vaporiser type.
3. That effective means will be taken to scavenge the power cylinder with cold air.
4. That some method of cushioning the reciprocating weights will be adopted.
5. That the crankshaft of the engine will be direct coupled to the propeller shafting without the intervention of gearing of any kind, except in the case of engines of very small power.
6. That manœuvring will be effected by compressed air, which may also be used for working the deck machinery.

LAUNCHES AND TRIAL TRIPS.

Teeswood.—The Teeswood, which was built to the order of the Meteor Steamship Co. by Messrs. W. Karkess and Son Ltd., ran her official trial trip on Tuesday, 12th July, when a mean speed of 11 knots was obtained. Everything worked satisfactorily.

Windsor Hall.—Messrs. Wm. Doxford and Sons Ltd. launched on July 22nd from their yard at Pallion a single-deck steamer 345 ft. long, 48 ft. broad, and of 27½ ft. moulded depth, built to the order of Messrs. Edward Nicholl and Co., Cardiff. This latest addition to their fleet is named the Windsor Hall, and is designed to carry 6,300 tons dead weight on moderate draught. The classification is with the British Corporation. The engines, with cylinders 25 in., 41 in., 66 in., and 45 in. stroke and the two boilers 15 ft. 9 in. by 10 ft. 10½ in., have also been built by Messrs. Doxford.

Dalecrest.—The Northumberland Shipbuilding Co. Ltd. launched on Friday afternoon, 22nd July, from their yard at Howdon-on-Tyne, the steamer built to the order of Messrs. Taylor and Worthington, Liverpool, for Messrs. The Dalecrest Steamship Co. Ltd., Liverpool. The vessel is 390 ft. long by 49 ft. beam by 29 ft. deep, and has been built under special survey to the highest class at Lloyd's. The machinery will be supplied by Messrs. Richardson, Westgarth, and Co. Ltd., Sunderland, consisting of engines with cylinders 25 in., 41 in., 69 in., by 48 in. stroke, and three large steel boilers with 180 lbs. pressure. This vessel will carry about 7,450 tons on a light draught and steam about 10 knots, loaded, at sea.

NAVAL NOTE.

Posen.—During the trials of the new German battleship Posen the vessel attained a speed of 20½ knots, thus beating the best performances of her three sister ships.

Blonde.—The unarmoured cruiser Blonde was launched from Pembroke Dockyard on Friday, the 22nd July. The ship is a replica of the Blanche and Bellona as regards external form, but has 50 tons more displacement than the Boadicea, which was the initial vessel of the class to which all four belong. The ships are intended for service as parent ships to torpedo-boat destroyers, and are an improvement on the scouts. The latter vessels carry too little coal for service at any great distance from a base, and are too lightly armed. The Blonde will carry 450 tons of coal and oil fuel, as compared with 150 tons carried in the scouts, and, like her sister vessels, will be armed with 4in. quick-firing guns. The ship will, therefore, be adapted for service much further away from a base than the scouts. The chief details of the Blonde are: Length, 385 ft.; extreme draught, 41 ft. 6 in.; mean load draught, 13 ft. 6 in.; displacement, 3,350 tons; Parsons turbine machinery of 10,000 H.P.; boiler installation, 12 small-tube Yarrow boilers. The turbines are expected to make 500 revolutions to the minute, and propel the ship at a speed of 25 knots per hour. No cruising turbines will be fitted. The armament will consist of ten 4 in. quick-firing guns, all mounted on the weather decks, and the ship will carry ten 21 in. revolving deck torpedo tubes.

NOTICES OF MEETINGS, &c.

July 29th.—Junior Institution of Engineers. Visit to the new Pumping Station at Grosvenor Road, Chelsea, of the London Hydraulic Power Company, at 6·30 p.m.

July 30th.—The Institution of Municipal and County Engineers. A party will go to the Second International Roads Congress at Brussels.

August 2nd to 4th.—British Foundrymen's Association. Seventh Annual Convention, to be held in the Municipal School of Technology, Sackville Street, Manchester.

August 2—Papers to be read: (1) "The Cupola," by R. Mason, Leicester; (2) "Cupola Slags," by T. Swinden, B.Met., Sheffield; (3) "Properties of Coke," by F. K. Knowles, B.Met., Sheffield; (4) "Hardness Testing of Cast Iron," by R. Mather, B.Met., Middlesbrough. Visit to the Locomotive Works of the Lancashire and Yorkshire Railway Company at Horwich.

August 3—Papers to be read: (1) "Malleable Cast Iron and How it is Produced in Scandinavia," by G. A. Blume, Sweden; (2) "Theory underlying Malleableising," by W. H. Hatfield, B.Met., Sheffield; (3) "The Electric Furnace," by W. S. Gifford, A.R.S.M., London; (4) "Brass Alloys," by O. F. Hudson, M.Sc., The University, Birmingham. Visit to the works of Messrs. Tweedale and Smalley, Castleton.

August 4—Picnic to Chester and Eaton Hall.

TRADE NOTES.

We understand that **Messrs Wm. Doxford and Sons,** Pallion, Sunderland, have received an order for a large Clan liner for Messrs. Cayzer, Irvine, and Co., of Liverpool and Glasgow, for whom Messrs. Doxford some years ago built a number of vessels.

The Admiralty has given the **Thames Ironworks Shipbuilding and Engineering Co.** the order for the supply of machinery for a second-class cruiser now under construction at Chatham.

The **Dundee Shipbuilding Co.** have received an order for a paddle steamer, 165 ft. long by 27 ft. beam, for river trade in Brazil.

Dust Destructor for Littlehampton.—At a meeting of the Urban District Council of Littlehampton, held last month, eight tenders were considered for the erection of a refuse destructor. After considerable discussion is was agreed to accept the scheme of **Messrs. Meldrum Bros.**

Sectional Superheaters.—We are informed that **Messrs. James Gordon and Co.,** 81, Knightrider Street, London, E.C., are placing on the market a new patented sectional superheater, in which, it is stated, several improvements have been introduced.

The **Power Gas Corporation,** of Stockton-on-Tees, has received a contract for a large Mond ammonia recovery plant for the Birchenwood Colliery Co., of Stoke-on-Trent. This plant is to produce gas for boiler firing and power from a mixture comprising bituminous slack, washery refuse, and belt pickings. The plant, which is equivalent to 32,000 H.P. in size, will gasify 320 tons of the fuel per 24 hours, and will comprise 13 special Mond producers fitted with arrangements for the mechanical removal of the ash, of which about 40 per cent will be contained in the fuel to be gasified. The whole plant is to be erected complete and started to work in nine months, and when finished will be one of the largest producer gas units in the world. This installation opens up the possibility of using for colliery work materials which are at present of no value. It is claimed that the revenue from the sale of the sulphate of ammonia produced will in a very short time repay the initial cost.

A contract has been placed with the **Cleveland Bridge and Engineering Co.,** of Darlington, by the Board of Control of the City of Winnipeg for a new structure which will span 48 tracks of the Canadian Pacific Railway at Winnipeg, and afford a connection between Brown and Brant Streets in that city. The total length of the bridge will be 2,168 ft.

Messrs. Hawthorn, Davey, and Co. Ltd., Leeds, have secured an order for a vertical triple-expansion pumping engine and boiler for the water supply of the town of Lahore. The plant will be able to raise 200,000 gallons per hour 120 ft. high.

Messrs. E. Bennis and Co. Ltd. have received an order from Messrs. Greenood and Batley Ltd. for two Bennis stokers and self-cleaning compressed air furnaces for an 8 ft. 6 in. Lancashire boiler. The same firm are also supplying the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board with four Bennis stokers at the generating station, Tame Valley, Stalybridge.

TRADE CATALOGUES.

Mr. E. E. Coy, of Bootle, Liverpool, has sent us a circular G.O.1 giving particulars and prices of his gas and oil engines, combined electric sets for lighting, accumulator charging, vacuum cleaners, fans, etc.

We have received from **Messrs. The Eclipse Electric Co.,** of Bootle, Liverpool, a pamphlet giving information and wholesale prices of an electrically-driven pump for inflating tyres.

A catalogue is received from **Messrs. Hans Renold Ltd.** dealing with their patent silent chains and sprockets.

Messrs. A. W. Penrose and Co. Ltd., 109, Farringdon Road, E.C., have favoured us with booklet describing the "Metzograph" grained screen in its application to block making, photo lithography, and photogravure. It is an alternative process to the usual half-tone ruled screen work. The grain consists of prismatic reticulations, the chief point of novelty lying in its transparency, there being no opaque grain points. The sample illustrations are very effective, and the circular is worthy the attention of both block makers and block users.

CORRESPONDENCE.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only; and if accompanied by sketches, these should be neatly drawn, and forwarded on a roll, to prevent creasing. We cannot undertake to return rejected communications, or to reply to inquiries by letter. In all cases letters must be accompanied with the name and address of the writer.

We do not hold ourselves responsible for the opinions of our Correspondents.

BEAMS.

To the Editor of "The Practical Engineer."

Sir,—*Re* query by "Ignoramus" and reply by "L. C." It seems to me that the formula given in Case 1 is not quite applicable to rectangular beams of C.I. The neutral axis passes through the centre of gravity of the suction only when the stresses are within the limits of elasticity, and breaking weights based on this assumption are only fully one-third of the actual breaking weights. It is generally thought that C.I. being weakest in tension will ultimately fail on the tension side, but such is not the case, for Hodgkinson found in his experiments with C.I. ⊥ beams, with the rib in compression, that a piece was invariably broken out of the compression rib.

As an example of a plain rectangular beam, take the standard test bar, 2 in. deep by 1 in. wide by 36 in. between the supports, which has an average breaking weight of 28 cwt. (central load).

By "L. C.'s" formula

$$\text{B.M.}_{\text{max.}} = 28224 \text{ inch pounds.}$$

$$\text{and } Z = \frac{1}{y} = \frac{b\,h^3 \times 2}{12 \times h} = \frac{b\,h^2}{6} = \frac{1 \times (2)^2}{6} = \frac{2}{3}$$

$$\therefore f = \frac{m}{Z} = \frac{28224 \times 3}{2} = 42336 \text{ lbs. per sq. inch.}$$

i.e., the above test bar, according to formula, breaks with a virtual skin stress f = 42,336 lbs. per square inch, which is nearly 2½ times the ultimate tensile strength of C.I., and so by using an ultimate tensile strength of 7 tons = 15,680 lbs. per square inch, in the above formula, the breaking weight arrived at is much below the average.

The following rational formula gives very near results for rectangular beams of cast iron:—

$$\text{B.M.}_{\text{max.}} = \frac{w\,l}{4} = k\,b\,d^2$$

k = constant derived by experiment = 7000 lbs. for cast iron

b = breadth in inches. d = depth in inches. l = span in inches

Taking the test bar as before.

$$w = 4\,k\,\frac{b\,d^2}{l}$$

$$= \frac{28000 \times 1 \times (2)^2}{36} = 3111 \text{ lbs.} = 27 \text{ cwt., nearly.}$$

Breaking weight = 27 cwt. Factor of safety of 6 should be allowed.

"Ignoramus" should study the book by D. Kinnear Clark, who treats all kinds of C.I. beams very fully, and also "Strength of Materials," by Anderson, who has paragraph giving a clear explanation of the neutral axis in C.I. beams.—Yours, etc.,

"Axis."

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2258. **Boosters.**—Will a reader kindly give me some working data for boosters for supplying the extra volts when charging accumulators from dynamos used on lighting circuits; also diagram of connections for same?—Attendant.

2261. **Manganese and Chrome Steel.**—I shall be very much indebted to any reader for a reliable method for distinguishing manganese and chrome steel from ordinary cast steel, and from each other?—M. K. H.

MISCELLANEA.

A guide and catalogue of their exhibits at the Japan-British Exhibition has been issued by Messrs. Burroughs, Wellcome and Co., which should be of great use to those interested in this firm's goods.

The Japan-British Exhibition.—In our issue of *The Practical Engineer* dated the 22nd inst, we referred to a few firms who had gained honours in connection with exhibits in the Mechanical Engineering Class at the Japan-British Exhibition. We now give the complete list of awards announced as follows: Grand prizes to Sir W. G. Armstrong, Whitworth, and Co. Ltd.; Vickers, Sons, and Maxim Ltd.; Babcock and Wilcox Ltd.; Linotype and Machinery Ltd.; Thames Ironworks Shipbuilding and Engineering Co. Ltd.; and C. A. Parsons and Co. Diplomas of honour—Humber Ltd.; W. B. Haigh and Co. Ltd. Gold medals—William Simons and Co. Ltd.; Ferguson Brothers; Lobnitz and Co. Ltd.; Palmer Tyre Co. Ltd.; Hurst, Nelson, and Co. Ltd.; Hydraulic Engineering Co. Ltd.; John Thompson; Yorkshire Patent Steam Wagon Co.; Clayton, Son, and Co. Ltd.; Andrew Barclay, Sons, and Co. Ltd.; W. R. Sykes Interlocking Signal Co. Ltd.; the Beldam Packing and Rubber Co.; Hans Renold Ltd.; Robert S. Allen and Co.; J. Hopkinson and Co. Ltd.; E. Green and Son Ltd.; British Uralite Co. Ltd.; Joseph Baker and Sons Ltd.; and Saxon Portland Cement Co. Ltd. Silver medals—F. Wallis Stoddart; Wailes, Dove, and Co. Ltd.; John Staniar and Co.; Glasgow Iron and Steel Co. Ltd.; Bowesfield Steel Co. Ltd.; Alfred R. Tattersall and Co.; W. C. Holmes and Co.; Head, Wrightson, and Co. Ltd.; "Loco" Vapour Gas Light Co. Ltd.; Waterlow and Co.; Windovers Ltd.; and J. H. Richards and Co. Electricity class, grand prizes—The Dowsing Radiant Heat Co. Ltd.; Electromotors Ltd.; Indiarubber, Gutta Percha, and Telegraph Co. Ltd.; Osram Lamp Works Ltd.; Western Electric Co. Ltd.; and the Chloride Electrical Storage Co. Ltd. Diploma of honour—Newtons Ltd. Gold medals—E. J. Dugdill and Co.; the Maxim Lamp Works Ltd.; Bertram Thomas; and the Float Electric Co. Ltd. Silver medals—T. and J. Jackson and Co. and Lambie Wrigley and Co. Textile machinery, grand prizes—Platt Brothers and Co. Ltd. and Wilson Brothers Bobbin Co. Ltd. Diplomas of honour—Robert Hall and Sons (Bury) Ltd. and Henry Tetlow and Co. Gold medals—Joseph Stubbs Ltd. and Greenwood and Batley Ltd. Various other exhibitors have received honourable mention and commemorative diplomas.

On July 12th last a party of members of the Society of Engineers inspected, under the guidance of Mr. J. E. Worth, district engineer, the works now in progress in connection with the Northern Low Level Sewer No. 2. With the great increase in the population of London, it became clear that Sir Joseph Bazalgette's scheme of intercepting sewers would require extension, therefore the London County Council in 1899 decided to enlarge the main drainage system. The works of extension, which have been completed or are now being carried out under the direction of Mr. Maurice Fitzmaurice, chief engineer to the Council, include on the north side of the Thames two new outfall sewers, each 9 ft. by 9 ft., which have been added to the existing lines (three) of outfall sewer, and are now in use; a new Middle Level sewer, No. 2, from Willesden to Old Ford, some 9 miles in length, which is also being used; and a sewer known as the Northern Low Level No. 2, which extends from Hammersmith to Bow, a distance of 12½ miles, parts of which are now under construction. This latter sewer between Hammersmith and Pembroke Gardens, Kensington, is constructed in brickwork, and commencing with a 5 ft. barrel increases in size to 6 ft. 6 in. diameter at this latter point, from which it is constructed in iron segments as far as Eastfield Street, Stepney. The diameter of the sewer in this section varies from 6 ft. 6 in. to 8 ft. 6 in. From Eastfield Street to the pumping station at Abbey Mills the construction is in brick and iron, the diameter increasing from 8 ft. 9 in. to 10 ft. 6 in. at the latter place, where the sewage will be lifted about 42 ft. into the outfall sewers, along which it will flow to the Barking Outfall Works. The depth of this sewer from the surface of the road varies from 20 ft. to 70 ft., and it lies chiefly in the blue London clay, although here and there water-bearing ballast is encountered. In these water-bearing sections it has been necessary to work with compressed air up to about 8 lbs. on the square inch. With respect to the construction of the portion of this sewer in iron, the segments are tapered on curves to the correct form, all the faces are machined, and liquid grout is employed under pressure to form a solid backing. The ironwork is lined throughout with 3 to 1 concrete, and the invert from springing to springing with 4½ in. blue brick. The work is carried on night and day, and in 24 hours the tunnel advances by about eight rings, each ring amounting to 1 ft. 9 in. of distance. At the Pont Street shaft, where the visit was made, the whole of the work is being carried out under compressed air with a shield.

PATENTEES' CHRONICLE

OF

Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

JULY 18th, 1910.

17016 Delivery malt beverages. Howell.
17017 Cycle guards. Purkis.
17018 Banana carrying device. Johns.
17019 Hair brushes. Clark.
17020 Cleaning yarns. Moulding and Watson.
17021 Anti-rust device. Walker, Turner, and Fawkner.
17022 Liquid sprays. Hilder.
17023 Haulage clips. Farnsworth.
17024 Skylight elevators. Smith.
17025 Brewery mash tun. Harrison.
17026 Spark ignition. Flood.
17027 "Disc" drill scarifiers. Wallace.
17028 Rolls for hoes and tools. Perks and Salmon.
17029 Fasteners for belts. Shaw and Harrison.
17030 Gas burners. Meyer.
17031 Brake mechanism. Holt.
17032 Safety pocket. Myers.
17033 Aerated water machine. Shroff.
17034 Colliers' axes. Mayers and Dawe.
17035 Self-heating soldering iron. Beesley.
17036 Aerial machines. Marshall.
17037 Railway traffic controlling apparatus. Moore.
17038 Door and window fastener. Wilson.
17039 Steam indicator. Harrison.
17040 Pulley blocks and hoisting gear. Tabulo.
17041 Portable tent. Wilson.
17042 Elastic wheels for vehicles. Rose.
17043 Gas manufacture. Lewis and True.
17044 *Leather stretching apparatus. Lukasiewicz.
17045 *Metallic barrels. George.
17046 Measuring cylinders. Sidey.
17047 *Electric fuses. Siemens-Schuckertwerke.
17048 Gas producers. Jones.
17049 Axle boxes. Peckham and Andrews.
17050 Music holder. Tyler.
17051 *Fireproof theatre fabrics. Penke.
17052 Electric switches. Herz.
17053 *Twine cutters. Arnold.
17054 *Railway coupling safety cage. Proudfoot.
17055 *Boiler feeding appliance. Pouninghaus and McMurdie.
17056 *Coffins. Becker.
17057 Spring tyres. Francis and Schauman.
17058 Shot. Hubbard.
17059 *Gas heating regulator. Fürlinger.
17060 *Rolling mill crank drive. Haferkamp and Cremer.
17061 Electric finger stalls. Arens.
17062 Aeroplane vanes. Gillett and Howard.
17063 *Interlocking sheet piling. Alexander.
17064 Internal-combustion engine carburetters. Lee.
17065 Engine carburetters. Lee.
17066 *Pneumatic tyre inflating valve. Austin.
17067 Portable stove. Harris.
17068 Marine propulsion. Parsons and Cook.
17069 Watercooling radiators. Dunn and Scrouther.
17070 *Air compressors. Modeer.
17071 *Superheater U bends. Schmidt.
17072 *Summary cash box. Stewart.
17073 *Rotary snow plough. Ferguson.
17074 *Improvements in propellers. Heinz.
17075 *Mono-rail conveying cars. Maloney.
17076 *Separation of liquid from fatty substances. Winterstein and Nitsch.
17077 *Improvements in tents. Simpson.
17078 *Internal-combustion motors. Vogel.
17079 *Explosion engines. Gaubert.
17080 *Small arm attachment. Quisling.
17081 Cardboard cylinders. Lovell.
17082 *Boot tread device. Reich.
17083 *Resilient reed holder for looms. Orth.
17084 *Building blocks. Ditter.
17085 Multiple photograph apparatus. Newlin.
17086 Flying toys. Jameson.
17087 *Manufacture of dyestuffs. Lucius and Brüning.
17088 *Manufacture of dyestuffs. Bloxam.
17089 *Treatment of materials in fluids. Pawlikowski.
17090 Improved roller skates. Seelenbinder.
17091 *Electrical measuring intruments. Weston.
17092 *Photographic apparatus. Lill.
17093 Slate refuse and slates or tiles. Owen.
17094 *Brush making machine. Kleemann.
17095 Expelling gases from cylinders. Nicholson.
17096 Shirt with reversible cuffs. Richardson.
17097 *Gas pendant fitting. Beal.
17098 *Adjustable bracket connection. Beal.
17099 Production of ammonium compounds. Johnson.
17100 *Treatment of hydro-carbons. Fendler and Frank.
17101 *Slat holders. Slaughter.
17102 Ticket rack for tramway conductors. Morelli.
17103 Kitchen ranges. Russell.
17104 *Water distribution in flats. Barbier.
17105 Production of new anodyestuffs. Newton.
17106 *Artificial leather. Newton.
17107 *Electric motor controllers. Adams.
17108 *Chaffcutter. Marks.
17109 *Utilising blast furnace slag. Gran.
17110 *Electro-mechanical controlling devices. Adams.
17111 Starting devices for explosion engines. Webster.
17112 Self-driving power plant. Dahl.
17113 *Handling type matrices. Degener.

JULY 19th, 1910.

17114 Cover for screw heads. Moore.
17115 Production of metal films. Wagner.
17116 Fire extinguishers. Cole.
17117 Nut cracker and grader. Gray.
17118 Shuttle spindles. Ingham.
17119 Screwing gaiter to pneumatic tyre. Barry.
17120 Automatic feeder and distributor. Heyden.
17121 Securing tubular parts of bedsteads, etc. Phillips and Alexander.
17122 Cabinet handles. Gunn Castor Ltd. and Piercy.
11723 Improved motor cycle. Hindle.
17124 Colour photographic plates. Timms.
17125 Fastening refrigerator car doors. Roach and Taylor.
17126 Electric magnetic drum. Hawley, Saunders, and Jones.
17127 Collar supports. Allday.
17128 Vegetable dishes. Brown and Steventon.
17129 Hydraulic testing cylinder. Dixon and Hummel.
17130 *Refuse destructors. Shannon.
17131 Internal-combustion engines. Draper.
17132 *Oxygen gas warming apparatus. Cooper.
17133 Prime movers. Brand.
17134 Lifting apparatus. Green.
17135 Aeroplanes and balloons. Maryon.
17136 Automatic propeller loss preventer. Gillam.
17137 Lubricating motor vehicles. Rainforth.
17138 Ozonising apparatus. Stanton.
17139 Furniture castors. Lauterwasser.
17140 *Penholder. Moyer.
17141 Pressure of vacuum gauge. Richardson.
17142 Hatpins. North and Selby.
17143 *Production of indoxyl. Elektrochemische Industrie.
17144 *Resilient spring wheels. Anderson.
17145 *Aeroplanes. Andrae.
17146 Detection of dangerous gases. Turquand and Grey.
17147 *Railway and tramway vehicles. Gresley.
17148 Electric conductor conduits. Monro.
17149 Valve operating mechanism. Thorneycroft.
17150 Pneumatic tyre rims. Siddall and Kendrick.
17151 Rolling mills. Siddall and Kendrick.
17152 Tents. Pattie.
17153 Windows and doors. Downes.
17154 *Mechanical toys. Henderson.
17155 *Pulling over machines. La Chapelle.
17156 *Circuit closing device. Allgemeine Elektricitats Ges.
17157 Internal-combustion engines. Dickinson.
17158 Projectiles. Richardson.
17159 *Bottle attachment. Van Clief Gear.
17160 *Air pumps. Wilson, Gregory, and Spohrer.
17161 *Engine starting devices. Wilson, Gregory, and Spohrer.
17162 *Artificial coal. Leach.
17163 *Printing presses. Morrison.
17164 *Printing sheet delivery apparatus. Lake.
17165 *Fish wire machines. Lake.
17166 *Motor starting device. Adams Manufacturing Co.
17167 Fluid cocks. Drumgold.
17168 Gill drawing frames. Hardisty and Macpherson.
17169 Spindles. Rintoul and Macpherson.
17170 Metal piling. Le Bas and Garratt.
17171 *Gun pedestal mountings. Dawson and Buckham.
17172 *Signalling apparatus. Bonhomme.
17173 Gas meters. Glover.
17174 Liquid cooling apparatus. Seton.
17175 Forming tools. Crick.
17176 *Tyre rims. Booth.
17177 *Electric system protective-device. B. T.-H. Co.
17178 *Boat releasing mechanism. Eriksen.
17179 *Boat disengaging gear. Macaulay.
17180 *Speed recorders. Renfro.
17181 Automatic guns. Dawson and Buckham.
17182 Material clips. Stevenson.
17183 *Heating and ventilating. McGerry.
17184 *Knife and fork cleaning machine. Happe.
17185 Aeroplanes. Dunne.
17186 Aeroplanes. Dunne.
17187 Hat holder. Krohn.
17188 *Steam nozzles. Marcotty.
17189 Hatpins. Darer.
17190 *Paper counting apparatus. Schlesinger.
17191 Game or puzzle. Adler.
17192 Air distributors. Stierlin.
17193 Fountain pens. Tansley (Bichel.)
17194 *Increasing density of explosive bodies. Bichel.
17195 *Cock and needle valves. Shaw.
17196 Mattresses. Bradshaw.
17197 Welt laying machines. Boult.
17198 *Water cooled valves. Mitchell.
17199 Feeding bottle regulator.

JULY 20th, 1910.

17200 Cutter holders. McConnell.
17201 Perforating paper. Windle and Lavender.
17202 Washing and cooling air. Robinson.
17203 Air pumps and condensers. Burton.
17204 Internal-combustion engines. Lundblom.
17205 *Counters. Nixon.
17206 Circular saw and cutter bench. Watson and Stally.
17207 Improved beverage. Farrow.
17208 Mine safety shot firing outfit. Kaye.
17209 Razor and strop cases. Crawford.
17210 Improved toy. Slack.
17211 Autotype apparatus. Rennie.
17212 Motor vehicle dust and mud guards. Louis.
17213 Life saving garments. Berman.
17214 Automatic tacking pincers. Sursham.
17215 Shaft lever safety barrel. Phillips.

17216 Boot and shoe lasting jack. Sursham.
17217 Acetylene gas generators. Freem.
17218 Marking garments. Bill.
17219 Self-acting mules. Ainsworth.
17220 Roll floor-cloth stand. Sykes.
17221 Waste breaking-up machines. Ashworth and Whittaker.
17222 Motor controller. Sumpter.
17223 Chair seats. Jeanes.
17224 Artists' canvas clip. Bottomley.
17225 Knife cleaners. Oakden.
17226 Coin controlled vending machines. Hardy.
17227 Telegraphing apparatus. Kundsen.
17228 Sanitary sink trap. Hadley.
17229 Belt fasteners. Anderson.
17230 *Lace insertion. Nagel.
17231 Fabric stretching device. Leindorf and Paul.
17232 Hot rolling and burnishing. Robertson.
17233 Cistern disinfecting liquid. Holt.
17234 Asphalt boilers or cauldrons. Braham.
17235 *Working two motor controllers. Siemens Dynamo Works Ltd.
17236 Grinding carbon brush surfaces. Watkins.
17237 Railway door safety lock. White.
17238 *Crucible furnaces. Buess.
17239 Milking machine pulsators. Davies and Ransome.
17240 Depositing pearls in oysters. Mikimoto.
17241 Floor dressing machines. Willis.
17242 Strengthened glass. Benedictus.
17243 Ship propelling devices. Rankin and Wrigglesworth.
17244 Detachable wheels for vehicles. Hurd.
17245 Road vehicle tyres. White.
17246 Artificial fuel. Coales.
17247 Driving machines electrically at variable speeds. James.
17248 *Tuyere for blast furnaces. Wildbore.
17249 Automatic switch gear controller. Stirk.
17250 Casting reel guide attachment. Thomas and Miller.
17251 Resilient tyres. Schiller.
17252 Aerating liquids. Sharman.
17253 *Automobile change speed and reversing mechanism. Méry.
17254 Liquid measuring apparatus. Shinebaum.
17255 Distance recorders. Elphinstone.
17256 *Side delivery rakes. Ransomes, Sims and Jeffries and Garrard.
17257 Connecting wood segments. Gubbins.
17258 *Rubber insertions for wear harness, etc. Iles and Goldsmith.
17259 Collapsible tubes or containers. Höll.
17260 Letter openers. McCrum.
17261 Casks and tubs. Jager.
17262 *Imitation tube work. Wallach.
17263 *Hair destructor in floss and waste silk. Seignol.
17264 Aeroplanes. McKay and Jochinsen.
17265 Lawn tennis posts. Davis.
17266 *Postage stamp delivery apparatus. Marks.
17267 *Spinning of sliver on mules, etc. Hilden.
17268 *Wood pulp finishing machines. Ullgren and Gleditsch.
17269 *Improvements in cases. Bauer.
17270 *Cheese vats. Hocknell.
17271 Motor pneumatic tyre tread. Stocks.
17272 *Pickpocket prevention. Saitzen.
17273 Transforming pince-nez to spectacles. Sutton.
17274 *Anti-fouling compound feeding apparatus to boilers. White.
17275 *Resilient wheels. Thomas.
17276 *Brake shoes. Stromeyer.
17277 *Lighting plant apparatus. Wüppermann.
17278 *Electrodes for arc lighting. B. T.-H. Co.
17279 Propellers and fans. Brierley.
17280 *Adjusting air injection for internal-combustion engines. Diesel.
17281 *Gas purifying apparatus. Masters.
17282 Gold and metal casting under pressure. Hayward and McChristie.
17283 Sulphuric acid. Moeller.
17284 Extraction of metals from ores. Moeller.
17285 Treating materials with ozone. Moeller.

JULY 21st, 1910.

17286 Aeroplane construction. Doig.
17287 Garden shear attachment. Stevenson.
17288 Tobacco pipe. Mathewson.
17289 Lavatories, sinks, baths, etc. Quine.
17290 Cart and vehicle spring covering. Banks.
17291 Gyroscopic devices. Barr and Stroud.
17292 Sectional boilers. Stubbs.
17293 *Compound air locomotive. Trapp.
17294 Chair castors. Woodward.
17295 *Pedestal spittoons. Morrison.
17296 Handle bar control devices. Brown and Barlow.
17297 Opening metal boxes. Henderson.
17298 *Ring spinning device. Brandts.
17299 Bedstead corner fittings. Moore.
17300 Door and gate latches. Cross.
17301 Trouser stretcher. Stenning.
17302 Brake mechanism. Tanner.
17303 Sheet and envelope statement. Field.
17304 Folding wardrobe. Cracknell.
17305 Internal-combustion turbine. Verity.
17306 Indiarubber manf., etc. Adshead.
17307 Cutting single and double helical gear. Llewellin.
17308 Non-spillable accumulator vents. Berry.
17309 Pipe and cigarette holder. Hodge.
17310 Boot top iron. Waite-Greenwood and Bland.
17311 Egg tester. Oddy.
17312 Ships' telegraph apparatus. Chadburn Telegraph Co. and Grant.
17313 *Turbines. Bill.
17314 Slaughtering pistols. Cash.
17315 Safety hatpin. Francis.
17316 Portable rack. Norbury.
17317 Motor and vehicle wheels. Pepper.
17318 Portable weighing machine. Groome.
17319 Pneumatic tyre inner tubes. Joyce.
17320 Umbrellas. Blount and Weir.
17321 Suppositories. Brown.
17322 Printing telegraph instruments. Kessels.
17323 Cycle tube pump. Nutbrown.
17324 Turbines. Barnabé.
17325 Spring holding device. Wilkins.
17326 Brush bridle. Mosley.
17327 Damper apparatus. Mackenzie.
17328 Compressed air device. Moseley.
17329 Malt separating machine. Green.
17330 Electric generators. Hall.
17331 Bleaching machines. Brierley and Melling.
17332 Mop fasteners. Mandley and Wade.
17333 Valveless gas turbine. Carter.
17334 Water waste preventing cistern. Smith.
17335 *Luminious plates. Rice.
17336 *Batteries. Hannemann.
17337 Projectiles. Tabulo.
17338 Projectiles. Tabulo.
17339 Gun safety slide. Beretta.
17340 *Motor controller circuits. Adams Manufacturing Co.
17341 *Motor controlling circuits. Adams Manufacturing Co.
17342 *Hen coops. Williams.
17343 Carburetter. Lamplough
17344 *Electric starters. Elec. and Ord. Accessories Co. Ltd., and Garner.
17345 *Talking machines. Dennison.
17346 Opening stoppered bottles. Goodwin.
17347 Boot formers. Chattoe.
17348 Haulage clips. Appleby.
17349 Motor controllers. Elec. and Ord. Accessories Co. and Garner and Mueller.
17350 Speed recorder. Donaldson.
17351 Detachable rims. Mackenzie.
17352 Mounting belts on pulleys. Warner.
17353 Falling rifle targets. Ralston.
17354 *Candy cutter. Trangott.
17355 Azodyestuffs. Newton.
17356 Pharmaceutical compounds. Newton.
17357 Steam boilers. Booth.
17358 Recording apparatus. Elphinstone.
17359 *Sulphate of ammonia from gas. Burkheiser.
17360 Oxyarylarsinic acids. Imray.
17361 Shaving device. Friedman.
17362 Gyroscopic device. Smith.
17363 Steam admission regulator. Wood.
17364 Gramophones. Green.
17365 Safety lifting apparatus. Loughlin.
17366 Ticket printing machines. Jung.
17367 *Carburetters. Archer.
17368 *Steam generators. Gadsby.
17369 Electric arc lamps. Bleckly.
17370 Boot making machine. Parmentier,
17371 Liquid fuel burners. Hoveler.
17372 Steam superheaters. Maryon.
17373 Cycle locks. Woodward.
17374 Bottle labelling machines. Jones and Automatic Labelling Machine Syndicate Ltd.
17375 *Tobacco packing machines. Smitt.
17376 Apparatus for handling invalids. Skeffington.
17377 Toilet requisites. Saunders.
17378 *Buffers. Heron.
17379 Internal-combustion engine valves. Sears.
17380 *Tramcar trolley attachment. Engel.
17381 Internal-combustion engines. Lemmens.
17382 Internal-combustion engines. Roots.
17383 Contraction of liquids. Simpson.
17384 Preventive devices. Harris.

JULY 22nd, 1910.

17385 Macadam apparatus. Ames.
17386 Convertible dining table. McDowell.
17387 Lead lettering. Woodcock.
17388 Petrol tin attachment. Fellows.
17389 Spirit measurer. Lowsby.
17390 Dental crowns. Macdonald.
17391 *Stamping machinery. Lanston Monotype Corporation Ltd.
17392 Resilient composition. Barbour.
17393 Spinning machinery. Riley, Ashworth, Foden and Steele.
17394 Pneumatic tyres. Hookham.
17395 Motor wind screen joint. Inshaw.
17396 Carriage safety lock. Boorman and Berry.
17397 Confectionery cutting machine. Robins.
17398 Staples and padlocks. Thomas.
17399 Generators and motors. Atkinson.
17400 Billiard cue lock-up. Whiteley.
17401 Scouring apparatus. Giesler.
17402 Cleaning tobacco bowls. Henderson.
17403 Automatic locks. Stone and Hide.
17404 Hairpins. Rogers.
17405 Resetting tramcar lifeguards. Whiteley and Moss.
17406 Detachable boot soles. Bellow and Newman.
17407 Mechanism for looms. Crabtree.
17408 Figure puzzle. Hough.
17409 Card advertiser. Berry and Co. and Hilton.
17410 Miners' picks. Owen.
17411 Hatpins. Younger.
17412 Stone treatment. Masters.
17413 Concrete moulds. Kirwan.
17414 *Watering pot roses. Coates.
17415 *Electricity meters. Chamberlain and Hookham.
17416 Pressure blowers. Williams.
17417 *Carbo-hydrates. Stahl.
17418 *Nut locking device. Kirke.
17419 Clock mechanism. Adams.
17420 Hearth floor. Wildbore.
17421 Ship speed device. Nockold.
17422 *Registering device. Dicker.
17423 Micrometer calipers. Bombach.
17424 Power transmission apparatus. Lamplough.
17425 *Boots and shoes. Knapp.
17426 Connecting electrical conduits. Incledon.
17427 *Coating materials. Golby and Ahrlé.
17428 Gas lamp burners. Still.
17429 Granulating machines. Collins.
17430 Piano tuning. Hawkins.
17431 Invalid handling apparatus. Skeffington.
17432 Eyeglass mounts. Hodd.
17434 Driving belts. Von Rabenau.
17435 Tobacco pouch and pipe charger. Blau.
17436 Table mechanical fans. Tarling and Burder.
17437 *Collapsible cupboard. Allan.
17438 *Nut locks. Burrows.
17439 *Colour transferring process. Rosier.
17440 Steam superheaters. Tourtel.
17441 Scissors. Willimott.
17442 *Gas governor. Holmes.
17443 Expansible finger rings. Emrich.
17444 Box manufactures. Fiske.
17445 Treating liquids. Browne.
17446 Spoke attachment to wheels. Esser.
17447 Water softener and purifier. Browne.
17448 Carburetters. Beer and Lipscombe.
17449 Liquid fuel burners. Bentley.
17450 Liquid measurer. Gibb.
17451 *Affixing labels and stamps. Michel and Stein.
17452 *Drilling and slotting machines. Unverzagt and Lander.
17453 *Steam turbine device. Barbezat.
17454 *Safety device for hoists. Benrath. Mas. Act.-Ges.
17455 Toilet receptacle, etc. Ginzler.
17456 *Oxygen supply device. Fleuss and Davis.
17457 Footwarmers. Partridge.
17458 Door lock. Sturmann.
17459 Artificial horizons. Logsdail.
17460 Balloon envelopes. Harger.
17461 *Stentering clips. Clay and Atkinson.
17462 *Typewriters. Lafarie.
17463 *Sewing tread receptacle. Essinger.
17464 *Barrel lids. Archer.
17465 *Vehicle tyres. Wilson.
17466 Aluminium lined cask. Aluminium Plant Co.
17467 Apparel measurer. Silverman.
17468 Card tables. Yates and Diehl.
17469 *Lamp filaments. Eisner.
17470 Liquid measurer. Bowley.
17471 Calculating machines. Goodson and Burnett.
17472 *Cash registers. Goodson and Burnett.
17473 *Insect destroyer. Ortel and Marquet.
17474 *Centrifugal compressors. Allgemeine Elec. Ges.
17475 Animated pictures. Sims.
17476 *Collapsible seats. Harding.
17477 Electric conductors. Mavor.
17478 Bedsteads and cots. Scofield.
17479 Valves and receptacles. Cohen.
17480 Mercury vacuum pumps. Fleuss.
17481 Airship projectiles. Randall.
17482 Overhead current collectors. Tucker.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to August 29th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

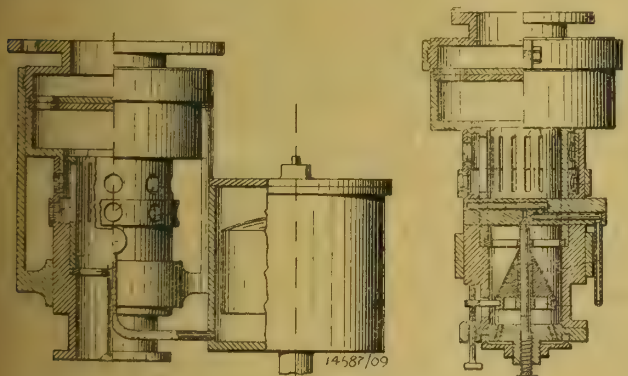
Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

6497 Landon: Construction of trumpets or sound amplifiers for talking machines. [Cognate Application. 8049, 1909.] 6540 Boult (Winslow): Method of and apparatus for producing chain-stitch sewing. 6584 Crabb: Hinged sliding windows. 6750 Bates, and British United Shoe Machinery Co.: Clicking presses. 6755 Link and Morgan: Type-casting and composing machines. [Cognate Application. 21388, 1909.] 6756 Link and Morgan: Type-casting and composing machines and typewriters. 6807 Philbrow: Combustion engines. 8049. *See* 6497, 1909. 9242 Henwood: Optical electro-magnetic speed indicators. 9391 Spencer: Buffer and other springs constructed with indiarubber. 9508 Greene: Process of refining metals and alloys. 11711 Justice (Plant): Heel and top-lift holders. 11840 Machlet: Combined temperature indicating and regulating apparatus for gaseous fuel furnaces. 11953 Barnett: Cases or stands for displaying umbrellas, walking sticks, and the like. 11956 Walker: Dynamo electric machines. 11970 Clarke: Vessels for carrying bulk cargo. 12001 Kottenbelt: Petroleum oils. 12021 Schilowsky: Gyroscopes. 12105 Chessher: Focal plane shutters for photographic cameras. 12406 Smith: Utilisation of spray jets of petrol and other liquid fuel internal-combustion engines. [Post-dated November 25th, 1909.] 12784 Mycock: Friction clutches. [Post-dated November 29th, 1909.] 13973 Shore: Street fire alarm, ambulance, and police call box. 14171 Klempnerowski: Cowls for increasing the draught in chimneys or ventilation shafts. 14247 Browning: Bicycles and motor bicycles. 14250 Dawson and Horne: Devices for testing the sighting apparatus of naval ordnance. 14271 Widdop: Brushes used in dressing warps. 14300 Teisset and Prat: Kessler's apparatus for concentrating sulphuric acid. [Date applied for under International Convention, December 31st, 1908.] 14307 Justice (Plant): Boot and shoe-channelling machines. 14361 Mackintosh: Combination garment capable of being used as coat, tent sheet, hammock, valise, and stretcher, for military and like use. [Cognate Application. 15825, 1909.] 14374 Haskins: Drain-pipe joints and the like. 14380 Sieber: Method of joining the ends of tubular driving straps and the manf. of such straps. 14381 Harris and Moss: Pliers and like tools. 14382 Kenwright: Two-valve slop tap. 14393 Britannia Patent Firelighter Co., and Barker: Process for converting the waste products and refuse from glass works into an article of commerce. 14414 Schutte: Airships. 14464 Smith and Gray: Machines for use in the manf. of bread, rolls, or other small breads, and the like. [Cognate Application. 29652, 1909.] 14468 Neesham: Moulding machines for foundry use. 14472 Weightman: Apparatus for trimming, cutting, jointing, and like treatment of kinematographic films. 14495 Hutchinson: Weighing apparatus. [Date applied for under International Convention, June 30th, 1908.] 14504 Graham: Attachment of cutlery blades to handles. 14508 Ewing: Gas retorts. 14526 De Mesquita: Safety razors. 14527 De Mesquita: Device for use in holding the blades of safety razors during stropping. 14548 Childs and Hill: Electric ovens. 14551 Hargreaves and Hulme: Toy or game giving the appearance of skating, dancing, switchback, and other effects. [Cognate Application. 29790, 1909.] 14574 Fitton and Milnes: Tape measure for use on bowling greens.

14587 Fisher: Carburetters for internal-combustion engines.

Relates to carburetters for internal-combustion engines, and its main object is to ensure a constant richness of gaseous mixture under all varying conditions of demand or speed of engine. It consists in forming or providing a carburetter which has a petrol jet or delivery orifice which delivers the petrol downwards against an upward air current or otherwise in a direction which is opposed to the direction of travel of the air passing the petrol jet and which is to be carburetted by such petrol, and has an externally regulatable inlet for the air which is to pass such petrol jet, with regulatable air opening above such petrol jet by means of which regulatable air opening very accurate air regulation can be effected, and in providing the carburetter, if desired, with a supplementary air inlet for admitting air to dilute the mixture coming from or past the petrol jet, such supplementary air inlet being positively actuated from or with the throttle valve and in the same sense—*i.e.*, as the throttle is closed the area of the supplementary air inlet is reduced, and as the throttle is opened the area of the supplementary air inlet is increased. Such throttle valve may itself form part of or be enclosed in the carburetter.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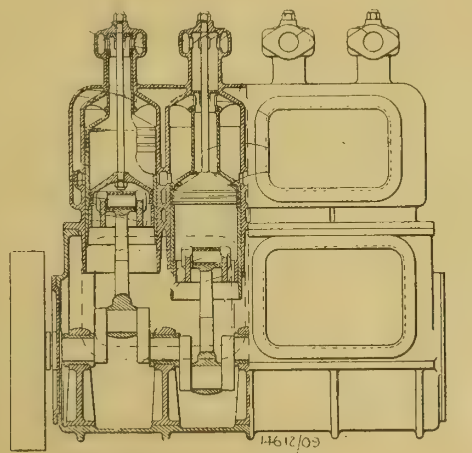
14612 Douglas: Internal-combustion motors.

This invention relates to improvements in internal-combustion motors, more particularly of the two-stroke cycle type, wherein a hollow piston slides over a fixed piston within the cylinder of the engine, the hollow piston having a hollow cylindrical extension that is provided with ports that register with other ports in a hollow extension of the cylinder wherein the piston extension slides. One feature consists in providing an internal-combustion engine of the above kind wherein the extension (or each extension if two are employed) for the piston is closed at the end remote from the piston, and has in its side wall near the end a port that registers alternately with the port in the cylinder extension and with the interior of the working part of the cylinder. Another feature consists in providing the moving piston of an engine of the type described with the hollow extension and also means for receiving the connecting or crank rod for the crankshaft. It has before been proposed to connect the crank rod to the moving piston, but not in conjunction with an extension carried by the piston which affords a simple and practicable construction.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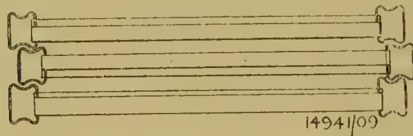
14656 Smith: Metal casing for use in wells. 14671 Thomas, Thomas, and Holme: Cranes and the like. 14678 Croft: Two-stroke cycle internal-combustion engines. 14690 Waddell: Vacuum dust extractors. 14707 Godelmann: Incandescent gas mantles and their supports. 14711 Sayer: Buffer couplings for railway car and other vehicles. 14713 Marsh: Window holders for sliding sashes. 14730 Sadler: Hook and eye fastenings for dresses and the like. [Request under Section 19 not granted.] 14737 Prien: Night lamps. 14738 Jenkins: Machines for use in closing the ends of receptacles or containers. 14741 National Cash Register Co. (National Cash Register Co.): Accounting machines such as cash registers and distant totalisers therefor. 14758 Hibberd: Coin-freed mechanism. [Cognate Application. 16141, 1909.] 14763 Lamkin and Nunwick: Holders for incandescence electric lamps. 14770 Baine: Method of and apparatus for testing flour and yeast. 14774 Beckton: Sash windows for facilitating cleaning thereof. 14781 Tatham: Stoves or firegrates. 14831 Pym, and Kreutler Bros. Co.: Lasting machines. 14834 Colardeau and Richard: Process and apparatus for obtaining and observing animated stereoscopic views. 14873 Holden: Electric clocks. 14896 Butteau: Indicator or waiter's call combined with dinner-table centre pieces.

14941 Guilleaume: Water-tube boiler.

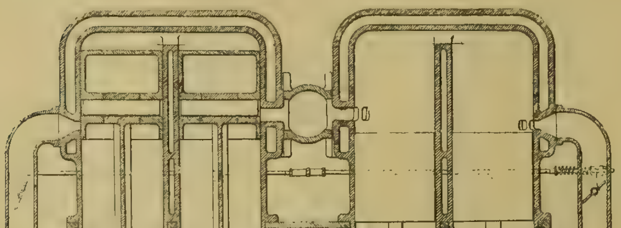
This invention relates to a header water-tube boiler having straight divided or sectional headers, the sides of which are rounded on their vertical edges and concave between such rounded edges. According to the present arrangement the sides of the divided or sectional headers are rounded along their vertical edges and concave between such rounded edges throughout the whole of their height, and such rounded edges and grooves are so proportional as to enable one rounded edge of each adjacent divided or sectional header to fit snugly within the concave part of the adjacent sectional header somewhat similar to interfitting teeth.



14959 Farjas and Jaboin: Radiferous fibres and the method of producing the same. [Date applied for under International Convention, February 16th, 1909. Application for Patent of Addition to No. 14760, 1909.] 14971 Carlsen: Printing block and method of producing the same.

15026 Albion Motor Car Co., and Murray: Two-stroke cycle internal-combustion engines.

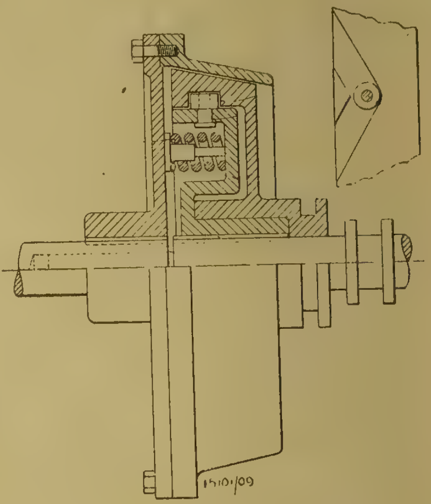
This invention relates to that type of two-stroke cycle internal-combustion engine, consisting of unit pairs of cylinders having synchronously moving pistons in which the combustion spaces of the pairs of cylinders are interconnected, while in one cylinder there is a piston-operated port communicating with a closed crank chamber in which is air or explosive mixture, while the other cylinder of the pair has a piston-operated exhaust port. The improved engine comprises two or more unit pairs of interconnected cylinders, each pair being identical, one cylinder of each pair having a piston-operated exhaust port and the other a crank chamber-connected piston-operated inlet port in known manner, the unit pairs operating upon the symmetrically disposed cranks of one crankshaft.



15028 Browning and Golder: Machinery for the manf. of casein. 15029 Waite, and Waite and Saville Ltd.: Mechanism for attaching metal and other sheets to the cylinders of rotary printing machines. 15036 Fair: Sewing and other machines with awl-feed mechanism for operating upon boots and shoes and like work. 15043 Grimwade: Pudding basin. 15055 Golter: Reversing gear, especially applicable to washing machines. 15056 Prugh, and American Floor Surfacing Machine Co.: Floor-surfacing machines. 15074 Culmore: Inner tube for pneumatic tyres. [Date applied for under International Convention, June 26th, 1908.] 15097 Parker: Pins for securing ladies' hats in position on the head.

15101 Savory: Clutch mechanism for driving gear.

The object of the present invention is to provide an improved coned clutch of the type in which thrust is imparted to the engaging clutch surfaces and relieved when the clutch surfaces are disengaged, such thrust being proportional to and automatically regulated by the torque transmitted through the gear. According to this invention two coned clutch members are employed, one of which embraces the other, the clutch surfaces of which are adapted to be brought into engagement when the members are moved axially, a member intermediate, or between the radial parts of the clutch members and in driving engagement with one of the shafts but slidable thereon, means whereby the rotation of the driven clutch member imparts axial movement to the intermediate member and resilient means for restraining such movement and for imparting by reaction thrust upon the clutch surfaces.

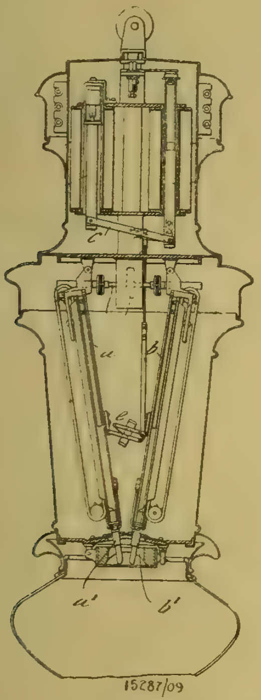


15156 James: Draw pulls and card holders for filing cabinets, drawers, and the like. 15159 Williams and Bryson: Burners for oil lamps. 15171 Nosworthy and Prescott: Closures for bottles and the like vessels. 15191 Williams, Berger, and Burroughs: Gas-lighting apparatus for use with life-saving apparatus and for other like purposes. 15273 Leigh: Suspension cables or supports.

15287 Johnson and Phillips Ltd., and Brockie: Magazine electric arc lamps.

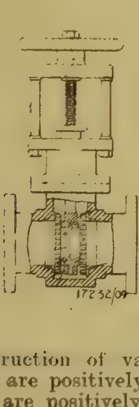
This invention relates to magazine flame lamps, and the objects are to render the regulation of such lamps very accurate and sensitive by simple means to improve the construction of the magazines, and to arrange the principal component parts of the lamp in a compact and practical manner. It has been found in lamps of this class that if the magazines are linked directly to the regulating lever as in usual practice the work imposed upon the regulating cores or armature in moving either or both of the somewhat heavy magazines renders the regulating action sluggish, so that the carbon feed gear is neither started nor stopped with the accuracy and promptitude which is desirable. This defect is overcome according to the present invention by the employment of a system of levers *e* connecting the carbon magazines *a*, *b* with the regulating lever *c* of the lamp so disposed as to transmit a gradually decreasing movement to the holders a^1, b^1 as they approach each other, so that when they have arrived at a certain proximity any further movement of the regulating lever *c* in the same direction does not produce any sensible change in the distance separating the carbon holders, and therefore, the regulating lever being relieved of the work of actually moving the magazines, any further movement of the lever *c* can be and is utilised in starting and stopping the motor mechanism or gearing which imparts or permits the actual progressive feed of the carbons out of the magazine nozzles.

15303 Cross: Manf. of a chloramine derivative. 15435 Jackson: Transport envelopes or boxes. 15441 Verity's Ltd., and Pipkin: Construction of quick make-and-break electrical switch. 15460 Baker: Ironing machines. 15514 Ward and Ward: Valves for internal-combustion engines. 15522 Chipperfield: Type cases and composing sticks for use in connection therewith. 15730 Clinch: Combined manure distributor and seed drill. 15752 Kenney and Boyle: Anchors. 15785 Millet: Trouser pressers. [Date applied for under International Convention, July 18th, 1908.] 15825. *See* 14361, 1909. 15846 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new dyestuffs of the anthracene series. [Samples furnished under Section 2.] 15847 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new azo dyestuffs. [Samples furnished under Section 2.] 16054 Hornby: Hatpin. 16062 Lubbock: Sounding device. 16069 Prideaux: Hypodermic and like syringes. 16125 Sweeney: Pressure plate tools for drop stamps or the like presses. 16141. *See* 14758, 1909. 16215 Jones: Carburetting apparatus for internal-combustion engines. 16333 Waller: Self-propelled agricultural implements or machines for ploughing, cultivating, and mowing. [Cognate Application. 2194, 1910.] 16556 Lake (O'Brien and Desmarais): Core extractors. 16558 Lake ("Polyfrequenz" Elektricitats-Ges.): Devices for producing electrical oscillations. 16607 Chetwynd, Kelvin, and James White Ltd., and Clark: Portable magnetic compasses. [Application for Patent of Addition to No. 21634, 1908.] 16649 West: Quick make-and-break switches. 17074 Lymn: Production of gas and ammonia from peat in a gas producer. 17077 Johnston: Mechanism for cutting or forming screws having threads of a variable or increasing or decreasing pitch.



17232 Holden: Construction of valve.

Relates to valves as generally used for controlling or stopping the supply of steam, water, gas, or other fluids, and particularly to the type known as parallel slide valves.

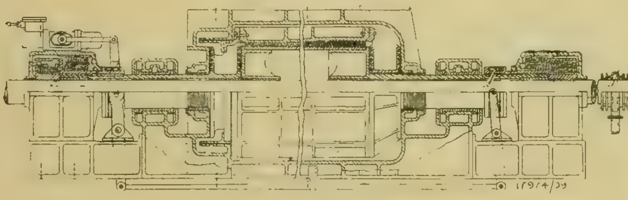


The improved construction of valve is as follows: The he and she portions are positively forced outwards as the valve is closed and are positively traversed in an inward direction as the valve is opened by forming the portions with teeth which gear with rack teeth whereby a rotative movement is set up, the he and she portions having helical grooves cut or otherwise formed in them into which grooves balls are introduced whereby the rotative movement of the he and she portions alters the relative position of the helical grooves, and by reason of the traverse of the portions on the balls causes the he and she portions to travel inwards or outwards to open or close the valve.

17380 Muller and Bomhard: Process of and apparatus for purifying gases. 17595 Wilson, and Wilson and Co. (Barnsley) Ltd.: Hoops or shields of bobbins and spools. 17624 Newton (Farbenfabriken vorm. F. Bayer and Co.): Dyeing half wool. 17832 Hodgson: Apparatus for use in the inhalation of ether and other drugs. 17863 Maggiora and Sinclair: Electric motors. 17872 Hilton and Coppell: Hood fittings of motor and other vehicles. [Application for Patent of Addition to No. 20412, 1908.]

17974 Wilson and Gregg: Reversible turbines.

Means for enabling the direction of rotation of a turbine to be reversed consisting of a fore and aft arrangement of brake and clutch mechanism fitted at each end of the turbine in connection with the fixed outer casing or cylinder, the inner revolving casing or cylinder, the rotor, and the driving shaft, and comprising sliding sleeves enclosed in casings and provided with a series of recessed discs fixed alternately to the sliding sleeve and to the outer casing and to an enlarged extension of the sliding sleeve and to a collar secured on the main shaft whereby, when the clutch mechanism at one end is connected to the shaft and the brake mechanism at the other end is connected to the outer casing and the rotor, the shaft revolves in one direction, whilst, when the clutch at one end is connected to the shaft and the inner revolving casing and the brake at the other end is connected to the rotor and the fixed casing, the shaft revolves in a reverse direction.

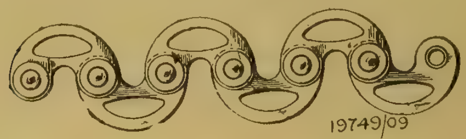


17992 Loring: Art of ageing and conditioning flour. [Application for Patent of Addition to No. 12781, 1908.] 18087 Loewe: Process for the manf. of artificial silk and apparatus therefor. [Date applied for under International Convention, September 18th, 1908.] 18257 Ince: Struts for floor joists. 18428 Gostick: Loose-leaf books. 18470 Troike: Valve gear of internal-combustion engines. 18593 Izod: Manf. of carburetted air. 18616 Collins and Pearce: Means for indicating the striking force of golf clubs and the like. 18851 James: Boat-disengaging and supporting gear. 18855 Sturridge: Harness. 18906 Gimson and Co. (Leicester), and Partridge: Heel-seat trimming machines. 18992 Mackay: Resilient tip or pad. 19109 Marks (Southern Manufacturing Co.): Baths for extracting products from wood. 19112 Alexander and Applebys Ltd.: Means for controlling the opening and closing of grabs, discharging of buckets, and the like. 19145 Presto Gear Case and Components Co., and Turner: Gear cases for cycles. 19239 Henderson, Henderson, and Henderson: Liquid taps. 19349 Aderholdt: Method of drying and finishing wet, dyed yarns, and textile fabrics. 19438 Martin: Combined side delivery rake and swath turner. 19439 Midland Railway Carriage and Wagon Co., and Currall: Dumping wagons. 19447 Lake (C. B. Cottrell and Sons Co.): Sheet delivery apparatus for printing machines. 19454 Cianferoni: Variable-speed gear. [Date applied for under International Convention, August 25th, 1908.] 19465 De Stefano: Electro-magnetic device for varying the intensity of light of electric lamps and for permiting the use of low voltage lamps on high voltage circuits. [Date applied for under Interantional Convention, August 26th, 1908.] 19531 Hendle: Incubators. 19587 Hodgson, and George Hodgson Ltd.: Loom dobbies. 19668 Middleton: Apparatus for the measurement or indication of power or efficiency of heat engines. 19682 Wiegard: Turn wrest or one way ploughs and the like. 19698 Bannister: Apparatus for producing blocks or coatings of ice.

19749 Hill, and Coventry Chain Co. (1907): Driving chains.

The links are of "U" type and assembled so that each adjoining link is in a reversed direction—that is to say, one link of U type, and next being an inverted U and so on.

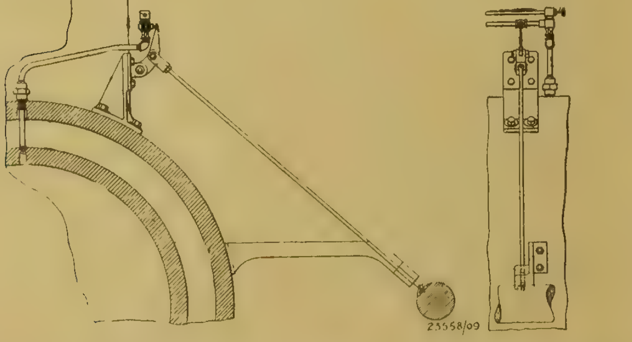
Near the ends of the U-shaped plates holes are made through which rivets are passed for the purposes of joining the adjacent plates together, but at the same time allowing them to be able to rotate round the rivets so as to insure the flexibility of the chain. Each link may be composed of one or more U-shaped metal plates side by side. Thus it will be seen that the chain may easily be made up of any desired length or width, and if necessary hardened steel bushes may be fitted in the U-shaped plates and flint hard rivets used to fasten the links together. This latter arrangement will prevent undue stretch.



19754 Jackson: Brakes for ships' rudders. 19989 Fox: Construction of shuttle pegs for looms for weaving. 20002 Royston (Meyer Supply Co.): Bottle-soaking and rinsing machine. 20050 Lehmann and Lehmann: Means for eliminating offensive exhaust gases in internal-combustion engines. 20060 Altmann: Liquid combustible burners of the inverted type. 20224 Spencer: Tip wagons. [Application for Patent of Addition to No. 10985, 1906.] 20391 Masurel: Machine for drying sized warp. [Date applied for under International Convention, November 20th, 1908.] 20453 Maudslay, and Standard Motor Co.: Detachable road wheels. 20525 Sargeant: Potato digger. 20883 Ellam and McMillan: Non-skids for motor wheels. 20960 Eimann: Apparatus for cutting or soldering metals along any curved lines by means of an oxy-hydrogen, oxy-acetylene or other like burner. 21021 Highfield: Installation of electrical conductors. 21231 Hollingworth (Crompton and Knowles Loom Works): Loom harness motions. 21264 Cramp: Reversible turbines. 21295 Pears and Creighton: Attachment for saw-sharpening machines. 21388. *See* 6755, 1909. 21455 De Selincourt: Clip or holder for neck furs, ties, and the like. 21526 Watkins: Insulator for supporting the current rails of electric railways and tramways. 21561 Downing, Hawkins, and Erwin: Front ends, stacks, and draught appliances of steam boilers. 21564 Royce: Electric heaters. 21983 Cosford: Apparatus for separating measured quantities of grain from bulk and delivering same. 22046 Cooksey: Syphonic water closets. [Cognate Application. 751, 1910.] 22206 Protin and Contal: Aeroplanes. [Date applied for under International Convention, March 27th, 1909.] 22400 Miller: Leers. 22542 Ritzenhoff: Strainers or containers for use in fish kettles, saucepans, and like. [Date applied for under International Convention, October 9th, 1908.] 22918 McNeill: Wire, rope, or like strainers. 22938 Vogel: Means for securing brush handles, chair legs, and similar bodies in their sockets. 23033 Lenz: Fountain pen. 23140 Hoyle: Bucket and stand apparatus for extinguishing fires. [23204 Newton (Farbenfabriken vorm. Friedrich Bayer and Co.): Manf. and production of new azo dyestuffs. [Application for Patent of Addition to No. 1397, 1909.] 23213 Popkess: Processes of treating earthy materials for surfacing roadways and the like. [Rights under Section 91 of the Act not granted.] 23429 Muirhead, and Muirhead and Co. Ltd.: Electric telegraphy.

23558 Horton and Keen: Lubricating apparatus for engines.

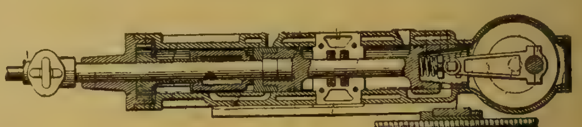
Relates to apparatus used in the lubrication of larger types of engines, and more particularly to lubricating apparatus used in connection with gas engine cylinders in which blast-furnace gases are used in driving the engines. The cylinder lubricating apparatus used with such gas engines heretofore has been very unsatisfactory, as the lubricant is not effectively distributed over the large surface of the cylinder, and in consequence the cylinders become badly scored and cut in a very short time after the engine is put into use. The object of the invention is to provide improved apparatus for supplying lubricant to the cylinders of such gas engines and apparatus having means whereby the lubricant is positively fed into the cylinder and is sprayed on the interior of the cylinders. Another object of the invention is to provide means for injecting the lubricant into the engine cylinder intermittently at predetermined times and mechanism by which the injecting means is automatically operated when the engine is operated. The apparatus comprises a lubricator having connections with the cylinder to be lubricated and arranged to collect and supply lubricant thereto, means connected with a reservoir and arranged to feed a regulated quantity of lubricant to the lubricator, a supply of pressure fluid in which the pressure has been generated independently of that which is to be utilised in the cylinder, and means arranged to admit pressure from the supply intermittently to the lubricator to periodically discharge the regulated quantity of lubricant into the cylinder in the form of a spray.



23674 Rees: Means of fastening and securing papers and such like. 23712 Perry and Co., and Moore: Construction of hat-guard clip. 23864 Dicker (Maschinenbau Act.-Ges. Golzern-Grimma): Liquid-vaporising or concentrating apparatus. 23871 Potter: Lap-forming apparatus of openers and like machines. 23873 Johnson (Badische Anilin and Soda Fabrik): Reduction of indigo and similar colouring matters. 23961 Moat: Means for cooling or warming milk and the like. 24052 Welch and Welch: Sewing machines. 24134 Manders: Apparatus for the production of continuously maintained and sustained oscillations of electricity. 24266 Harle: Detonators. [Date applied for under International Convention, October 22nd, 1908.] 24374 Mitchell: Cuff for shirts. 24507 Levy: Coats, jackets, and the like. 24836 Buckthorpe: Combination inkstand, stamp box, or like receptacle and stamp damper. 24902 Brocklehurst: Mechanical flying machines. 25001 Lamb, Battersby, and Kershaw: Amusement devices. 25035 Chinneck: Plates. 25206 Harper: Method of forcing or feeding petrol or liquid fuel to motors of road vehicles and such like and means for such purpose. 25400 Dependence Incubator Co., and Johnson: Incubators. 25461 Jane: Device for filling fountain pens and the like. 25591 Rosenthal: Stacking and elevating devices for use with threshing machines and the like. 25774 Bengtsson: Military entrenching tools. 26223 Stevens: Wheels of roller skates. 26387 Reid (Reinforced Concrete Pipe Co.): Sectional sewer pipes. 26405 Brown: Burglar alarm. 26416 Humber Ltd., and Watson: Motor car bonnets. 26566 Lawyer and Lawyer: Folding cribs. 26672 Snowball: Lift latch. 26889 Harding: Cop holders or spools for carrying cops of twine or thread. 27075 King: Diamond-fold forming mechanism for paper bag machines. 27087 Sectional Box Co., and Fassnacht: Shipping boxes or cases. 27201 Allison (International Metal Products Co.): Iron product and open hearth process of manufacturing same. 27256 Pigge: Combined cigar cutter and advertising apparatus. 27352 Jenkins and Jenkins: Emergency wheel rims. 27543 Renger: Label-affixing machines for tins, bottles, and so forth. 27705 Brice: Dental applicator for use with any electric massage vibrator. 27782 Perry and Co., and Perry: Manf. of fountain pens. 27794 Ogilvie and Empey: Organ bellows or the like, and the mechanism for controlling and operating the same. 27823 Meyers: Devices for sharpening razor blades. 27844 Gartner: Brooms and brushes. 27896 Macintosh: Sheet metal lathing.

27932 Scott: Rock drills.

This invention has reference to improvements in internal-combustion rock drills designed for use in mines and quarries for drilling the holes in which are placed the explosive charges for breaking away the rock or mineral, and relates to that class of internal-combustion rock drill wherein are provided a pair of opposed two cycle engines having their pistons mutually connected and caused to reciprocate wholly by the action of the internally fired gases, a reciprocating drill rotatably connected to the engines, and means for intermittently rotating the drill, the drill and cylinders being arranged in alignment. The present arrangement comprises a pair of two-cycle engines arranged with their combustion chambers intermediate

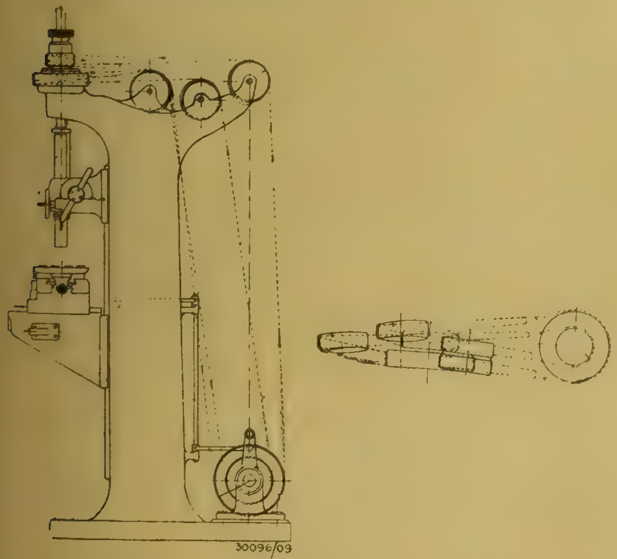


their pistons, a piston rod mutually connecting the pistons, a crankshaft, a yielding connection between the crankshaft and the adjacent piston, and a drill rod connected to the other piston.

28142 Schiffers: Cylinder-fulling machines. [Date applied for under International Convention, December 5th, 1908.] 28256 Friedrich: Process for the production of fine artificial threads. [Date applied for under International Convention, December 3rd, 1908.] 28275 Miller: Drawing instruments. 28359 Hintz and Schmidt: Detachable soles and heels for boots and the like. 28590 Wild and Mahan: Apparatus for coating candies with sugar. 28641 Droitcour: Removable sheet catcher or receiver for use with the sheet delivery apparatus of high-speed printing presses. 28732 Panton: Brake blocks for railway cars and like vehicles. 28776 Internationale Bauaustrocknungsges and Paetsch: Apparatus for drying damp rooms. 28839 Poschl: Illuminated advertising or direction-indicating signs. 29014 Porter and Johnson: Boat chocks and their releasing gear. 29026 Van Raden: Electrical ignition apparatus for internal-combustion engines. 29273 Soc. Anon. des Plaques et Papiers Photographiques A. Lumiere et ses Fils: Process for the manf. of polychrome screens for colour photography. [Date applied for under International Convention, February 6th, 1909.] 29342 Fairweather (Chicago Vacuum Jar Co.): Jar closures or covers. 29424 Starley: Roller skates. 29630 Aldous: Billiard cue rests. 29652. *See* 14464, 1909. 29656 Mould: Rests for grindstones and the like. 29770 Robinson: Mechanism for filling pipes with tobacco. [Cognate Application. 2601, 1910.] 29790. *See* 14551, 1909. 29822 Voirol: Cases for watches, motor car and other clocks, jewellery, knives, and the like. [Date applied for under International Convention, December 23rd, 1908.] 29823 Koehler: Shock absorbers for vehicles. 29859 Crim and Loy: Locks for automobiles. [Date applied for under International Convention, December 23rd, 1908.] 30039 Henrichs and Adolph Frankau and Co.: Mouthpieces for tobacco pipes. 30056 Baugatz: Shirts. 30093 Hibberd: Coin-freed mechanism for electricity meters. [Date applied for under Rule 13, June 23rd, 1909.]

30096 Ludw. Loewe and Co., Akt.-Ges. and Bechstein: Drilling machines.

This invention relates to a particular arrangement of the belt in drilling machines having a belt deflected at an angle of 90 deg. In drilling machines of a similar kind hitherto constructed, the belt has to be shifted from one cone pulley to the other when the speed of the drilling spindle is to be changed, whereby much time is lost. The essence of the present arrangement consists in arranging several belt pulleys next to one another on the driving and working spindles, the pulleys being in connection with one another by means of a belt common to all of them and able to be coupled separately to the corresponding spindle. This arrangement has the advantage that the speed of revolution of the drilling spindle may be changed without loss of time by changing the engagement of a coupling.



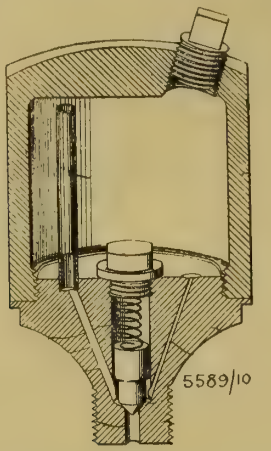
30153 Wratten: Handles for cricket bats, hockey sticks, and the like. 30171 Heaton: Baking ovens. 30173 Turnbull: Drying of leather. 30200 Elliott: Shop fronts and the means of displaying goods therein. [Cognate Application. 1602, 1910.] 30366 Fiel: Fastening device for ladies' collars. 30389 Kewisch: Hatpins. 30406 Hinckley: Linings for golf holes. 30422 Dimelow: Artificial teeth. 30600 Von Bechtolsheim: Calculating apparatus. [Date applied for under Internatinoal Convention, January 14th, 1909.]

1910.

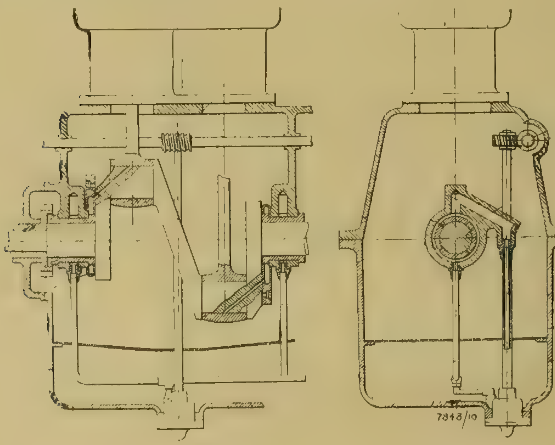
79 Linderman: Tongueing and grooving devices for use with lumber-joining machines. 192 Fisher: Fasteners for gloves and the like. 231 Swanson: Nut and spindle-attaching devices. [Date applied for under International Convention, February 27th, 1909.] 474 Paterson: Filters. 617 Soc. Jules Grouvelle H. Arquembourg et Cie.: Carburetter for internal-combustion engines. [Date applied for under International Convention, January 9th, 1909.] 722 Farrell: Electric motor power transmission. 751. *See* 22046, 1909. 901 Philipson: Construction of brushes. 1038 British Thomson-Houston Co. (General Electric Co.): Apparatus for automatically transferring articles to and from a machine in which they receive treatment. 1073 Granges: Covers for autoclaves or other vessel. [Date applied for under International Convention, January 25th, 1909.] 1396 Meadows: Instrument to facilitate the secure knotting of surgical sutures, ligatures, and the like, and suitable also for various common surgical uses. 1442 Lake (Soc. Anon. Fides Fabbrica di Automobili Brevetti Enrico): Joints for the attachment of radiators to the frames of motor vehicles. 1520 Ely: Folding umbrellas. 1590 Ges. fur Rohrenreinigung: Tube cleaner driven by a travelling turbine with metallic guide-wheel collar. [Date applied for under International Convention, February 8th, 1909.] 1602. *See* 30200, 1909. 1632 George and Jarvis: Writing tablets or note books adapted to be fastened to the wrist. 1896 Joseph: Fasteners for use on walls, partitions, and the like. 2017 Williams: Automatic gas regulators. 2080 Ferrand: Detachable and divisible wheel rim. 2125 Fisher: Woven fabric cartridge pockets or belts. 2194. *See* 16333, 1909. 2196 Baird, Wollman, and Holmes: Metallic railroad ties. 2298 Nauss: Manf. of gas suitable for filling balloons of airships. [Date applied for under International Convention, March 30th, 1909.] 2347 Wild: Lubricating devices for vehicle wheels. 2365 Kops: Corsets. [Date applied for under International Convention, July 22nd, 1909.] 2366 Kops: Corsets. [Date applied for under International Convention, October 19th, 1909.] 2373 Bellah: Pocket guards. 2492 Morse: Dust collectors. [Date applied for under International Convention, July 10th, 1909.] 2601. *See* 29770, 1909. 2773 Healy: Lamp shade. 2882 Smith: Buckles for belts. 2902 Societe Generale des Etablissements Bergougnan et Cie.: Method of connecting solid resilient tyres to the wheels of vehicles. [Date applied for under International Convention, April 16th, 1909.] 2904 Hintermann: Cross tie or sleeper for railway rails. 3428 Wever, and Union Special Maschinenfabrik Ges.: Method of mending or repairing sacks and the like and apparatus therefor. [Date applied for under International Convention, May 3rd, 1909.] 3578 Dutton, and McKenzie and Holland Ltd.: Signalling and interlocking for railways and tramways. [Application for Patent of Addition to No. 784, 1909.] 3583 Conekin: Rotary engines. 3841 Townsend: Devices for projecting lubricants on to or into parts to be lubricated, and for analogous purposes. 3898 Joshua Buckton and Co., and Wickstreed: Testing machines. 3935 Thomson: Ground levels and the like for railway points and switches. 3974 Thompson (North-Western Wheel and Wagon Co.): Wheels. 4393 Chanbeyre: Manf. of hooks, swivels, and the like. 4559 Kettering and Chryst: Cash registers or accounting machines. [Date applied for under International Convention, September 2nd, 1908. Originally included in No. 6428, 1909.] 4679 O'Hanlon: Fountain pens. [Application for Patent of Addition to No. 11699, 1909.] 4680 Robier: Mould for imparting convexity or curvature to glass plates. [Date applied for under International Convention, December 31st, 1909.] 4755 Webb: Protection of wheels fitted with pneumatic tyres. 4912 Soc. Anon. des Plaques et Papiers Photographiques A. Lumiere et ses Fils: Process of manf. of polychrome screens for colour photography. [Date applied for under International Convention, February 27th, 1909. Application for Patent of Addition to No. 29273, 1909.] 4921 Munar y Cona: Dust or waste bins or receptacles. 4967 Siemens and Halske Akt.-Ges.: Subaqeous sound producers. [Date applied for under International Convention, March 5th, 1909.] 4971 Rauwolf and Hirschberg: Tyres for motor cars and the like. 4995 Luders and Lehmann: Compounds for automatically sealing punctures in pneumatic tyres. 5346 Lamson Paragon Supply Co., and Evans: Check or sales books. 5377 Soc. Anon. des Plaques et Papiers Photographiques A. Lumiere et ses Fils: Process of manf. of polychrome screens for colour photography. [Date applied for under International Convention, March 10th, 1909. Application for Patent of Addition to No. 29273, 1909.] 5528 Fowler: Calculator.

5589 Beaton, Eason, and Wilson: Automatic lubricating apparatus.

The present invention relates to self-contained lubricating apparatus of the kind comprising an oil vessel furnished with a single oil discharge orifice, solely by means of which the interior of the vessel is put into communication with a region of fluctuating fluid pressure, such orifice being controlled by a valve opening inwardly to the oil vessel and serving, when seated, completely to close the orifice. In the operation of such devices the fluctuating pressure of the fluid under the valve causes such fluid to surge in and out of the valve-controlled orifice whereby it carries successive small quantities of the oil with it. The object is to provide a lubricator of the kind referred to which will operate in practically any position without adjustment according to its position, and is thus particularly applicable for use with rock-drilling machines and similar apparatus subject to extreme change of position when at work. To this end the invention consists in placing the valve-controlled orifice in the base of the oil vessel and affording communication from above the valve seat and the interior of the vessel by two holes, one of which opens directly to the adjacent part of the oil chamber, and the other being extended, as by means of a pipe, to open at the distant part of the oil vessel.



5709 Eickworth: Crucible furnaces. [Date applied for under International Convention, March 16th, 1909.] 5917 Siemens and Halske Akt.-Ges.: Rectifier for high-tension alternating currents. [Date applied for under International Convention, May 28th, 1909.] 5980 Churcher: Spring tyre and cover for wheels of road vehicles. 6062 Bachmann: Egg-hatching apparatus. 6468 Morris and Bastert: Overhead runways. 7030 Butterfield: Spring wheels for automobiles and the like.



7310 Forsyth and Wallace: Devices for removing bottle caps. [Date applied for under International Convention, October 9th, 1909.] 7442 Cunningham: Oarsmen's exercising apparatus. [Date applied for under International Convention, March 31st, 1909.] 7451 Sundberg: Milking machines. 7754 Coulson: Handle bars for velocipedes and the like. 7802 Pollaert: Devices for connecting scaffold poles.

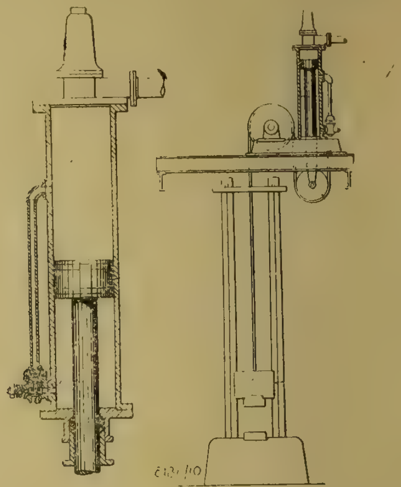
7848 Renault: Means for lubricating internal-combustion engines. [Date applied for under International Convention, April 19th, 1909.]

The object of the present invention is to ensure the circulation of the oil continuously around moving parts of the motor in such a manner that the oil that enters the bearings as a result of the wear that they experience in use does not increase in accordance with the fluidity of the oil or with the amount of wear. According to the present method the oil is supplied under pressure to the lower part of the bearings from the gear case by means of a pump, and then proceeds through an annular conduit and orifices formed in the bearing to the crankshaft, the bearings of which it lubricates; the excess of oil escapes at the upper part of the bearing through an orifice, the cross section of which is much larger than that of the admission pipes and returns freely to the gear case.

7942 Nelson: Tyres. 7985 Mawson: Lead pencil cases.

8182 Rulcovius, and Bainbridge Engineering Co.: Apparatus for operating trip hammers.

Relates to apparatus for operating trip hammers of the type in which the monkey is raised by forcing a piston from one end to the other of a cylinder by fluid pressure, and in which the travel of the piston is regulated by a valve-controlling communication with the atmosphere, and consists of providing a valve-controlled by-pass connecting the two ends of the cylinder so that on the falling of the monkey the piston shall not be caused, by the air compressed under the same during the working stroke of the piston, to travel at a greater rate than that at which the monkey descends.



8239 Johnson (Kalle and Co. Akt.-Ges.): Manf. of di-bromo-isatine. 8331 Rose: Oil cans. 8408 McBride: Machines for gapping turnips, mangolds, beetroot, and the like. 8524 Peetz, McDanel, and Thompson: Copy holders for typewriters. 8671 Fleming and Ferguson Ltd., and Cochran: Self-ejecting barge for sewage, oil, and the like. 8722 Bloxam (Chemische Fabrik Griesheim-Elektron): Manf. of mordant azo dyestuffs. 9173 Bloxam (Chemische Fabrik Griesheim-Elektron): Manf. of disazo dyestuffs. 9294 Kettering and Chryst: Cash registers. [Date applied for under International Convention, May 4th, 1909. Originally included in 18359, 1909.] 9383 Scherrer: Apparatus for life-saving in case of fires. 9416 Corwin: Anti-skidding tyres. 9877 Morison: Undergarment. 9892 Knottenbelt: Petroleum and other hydrocarbon oils. [Date applied for under Rule 13, May 21st, 1909.] 10052 Dennison: Talking machines. [Date applied for under International Convention, April 26th, 1909.] 10082 British Loose Leaf Manufacturers Ltd. (Sieber and Trussell Manufacturing Co.): Loose-leaf binders. 10560 Snuyff: Swimming baths. 10822 Lachman: Wheels especially suitable for vehicles. [Date applied for under International Convention, April 30th, 1909.] 11034 Haydon: Horseshoes. 11065 Kuttner and Lubecius: Toys. [Date applied for under International Convention, May 26th, 1909.] 11187 Vereinigte Uhrenfabriken von Gebruder Junghans und Thomas Haller Akt.-Ges.: Clocks. [Date applied for under International Convention, April 6th, 1910.] 11617 Sundling: Cooking ranges and the like. [Date applied for under International Convention, May 15th, 1909.] 12709 Leake: Electrical operation of gun mechanism and the like. [Date applied for under Rule 13, June 18th, 1909.]

COMPLETE SPECIFICATIONS OPEN TO PUBLIC INSPECTION BEFORE ACCEPTANCE, UNDER THE PATENTS ACT, 1907.

1909.

29502 Soc. du Gaz de Paris: Apparatus for automatically controlling luminous signs.

1910.

937 Jacques: Percussion boring machines. 1768 Akt.-Ges. Brown, Boveri, et Cie.: Compensating winding for polyphase commutator machines with drum armatures. 1781 Firm Carl

The Life Story of an Engineer

Remarkable rise of an untutored farmhand.
A system by which success is open to all.

THE story of a man's fight for success is one which never fails to win our sympathies, especially those of us who have yet to make our own success. Such a story as the one we are here enabled to present, as the result of a recent interview with Mr. B. Danby, Works Manager, Humber Brass and Copper Works, Hull, is the more exhilarating because, in addition to showing how sheer grit can overcome all obstacles to success, it tells us how much of the old heart-breaking struggle can now be avoided.

Mr. Danby was born of poor parents, 27 years ago, in a Yorkshire moorland village. After brief attendance at the distant village school, he, at the age of 12,

Became a Regular Farmhand.

A year later, however, observation of the threshing engine and railway engine had determined him to become an engineer. His parents could not assist him, so he tramped to Hull, where he

Apprenticed Himself to an Engineering Firm,

the Humber Brass and Copper Works. Now, after another thirteen years, he is works manager to this firm.

For the first year he received 4s. a week, the next year 5s. a week, and, to quote his own words to us concerning that period, "I scarcely ever had enough to eat, and many a night I have cried myself to sleep with the pain of it." At the age of 19, when he was earning 10s. per week, he attended a weekly technical school for a year, took first prize in machine construction, and then

Left it in favour of the I.C.S.

"For I am convinced," Mr. Danby remarked to us, "after giving both a fair trial, that a man can get a more thorough training in five years' work with the I.C.S. than he could in ten years' work at a good technical school, and time is money to me."

How valuable this up-to-date training proved is shown by the fact that when, at the age of 21, Mr. Danby's apprenticeship expired, he was

Offered the post of Foreman.

Great was the responsibility thus thrown on the young man's shoulders. "I scarcely ever went to bed before two o'clock, sometimes not at all," Mr. Danby told us in referring to this period, "and I was always at work at six. I don't work so hard now. I find that with the I.C.S. everything I learn is a gain. The matter has been sifted through the brains of men of practical experience, who know just what knowledge a practical man needs."

Asked for an instance of

The Practical Value of his Studies,

Mr. Danby told how on one occasion his firm were asked by the head of a large chemical factory if they could make a certain intricate machine, known as a chemical digester, which had never been made in England. The firm were about to reply in the negative, when young Danby heard of this, and asked the manager to defer his reply for a few days. "I was sure I could draw the plans for it," to use Mr. Danby's own words to us. "The manager smiled, for whereas my previous experiments had involved only a few pounds of metal, this was a complicated piece of mechanism, requiring about seven tons of copper and costing upwards of £1,000. But he gave me the opportunity. I was not entirely ignorant of such a machine. As far as I am able I never pass even an allusion to a machine without following it up. For instance, we made parts for the machinery of

The Ocean Liner 'Mauretania.'

I made myself as well acquainted with that wonderful machinery as though we made the whole of it.

"After a month's work my plans were complete; they were thoroughly tested, the machine was constructed, and has given every satisfaction. That machine was a landmark in my life's history. It brought me into contact for the first time with men high up in the profession I love. Through it I visited London for the first time."

No need to tell more of Mr. Danby's career. It is typical of the I.C.S. student's success. The man himself is of the type that the International Correspondence Schools are proud universally to recognise—the type that here and now they are seeking to train.

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Terms to Meet Your Needs.

Remember that when Mr. Danby started he had not the opportunities of I.C.S. training here offered you. To quote his own words again:—

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"I can see a straight road to the goal of my ambition through the I.C.S. tuition. I have never seen it before, though I have striven since I was thirteen years of age. My ambition is to be not merely an engineer, but one of the chief men in my profession."

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Jager: Azo dyes. 3967 Gauthier: Apparatus for the manf. of metal plastic packing rings. 6973 Andreas and Wolf: Exhaust silencers for internal-combustion engines. 10979 Elzer and Schuler: Holders for cooking vessels. 11055 Landau and Co., and Kreidl: Process for loading silk. 11056 Landau and Co., and Kreidl: Loading of silk. 11943 Firm Robert Erlemann: Appliance for shooting up propeller-like bodies, discs, or the like. 12445 Firm Wuster Bros.: Method of manufacturing the top notches and runners of umbrellas, parasols, or the like. 12471 Hendryx: Dewatering device. 12737 Farrand: Fastening devices. 13318 Putz: Wheel. 13711 Aeschbach: Process and apparatus for the treatment of dough. 13991 Widegren and Widegren: Method of and means for controlling from a distance electric apparatus, and especially telegraph apparatus and the like. 14028 Menck and Hambrock Ges.: Supporting tracks for scoop navvies. 14100 Viatour: Process and apparatus for the automatic regulation of gas producers working by suction. 14109 Von Merkl: Rivetting machine. 14198 Auvray: Folding stretchers for the conveyance of invalids and wounded persons. 14278 Soc. Anon. des Anciens Etablissements Panhard and Levassor: Valves for explosion engines. 14304 Soc. Francaise de Materiel Agricole et Industriel A. Vierzon: Gas generators. 14345 Siemens-Schuckertwerke Ges.: Means for controlling the speed of electric motors. 14381 Brauer: Process for concentrating nitric acid. 14391 Akt.-Ges. Brown, Boveri, et Cie: Alternating-current commutator machinery. 14398 Lemercier: Artificial sleeper for railways. 14477 Madsen: Cylinder straw presses. 14492 Julius Pintsch Akt.-Ges.: Ignition device for inverted incandescent gas lamps with central chimney and travelling flame kindled by a pilot flame. 14500 Ohrn: Channel kilns. 14552 Dohle: Fork-cleaning apparatus. 14558 Ohmer and Bridenbaugh: Ticket-issuing and recording machines. 14562 Lehmann: Boxes or bags. 14589 Champeix and Champeix: Apparatus for ascertaining the equivalent of various values, such as those of weights, measures, and money. 14791 Pittroff: Fexible props of iron or the like, more particularly intended for use as a mine prop. 14852 Rosen: Memorandum tablets.

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The Patent covers an invention interesting to manufacturers of Automatic Fire-arms.

Detailed information as to the Invention will be found in the Patent Specification, of which a copy will be supplied to any interested party on request.

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ENGINEERS AND THE PEACE OF THE WORLD.

In saying, as we do, that the papers read at the joint meetings, just concluded, of the Institution of Mechanical Engineers and the American Society of Mechanical Engineers did not constitute the most valuable feature of those meetings, no disparagement is cast upon the authors of those papers. No complaint can reasonably be made as to the subjects selected nor of the manner in which they were treated. But the good accomplished merely by the papers might not have been very seriously diminished had they been read before the ordinary meetings of the two societies in London and New York respectively. The engineering world is now so well served by the technical press that a paper read either in London or in New York reaches a vastly greater audience than is gathered on the occasion of its presentation. What that press cannot supply is the very thing that was so well accomplished by the Birmingham and London gatherings—the social intercourse between the men of differing nationalities who are following the same calling. It is for this that the meetings will be remembered when other matters are forgotten.

Some people, whose self-imagined superiority is exceeded only by their actual superficiality, are in the habit of scoffing at such meetings as being mere picnics. They look only upon the symbols, in the shape of teas and receptions, but overlook the opportunities, which are made full use of by others, for getting to know the other man's point of view by informal conversation with him between the buns and the fireworks. Everyone of any considerable business experience knows that nothing is more conducive to mistakes than misunderstandings. The best of all possible ways to prevent misunderstandings with any man is to be compelled to come into some other relationship with him than mere negative civility. By the snatches of personal conversation, by the friendly shake of the hand, and by the fact that every one at these gatherings feels it a duty to make an attempt to give some output of friendly feeling towards other people, a great deal has been done to help forward the completion of our civilisation.

Between our American brethren and ourselves social intercourse is easy and the removal of such misunderstandings as may exist is a light and pleasant task. There is no language barrier. Between the engineers of some countries and ourselves there is a language difficulty. But to an engineer the existence of a difficulty is no warrant for doing nothing. We have already indicated that the mere reading of papers is not the prime essential to the real success of these joint meetings. What is wanted is the opportunity for coming to close quarters with the men with whom there is, or may be, misunderstandings. When that is done the misunderstandings have a way of disappearing automatically. There is no reason whatever at this time of day why we should continue the habit of looking to the gutter or yellow press for views and opinions which we ought to obtain for ourselves as a result of personal thought and investigation. The gutter or yellow press will lose its danger and become merely contemptible when we do this, and a serious menace to international peace will be deprived of its power to work mischief.

We can all appreciate the truth of the observation made by one of the speakers at the opening meeting in Birmingham, that a Dreadnought represents a triumph in mechanical engineering. There is no danger of our losing sight of that fact. But there is a danger of our failing to equally appreciate some other facts. It is sometimes suggested, for instance, that whether they are wanted or not we should manufacture munitions of war merely because it is supposed to be "good for trade." This is simply not true. When a ship goes aground near a small fishing village the local community may get some benefit. The occurrence has been temporarily good for local trade perhaps, but permanently bad for the people. In any case, the encouragement of local trade by the ancient art of enticing a vessel on to the rocks is now looked upon with disfavour by all persons slightly above the savage state. Similarly the persons who in former days were ready to sacrifice other people's life and treasure in coffin ships in order that they might lay hold of insurance money are now recognised as criminals of a particularly low-down type.

The visit of the American Society of Mechanical Engineers was in the nature of a return of the visit of the Institution of Mechanical Engineers to America six years ago. Both visits did much good to both countries, and there is no sufficient reason to prevent the arrangement of similar visits with equally good results between ourselves and the members of kindred institutions in Continental countries.

New Line of Cargo Steamers.—The Sydney Shipping and Mercantile Agency, steamship and colliery managers, in conjunction with leading merchants and shippers, have made arrangements for the formation of a new line of fast cargo steamers, fitted with refrigerators and space for all kinds of perishable goods, to run between Australia and Tasmania, and America, Canada, and Great Britain, and it is intended that Manchester, if possible, shall be one of the ports in the itinerary. It is stated that "the fleet will consist of five large steel steamers, and will maintain regular monthly sailings. The plans and specifications provide that they will be amongst the best and most up-to-date cargo steamers trading to the southern hemisphere," and that they will be owned and managed in Australia—the first fleet of over-seas trading steamers to be owned in the Commonwealth.

British Shipowners and the Suez Canal.—At the annual meeting of the General Shipowners' Society in London, Mr. J. Wilson Potter, who presided, said the question of the Suez Canal continued to be a matter of grave concern to British shipowners. By the agreement made in 1883 between the Company and the shipowners, it was arranged that so soon as the dividend on the Canal shares reached 25 per cent all profits over and above this should be devoted to a reduction in the dues. The Canal Company had now totally disregarded this agreement, and applications to the British Government to interfere in the matter had met with no success. The British Government's investment in the Canal amounted to an original sum of about £4,000,000, and the return of this investment was now about one and a quarter million per annum. Assuming that the British Government borrowed this money at 3 per cent, the difference between a return at this rate and the 28 per cent annually received for several years amounted to over £1,000,000 per annum, and represented about three and a half francs per ton on the British tonnage using the Canal.

Portable Gas Engines.—The utility of the portable steam engine does not need arguing. The persistence of the type is sufficient proof of its utility. Attempts have been made to improve the economy of portable engines by using oil engines instead of steam, and occasionally gas engines have been tried. There should be a considerable field for the portable suction-gas engine, especially if small suction producers using ordinary fuels prove to be as reliable and as simple to operate as the variety using coke and anthracite. In some respects the steam engine is ideal, the ease with which it can be stopped and started and its generally high reliability being strongly in its favour. On the other hand portable engines commonly receive atrocious treatment, and when boilers are corroded high-pressure steam is a dangerous thing. Boiler explosions are not very frequent it is true, but the possibility is a drawback. The suction gas producer has its drawbacks, but the great popularity which it has achieved among non-technical people is evidence of its suitability for the conditions under which portable steam engines work.

The Oil Engine for Marine Propulsion.—The Hamburg-American Company intend building a large cargo liner whose twin propellers will be driven by oil engines. This suggests that the long-standing contest between the gas engine and the oil engine as a means of marine propulsion is pretty well concluded. The new vessel, it appears, will be fitted with two Diesel engines, each of 1,500 horse power. The idea of ever employing internal combustion engines for the propulsion of battleships has been widely scouted. This new step is, however, suggestive of the possibilities of the motor engine. Economy, as usual, is the aim in view. There will be, among other things, a great saving of space. Boilers will go by the board, and a large proportion of the bunker space will also be rendered available for cargo-carrying. The stokers, the hardest worked and often the most unruly element in the ship, will be dispensed with. The engineers and a few greasers will do all that is wanted. As for the fuel to be employed, it will be petroleum residue, the cheapest grade of oil, and readily obtainable on either side of the Atlantic. It is the certainty of a sufficient supply which is necessarily at the base of the venture. It is to the credit of the Germans that, after all that has been talked about the possibilities of the oil engine in big ships, they should be the first to make this experiment on so important a scale. The new boat is to be built by Messrs. Blohm and Voss, of Hamburg, and the oil engines are also to be made in Germany.

MODERN AUTOMOBILE PRACTICE.

By A.M.I.A.E.

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(Continued from page 106.)

Valveless Two-Cycle 25 H.P. Engine.

An altogether novel feature is introduced in this engine, namely, its combustion space, which serves two pistons; the crank webs are circular and have gear teeth cut on them, so that the cranks revolve in opposite directions, the engine being placed transversely in the chassis and the transmission shaft lying on one side of the longitudinal axis of the car. The engine, which has a nominal horse power of 25, is a twin-cylinder one, with a bore of 5¼ in. and a piston stroke of 5½ in., the connecting rods acting on separate crankshafts as shown.

$$\text{The } \frac{\text{stroke}}{\text{bore}} \text{ ratio} = 1{\cdot}047.$$

The cylinders, which are about 6½ in. apart, are offset or placed *desaxé*, the principles and reasons of which will be explained in the next article. The crankshafts are very short and stiff, and are mounted on single-row ball bearings, having ¾ in. balls with a ball circle diameter of about 3¼ in. at 6¾ in. from centre to centre longitudinally. The engine is exceedingly well balanced, for, in consequence of the opposite direction of rotation of the two crankshafts, any unbalanced force in the shaft, after the usual commercial balance of each, is neutralised by the corresponding force of opposite sense in the other. Lubrication is by pressure pump to the main bearings, and thence to an annular recess turned in the circular crank webs, which extend back over the edge of the ball bearings so that all the oil is caught; its only egress is through a hole in the crank pin which is situated at the greatest diameter of the annular recess; the oil is then conveyed up a copper pipe lying along the connecting rod to the gudgeon pin, which is hollow and leads the oil out to a groove on the outside diameter of the piston. The only other parts requiring lubrication are the gear teeth on the crank webs, these being fed efficiently by splash. The trouble of scavenging is of lesser importance with this engine than with most two-cycle engines, owing to its working principle, as shown by the fact that the engine is capable of "pulling" at speeds from 100 to 2,300 revolutions per minute. The exhaust gases escape through the large exhaust port E, which has an area of 9 square inches, whilst the fresh incoming mixture enters the other cylinder through a port of 5 square inches, the new charge helping to push out the burnt products. The large areas which are possible in this construction far exceed those of the ordinary type of valve, as will be understood when we mention that in a good example of a four-cycle engine, 5 in. bore by 5½ in. stroke, it was considered quite satisfactory to have maximum areas of 1¼ square inches for the inlet and 1¾ square inches for the exhaust.

The cycle of operations of the Valveless engine shown in fig. 15 is as follows: Air is sucked from the atmosphere through the spring-loaded air valve V into the common air-tight crank chamber by the upward travel of the piston; the lifting of the air valve raises the needle valve from its seating in the jet, and sprays the petrol into the passage P. When the pistons are near the bottom of their stroke the air compressed in the crankcase passes through this rich mixture, carrying it with it into the cylinder through the port C, which opens ¾ in. of piston travel after the opening of the exhaust port P. By this time the pressure in the cylinders has dropped below that in the transfer passage, the new charge thus assisting in the scavenging, as mentioned above. The exhaust port is closed, compression begins, the charge is fired, and the cycle repeated.

$$\text{It will be observed that the } \frac{\text{stroke}}{\text{bore}} \text{ ratio is usually small,}$$

and is generally found to be unity, and very rarely greater than unity. It will also be noticed by studying the illustrations that the simple two-cycle engines are reversible without structural alteration. This property is of great advantage in marine engines, thus saving all forms of transmission gears.

In the last article we inferred that the sparking plug was not the only form of ignition on two-cycle engines. The other type, which is confined almost entirely to industrial marine motors, is the bulb igniter, an example of which is shown in fig. 16. This engine is a 22 H.P. single-cylinder two-cycle engine, working on paraffin. The cylinder has a bore of 10 and a compression of about 70 lbs. per square inch. In the cylinder head is inserted a cast-iron bulb, 3¼ in. bore, $^9/_{16}$ in. thick, with a passage 1 in. bore leading into the cylinder; after considerable experiment this form of ignition chamber has been found the most reliable. Surrounding this bulb is a light protection cover, having a hinged door shown on the left of fig. 16; this door is to enable the bulb to be made red-hot with the blow lamp. Once this has been accomplished, the engine will continue to fire regularly without any outside assistance, thus dispensing with the magneto and its drive, or the accumulator and coil, which for the above-mentioned purpose is of great advantage. The cylinder is fed by means of a paraffin injector, provision for which is shown on the figure. When the injector is in this position, injection should take place when the piston is at the bottom of its stroke; should it be desirable or necessary to inject when the piston is at the top of its stroke, then this must occur in the igniter bulb itself, which is the hottest part. As will be gathered, the bulb forms a large part of the compression space, and in smaller models it constitutes practically the whole of that space.

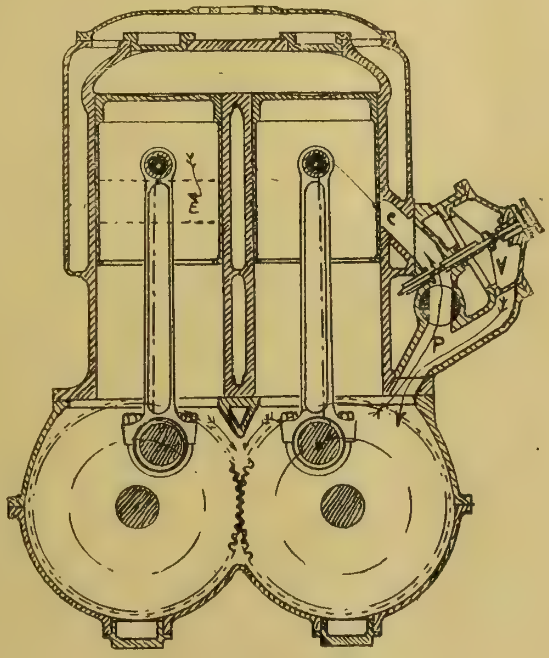


Fig. 15.—25 H.P. "Valveless" Two-cycle Engine with One Combustion Chamber for Two Pistons.

Offsetting the Cylinders.

By offsetting the cylinders we mean the displacement of the cylinder and crankshaft, so that their axes are in different planes. This principle is not entirely new to engine design, and comes to us from single-acting stationary steam-engine practice, and later from stationary gas-engine practice. The principle is one that has been much discussed, and concerning which there is but little authoritative experimental data available. The claims are, firstly, the reduction of the side pressure of the piston on the cylinder wall, enabling more efficient lubrication with a corresponding reduction in wear; and secondly, a much greater latitude in the constructional design of the engine, by which we mean:—

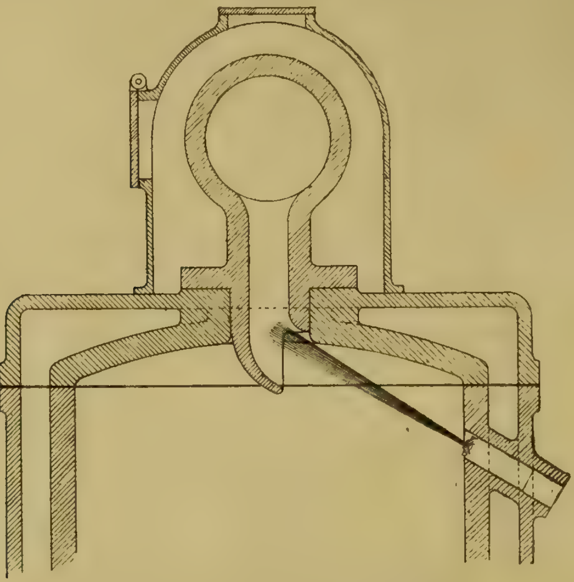


Fig. 16.—Bulb Igniter for Two-cycle Engines.

(1) The ability to shorten the connection rod to such an extent that it gives the same side thrust as usually permitted with the standard design of connecting rod and offset, thus giving a lighter engine.

(2) In a long-stroke engine we can offset the cylinder and obtain sufficient room for our connecting-rod big end to clear the crankshaft, and thus maintain a combustion space of normal shape and dimensions.

(3) In an engine of normal $\frac{\text{stroke}}{\text{bore}}$ ratio, we can, by offsetting the cylinder, reduce the length of the connecting rod, reduce the height of the crankcase and the length of the cylinders, and thus reduce the height of centre of mass relative to the ground.

When adopting the principle under discussion, the crankshaft remains in the longitudinal axis of the car, and if possible the water outlet at the top of the cylinder should be brought back to the same axis, so as to avoid oversights and omissions, causing trouble with the radiator makers and in other ways. Whilst this is only a small point, it is one that should not be overlooked, especially by makers of engines only.

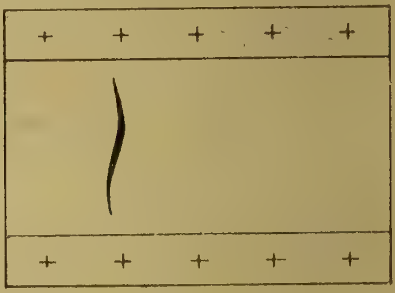
(*To be continued.*)

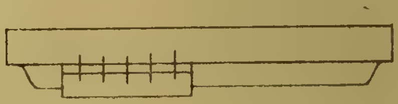
Tool Hardening by Gas.—The use of the gas furnace for forging, tempering, and hardening steel is superseding the old "hearth" method. The gas furnace is much smaller, is comparatively clean and neat, and a uniform temperature may be obtained, thereby avoiding damage to the steel through "burning" or irregularity of temperature. The working is also more economical, owing to the fact that the gas may be cut off immediately the operation is finished.

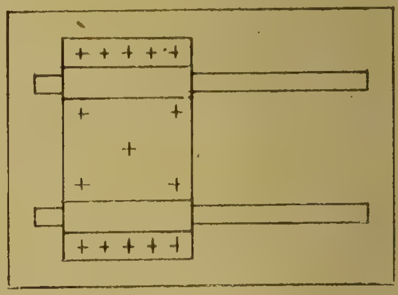
THE GUIDES OF A MARINE ENGINE.

It will hardly be necessary to explain to marine engineers that in order to overcome the heat developed by the constant sliding of the guides upon the guide plate in an engine, this heat, owing to the large surface exposed to friction, being considerable in spite of careful lubrication, it becomes necessary to introduce into the metal of the guide plate an efficient cooling system. The headway guides have a water-cooling service obtained by introducing small pipes at the back of the guides, which enter at the bottom and leave at the top, so that water may constantly flow through the metal.

When a steamer is in shallow water, or when it passes through the accumulations of weed in the Gulf Stream or the sandy waters of the Suez Canal, it occasionally happens that these pipes become choked up, as they are of comparatively small diameter. As the water then stops flowing round the part of the guide metal, this is almost sure to become heated, and if great care is not taken considerable trouble will result. This is rather an insidious enemy to combat, as there is no indication of the defect other that the sudden heating up of the surfaces. As a rule, it is impossible, for reasons of navigation, to stop the engines, as the steamer is in narrow waters, and if the pipe is cleared or clears itself and the water is allowed to flow at full strength straight on to the overheated guide, the latter is likely to crack, hence careful regulation of the supply and constant watching is absolutely necessary.







If the guide plate does crack a lot of work will be caused, and it is not unlikely that a total breakdown of that engine will ensue. The formation of these cracks is rather interesting. They very often crack towards the bottom of the face plate, and in this case the water passing up to a certain distance will then leak through, leaving the top half to get unduly hot, and causing a big increase in the consumption of engine oil. Another interesting feature is, strangely enough, that the cracks rarely extend right across the plate. Very frequently the widest gap is in the middle of the surface, as shown in the typical front view (fig. 1), tapering away to nothing at each side. For this reason it is usually only necessary to put a very light patch on the guide, but even with this relief the patch requires a considerable amount of fitting owing to the shape taken by the back of the casting. There is usually down the centre of this portion of the casting a strengthening rib, as shown in the side elevation of figure, and the only way in which a patch can be placed on the back of the casting is to take a piece of copper sheet $^1/_{16}$in. thick, and amply large enough to cover the crack, after it has been set to shape over the rib.

This portion of setting the shape is carried out by means of a hammer, the patch then appearing as shown in the back and side view of figure. Six or eight $\frac{1}{4}$ in. or $\frac{3}{8}$ in. clearance holes should then be drilled in the patch, and the guide marked off to suit them. After drilling tapping holes, a joint of manganese cement, red lead, or other water-tight cement should be made, and the patch should be screwed on tight with pressed tap bolts. It will be found that this will make a perfectly tight job. Alternatively, Muntz metal or sheet iron can be used in place of the copper, but these metals are not so easy to work into shape.

As this is a somewhat frequent difficulty in tramp steamship engineering practice, it is hoped that this note may be of service to other engineers.

CORES IN THE FOUNDRY.

The use of cores in castings is admittedly a necessity, but by implication the proper cores for the particular metal being cast should be used, and this one point opens out a wide field of discussion. Plainly we cannot use the same cores for all metals alike if we wish for the best results, those which are well suited to a strong metal like iron being not always suited to tender stuff like aluminium, and a plain straight-through core need not be made in the same way as an enclosed one, and possibly one made on a wire frame, which has to be got out with the core from places which are "round the corner," as in the case of the passage-way cores used in some forms of steam cylinders. A straight-through core can be forced or otherwise dealt with, but a passage-way core has to be dealt with very carefully, and it must be friable after the metal is cast or trouble begins at once. A hard core will cause tender metals to tear, and for this reason should be avoided, while a too aluminous sand in iron will fuse and become as difficult to remove as would be a block of brick or stone.

Cores to be effective must be firm enough to stand against the pressure of the metal in cooling sufficiently to keep the form of the hole, but at the same time they must be sufficiently elastic or compressible to give somewhat with the contraction of the metal. In fact, cores must be firm and elastic—or friable—and to some extent it will be found necessary to use something other than new sand. Of course, it is a more or less common practice to use a proportion of floor sand in making cores, but usually there is some uncertainty in its composition, and often there are undesirable materials in the general content which do not tend to secure certainty in the results.

Porosity and, as far as possible, freedom from gas-forming elements in the cores are very desirable where sand cores are concerned, but with loam cores, of course, the fibrous material used will char and make gases. In all cases this renders sufficient venting a very necessary proceeding, and while straight cores can very well be vented by passing a straight vent wire through them, enclosed and crooked cores should be vented by having wax-wire placed where the vents are to be, and these melt and are absorbed during the drying of the cores, clear vent passages being left. This wax-wire venting contains only one thread through the centre, and is quite different to the tapers which are sometimes used, as these latter consist of a number of threads saturated and covered with wax, and they do not leave a free air passage after the wax is melted out, whereas the wax-wire does. Each core needs its own particular treatment, and this has to be decided by the operator. Of course, loam cores which are struck up should be on perforated barrels, and the question of additional venting will depend largely on the position they are to occupy in the casting.

Usually cores require some facing to cause them to leave the holes clean and free from sand, and probably a mixture of about three-fourths plumbago and one-fourth china clay, well mixed together and applied as a paint, will be as good a thing as can be used, as it gives a polished face to the core, which will not burn into the metal. Usually cores of all kinds should be faced, whatever they are composed of, and moulds should be sleeked where a fine smooth skin is needed, but with the latter it is not always necessary that plumbago should be used.

A fair amount of trouble with cores is caused by not providing an escape for the gases as they leave the cores, for while the cores themseles are vented, the matter ends there. No experienced moulder would omit to provide for a proper escape for the gases, but in many cases where boys and apprentices are employed, the matter gets overlooked, and the coremaker gets the blame when things go wrong. This does not affect the method of making cores, naturally, but it often affects the results of their use, and is a matter which should be kept in view at all times, as it is not very conducive to good feeling in any workshop to place blame on the wrong shoulders.

In selecting sand for core-making it should be such that will dry firmly, and at the same time not contain as much clayey or aluminous material that it will burn hard in the casting. In fact, it should be more on the side of friability when made red hot, as then it is readily removed from the casting. Generally a mixture of fine moulding sand and a sand free from alumina will be found to give the best results after a few trials are made, or burnt sand can take the place of the new non-aluminous sand where the latter is hard to get, that is, if the burnt sand is clean. In some cases an absolutely non-binding sand may very well be used, a small percentage of core gum or even starch being added as a binder; and in regard to this it may be pointed out that the heat of the metal will burn out the binder and leave a friable body of sand behind which is easy to get out. Binders which hold the sand together tightly after the casting has been poured are not good, and particularly are they a source of trouble where from their shape the cores are difficult to extract, it often happening that hours are spent in the matter when minutes should suffice. This loss of time in some foundries is very considerable, and means should be taken to prevent it by providing core sands and binders of such a character that will provide the best core material obtainable, and then use no other.

It has for a long time been a matter of surprise to the writer that some enterprising firm has not started in the manufacture of graded core sands for different purposes, as this would in the end pay both user and seller; but of course the stuff would have to be good. If it pays to prepare parting sand and similar materials, surely it would pay to put a good core sand on the market at a fair price, and in a dry state ready for damping down. There are natural sand deposits which would supply the crude material for such work, if they were sought for, and the drying and grading of the sand would not be a very expensive matter.

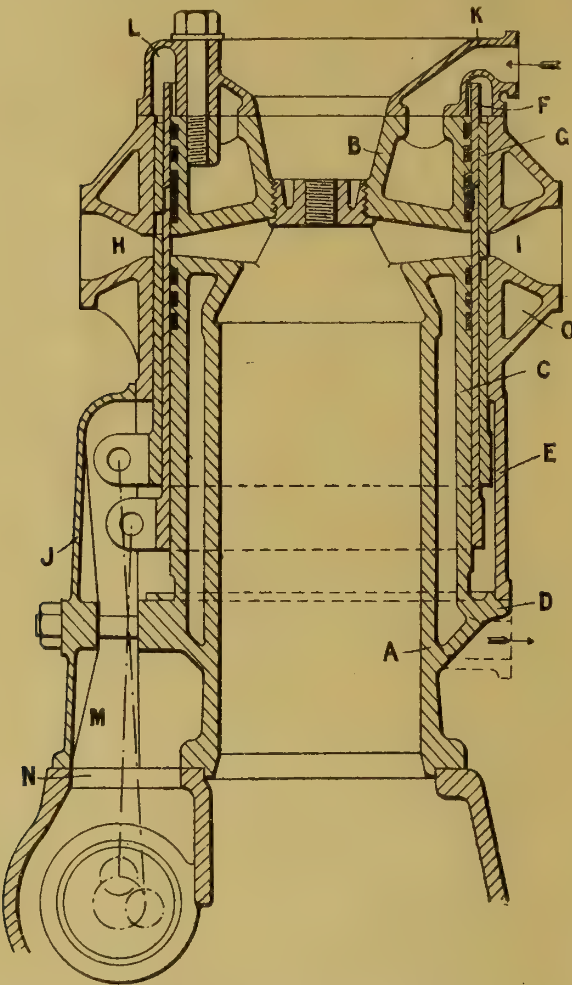
The steel ship Aberfoyle, owned by **Messrs. Crawford and Rowat,** Glasgow, has, it is reported, been sold to Norwegians for about £2,300. The vessel has a carrying capacity of about 2,630 tons, and was built in 1885 by Messrs. A. M'Millan and Son, Dumbarton.

SLIDE VALVES FOR INTERNAL-COMBUSTION ENGINES.

Among the various types of slide valves that have been designed for internal-combustion engines since the advent of the well-known Knight type, mention might be made of that construction which has been designed and patented by Messrs. William Cameron and Allan Coats, of Paisley.

The various objects aimed at in this construction are better cooling of the valves and cylinders, more efficient lubrication of the valves, and also a construction that may be easy of access.

The engine cylinder, its water jacket casing and water-jacketed head, are cast integral, and the cylindrical slide valves are placed outside the water jacket casing. The cylinder is attached direct to the crank case, and is made at its top or combustion end of such a form as will admit of the water space over the cylinder head being open in order that the water jacket core may be supported and removed. This opening is enclosed by a cover which is provided with an outlet for the cooling water. The inlet and exhaust ports are shaped in such a manner to get into the engine cylinder a greater weight of working fluid than is at present possible, and also more quickly exhausts the burnt gases. In order to facilitate manufacture, the outer sleeve valve is guided by the interior face of the valve casing, and the inner sleeve valve is guided by the interior face of the outer sleeve valve. The valve casing is provided with suitably shaped inlet and exhaust ports, and the exhaust port is provided with a water jacket or gills. The valve casing is secured to the engine cylinder at that end of the cylinder nearest the crank case.



Slide Valve, Internal-combustion Engine.

The illustration shews a cross section of a cylinder embodying these features: A is the cylinder, B the water-jacketed cylinder head, C the water jacket casing, D a flange, to which the valve casing E is secured. All these parts are cast integral.

F and G are the slide valves, H and I the inlet and exhaust ports, J is a cover enclosing the connecting rod operating the valves, K is a cover enclosing the cooling water covering the cylinder head; integral with part K is the slide valve chamber L.

The valve casing E registers on the flange D and is secured by bolts.

An opening is provided in the casing E, through which the lugs on the valves project.

This opening has formed along its edges suitable ledges which, together with similar ledges formed on the cylinder, constitutes a chamber M in which the connecting rods operating the slide valves oscillate and on whose face is placed the cover J, which entirely closes the chamber M and retains the oily vapour which surges within the crank case. The oily vapour has free access to the chamber through the opening N.

By this construction the stresses due to the reaction of the force from the working fluid are transmitted direct to the crank case or casting supporting the crankshaft, whilst the slide valve and spring rings are rendered much more accessible than heretofore, and binding of the slide valves is prevented by avoiding the use of a cylinder or liner which is pendant from an outside cylinder or casing.

For example, to remove the slide valves the covers K and J would be taken off, and the pins coupling the slide valves to the connecting rods removed, after which the valve casing E can be removed, exposing the slide valves. On lifting these away the spring rings are open to inspection or removal, whilst the cylinder and valve gear has remained undisturbed, and further the piston and its rings can be got at without disturbing the valve gear or engine connecting rod, and without the removal of any cover on the crank case, by simply removing the cover J and taking out the coupling pins. The cylinder can then be lifted off after removing the nuts from the holding-down bolts.

The slide valves may be lubricated by the oily vapour which is constantly surging within the crank case and chamber M, suitable holes and ducts being provided in the valves for distributing the oil. To protect the valves in the neighbourhood of the exhaust port I from the heat retained in the walls of the casing, the passage is water jacketed or gills may be cast on the outside of the passage to increase the surface to carry away the heat. When the exhaust passage is water jacketed it is preferable to place the passage on that side of the valve casing on which the water jacket inlet is located, and arrange a duct between the inlet and water jacket O surrounding the exhaust port and connect the water jacket to the main cooling outlet by a suitable pipe.

In order to obtain a greater weight of working fluid into the cylinder than heretofore, and to exhaust the burnt gases quickly and more thoroughly, the ports H, I within the cylinder are formed so that their area increases towards the centre of the cylinder. By this means the velocity which the working fluid has at the contracted part of the inlet port—that is, through the slide valve port—is converted into pressure within the cylinder.

On the exhaust port opening, the pressure then existing produces a velocity in the gases which is greatest at the most contracted part; that is, at the exhaust port through the valves. The energy stored in the gases in the form of velocity is converted into a pressure on its velocity being decreased in the exhaust port of the valve casing. The pressures on each side of the openings through the slide valves may, by this means, be made nearly equal.

In cases where the height of the engine is curtailed, and where the valves must of necessity be shortened, the possibility of leakage is prevented as far as possible by inserting spring rings in the outside valve on each side of the ports.

FIRST OIL-BURNING TURBINE STEAMERS.

The steamships Yale and Harvard, of the Metropolitan line, running between New York and Boston, were the pioneers in the adoption of the steam turbine on the Atlantic coast, and again are the first steam-turbine vessels to use oil as fuel. The Lassoe fuel oil-burning system has just been installed by the W. and A. Fletcher Company, Hoboken, N.J., from designs and under the supervision of Robert McGregor, consulting engineer of the Metropolitan Steamship Company.

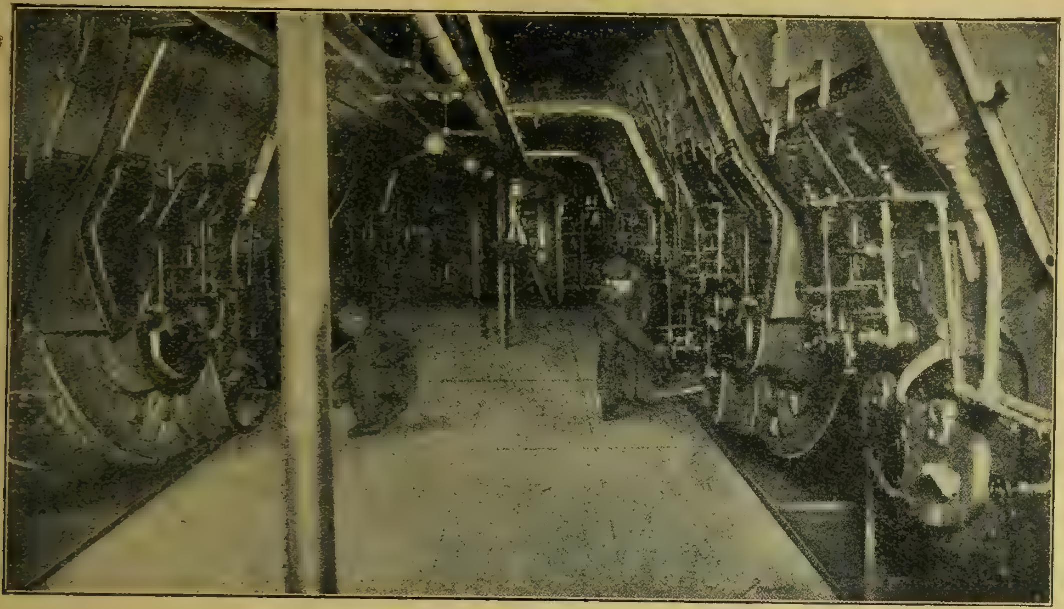


Fig. 1.—Aft Boiler Room of Steamer Harvard.

While there will not be any marked economy of oil fuel over coal, there are some excellent advantages. For instance, the steaming time between the two ports will become a fixed factor, the ships will be cleaner, due to the absence of coal dust when replenishing the coal bunkers and soot from the stacks when under way. The expense for labour will also be reduced, owing to the reduction from 48 to 12 boiler attendants. In all probability the life of the boilers will be lengthened, as there will be no necessity for cleaning fires and exposing the hot plates to cold daughts of air. Also, a more even steam pressure can be maintained, which will tend to prevent a loss in speed.

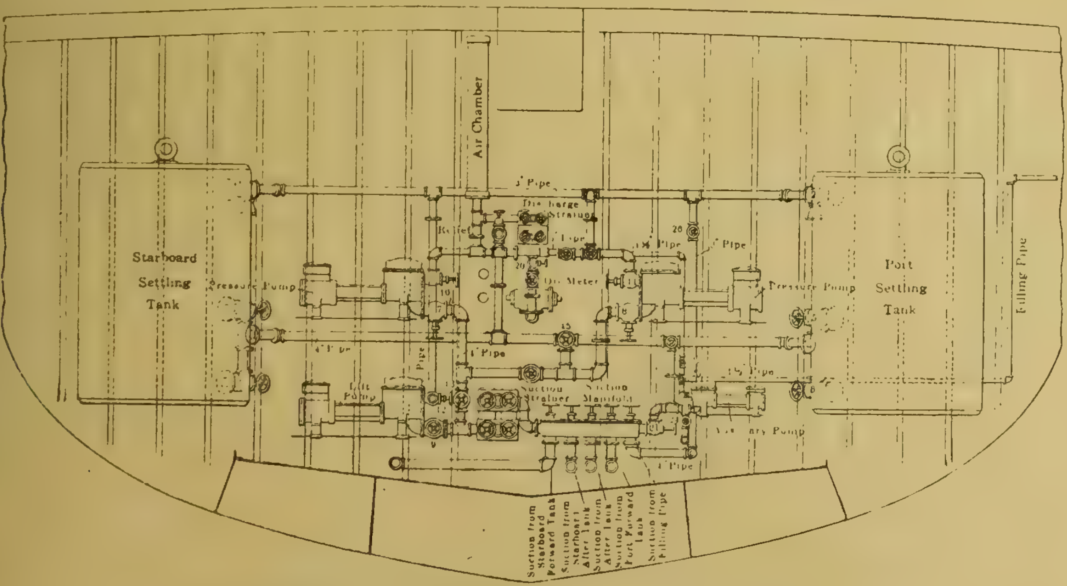


Fig. 2.—General Arrangement of Oil Piping System.

Mr. W. O. Rogers gives, in *Power and the Engineer*, the following particulars of the installation:—

Fig. 1 is a general view of the aft boiler room of the steamer Harvard, in which are six 1,000 H.P. marine type of boilers, each having three furnaces. The oil is stored in four oil tanks located under the forward and aft boiler-room floors. These tanks have a capacity of 100,000 gallons of crude oil, which give the vessel a steaming radius of 650 miles. To prevent the oil from escaping, cofferdams are fitted to each end of the fuel-oil section. These being full of water under pressure, prevent the escape of the oil to any other part of the ship.

The fuel oil is pumped from the oil barges and delivered to the furnaces as follows: A 6 in. hose connection is made from the oil barge to an intake pipe on the main deck of the ship, from which the oil is conducted through pipes directly into the double bottom. From the double bottom the oil is pumped by a 9 in. and 5 in. by 10 in. Warren duplex suction pump into two large settling tanks, having a total capacity of 6,000 gallons. This quantity is sufficient to steam the vessel about four hours at full speed. From the settling tank the oil is drawn by another Warren duplex force pump similar to the above, and, after passing through two series of filters and an oil meter, is conducted along the main 3 in. supply pipe, branching out to the individual burners. Each steamer has 36 burners, or three under each boiler.

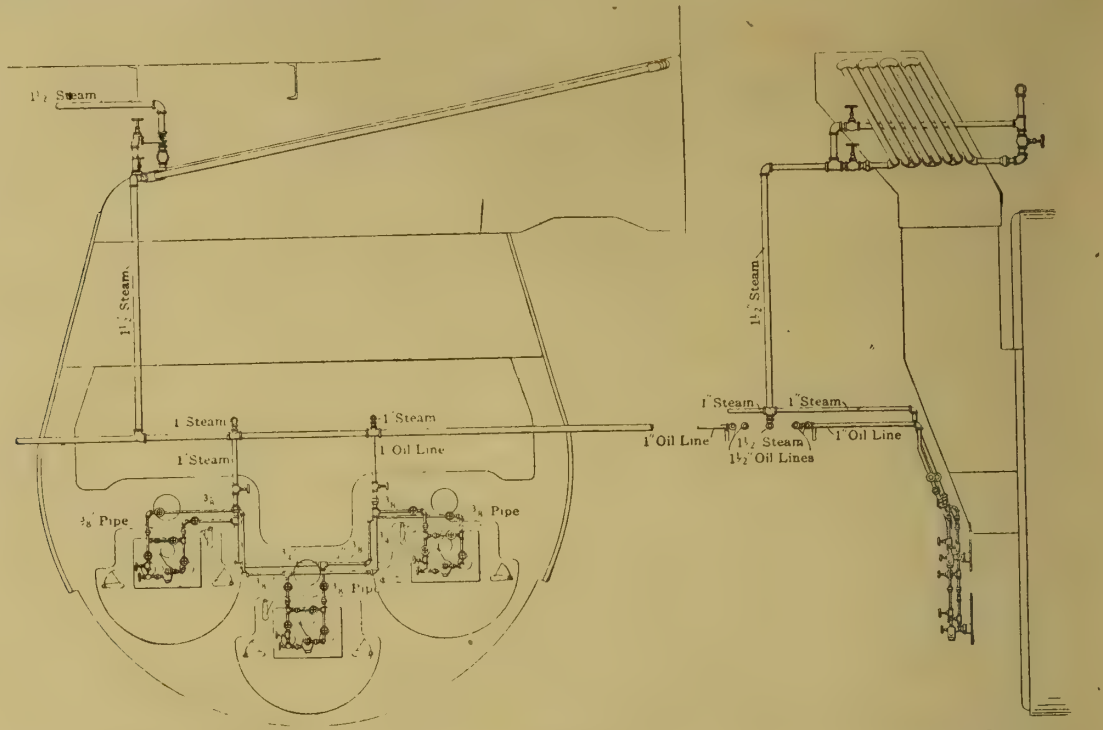


Fig. 3.—ARRANGEMENT OF OIL PIPING AND MIXING CHAMBER ON FRONT OF FURNACE.

The oil is discharged into each settling tank at the top, and the suction-pipe connection is made 3 ft. from the bottom. While oil is settling in one, the supply for the burners is taken from the other. Both settling tanks are connected by a pipe running into the bottom of each, so that the supply can be equalised if desired. One pump is used for filling, although there are two force pumps, either one of which may be utilised for filling the tanks. There is also a 5 in. and 3½ in. by 5 in. Warren duplex steam pump, which is used as an auxiliary force pump for feeding oil to the few burners used when the steamer is coming into port. The feed pumps work on 100 lbs. steam pressure, and force the oil to the burners at a pressure of 131 lbs. per square inch.

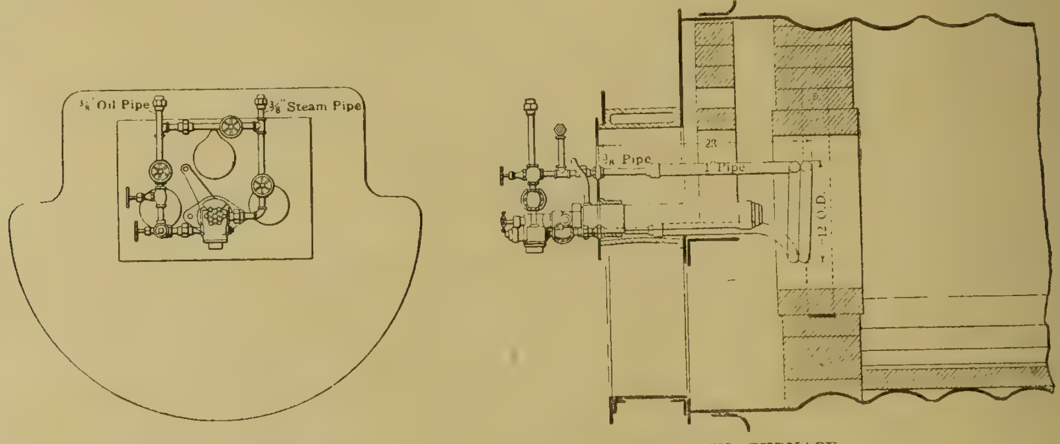


Fig. 4.—METHOD OF INSTALLING OIL BURNER IN FURNACE.

The suction pipe of the pump supplying oil to the settling tank is connected to a manifold located between the two force pumps. To this manifold are connected the four oil pipes running to the fore and aft starboard and port oil tanks, which are separated by a centreboard. To this manifold is also connected the filling pipe, through which the four tanks receive the supply of oil from the oil barges lying alongside the steamer. Each tank has a separate filling pipe branching from the main pipe, and fitted with a stop valve.

As the oil is pumped from the tank to the settling chamber, it is passed through a double strainer, one side of which can be cleaned while the other is in operation. The oil is strained a second time when it is pumped from the settling tank to the burners. Fig. 2 shows the general arrangement of the pump, settling tank, and piping, which are located on the bulkhead forming the partition between the aft boiler and turbine rooms.

Each oil tank is provided with a steam pipe, so that in case of fire steam can be turned on to smother it.

Another precaution is the arrangement of a valve in the main oil pipe running to the boiler. This valve has an extension steam valve running to the main deck of the steamer, so that in case of accident in the boiler room the entire fuel supply can be shut off without entering the stokehold. Each oil tank has a tell-tale gauge, and the settling tanks are both fitted with a gauge glass at the bottom and three trycocks at the top. The oil tanks are also equipped with vent pipes, so that gas may escape outside of the boiler room.

Each furnace is fitted with a Lassoe oil burner, and the bottom of each furnace is lined with suitable firebricks, which extend half way up the side. The oil is atomised by means of superheated steam. The superheating coils are placed in the smoke flue of each boiler, as shown in fig. 3. The steam is brought down after passing through the coils to the front of the boiler furnace, and admitted to the mixing chamber or atomiser of the burner. The oil is heated by passing it through a coil of 1 in. pipe, which extends into the brick-lined mouth of the furnace, as shown in fig. 4. After passing through the coil, the oil is delivered to the mixing chamber of the burner. The atomised oil and steam are then discharged to the furnace through the burners. Figs. 1, 3, and 4 show the arrangement of the piping and the mixing chamber of the burner on the front of the furnace. The steam and oil are regulated by separate valves. The burner is shown in detail in fig. 5. Steam enters at A, oil at B. The threads on the stem of the oil valve are made close to the valve, so that the expansion of the valve stem will not affect the valve opening, as would be the case were the thread placed next to the handwheel. A scale at the steam-valve handle indicates the amount of steam-valve opening. When the burner is in full operation, the pointer P is at fig. 3 on the scale, and the steam valve is open $^1/_{120}$in. The oil sprays from the burner at an angle of 50 deg.

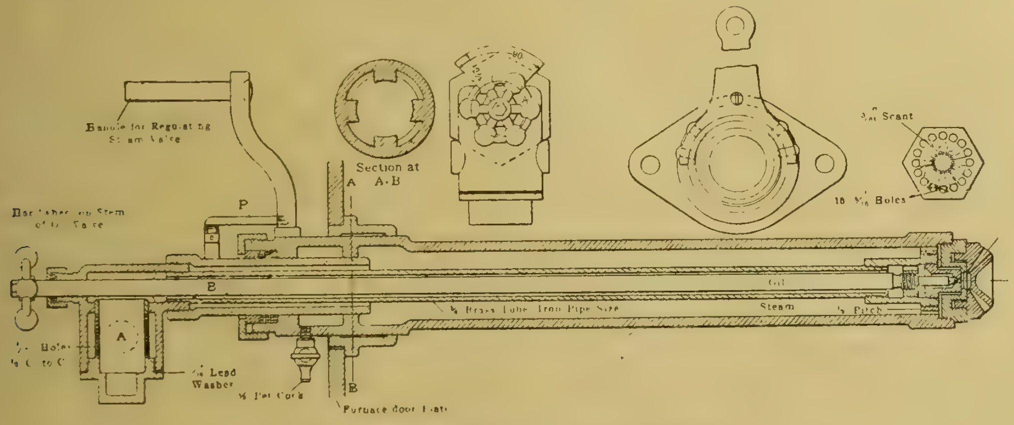


Fig. 5.—Sectional view of oil burner.

The conditions of the fire are determined by peepholes through which the firemen look. Too much oil will produce smoke, so that the amount of oil fed can be gauged accordingly. Bypass pipes admit of cutting out the oil-heating coils in case they become burned out, and the burners can then be kept in operation until the ship reaches port. A forced draught of 1·2 in. is used.

When a steamer arrives in port the oil burners are shut off and cleaned, and the furnace cleared of gas by opening the lower door and the damper in the stack. Steam is then turned on until the gas has been blown out of the furnace. The burners are lighted by means of a suitable torch attached to an iron rod about 4 ft. long.

The four oil pipes supplying the burners with oil extend overhead the entire length of the two boiler rooms, while the pipe supplying steam to the superheaters is placed between them. At the present writing, comparative cost figures on oil and coal burning are not available.

MULTIPLE-SPINDLE DRILLING ATTACHMENT.

Multiple drilling on short centre distances is a problem which looms up quite frequently these days. It seems that no matter how short a centre distance a machine will accommodate, there is generally some job that could be more profitably done, could the machine drill on still shorter centres. The accompanying sketch illustrates the construction of an attachment applicable to almost any kind of a drilling machine, by which holes with short centre distances can be drilled. This device (according to D. E. Rose, in the *American Machinist*) can be attached to or detached from the machine, as the occasion may require, thereby not limiting the machine to one particular piece of work.

The problem to which it owes its conception and subsequent design was to drill three $1\frac{1}{2}$-in. holes, arranged on a circle, $3\frac{1}{2}$ in. centre distance and 120 deg. apart, without materially increasing the upward thrust on the spindle sleeve.

In order to attach this device to any machine already built, the spindle and spindle sleeve must be taken out, the flanged end of the former recessed as shown, to receive the ball bearing. If there is no flange on the spindle, a collar may be shrunk on and afterwards finished as stated.

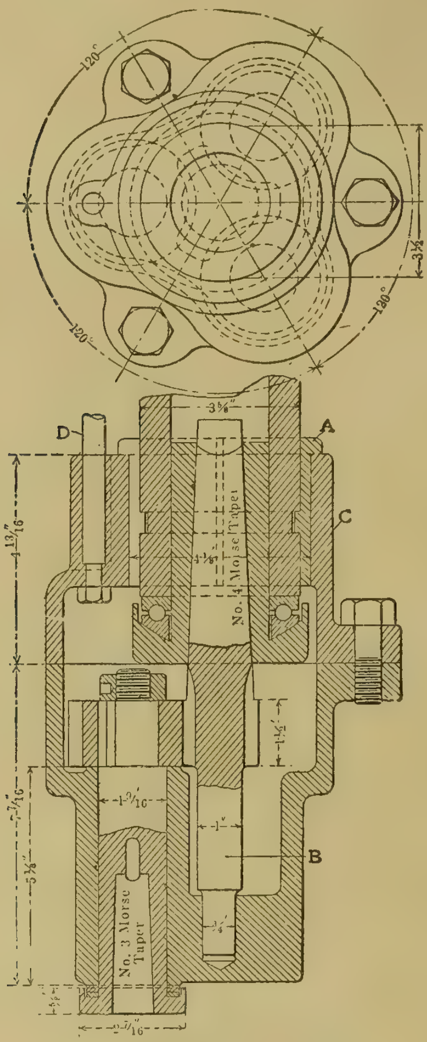
In the spindle sleeve a small groove must be turned to receive the offset in the steel bushing A. This bushing is bored to fit the sleeve and afterwards split in order to get it in place.

The driving of the drills is accomplished by spiral gears, the ratio of which must be determined beforehand, this being governed by the spindle speed of the machine and the speed the drills will be required to run. Many combinations may present themselves in making this calculation, and it remains with the designer to choose the best one, according to his judgment and the conditions.

To transmit the power from the machine spindle to the drills, the shaft B, on which are cut the pinion teeth, should be turned to fit the taper in the machine spindle. It should also have a tang on the end. Gearing into the pinion are the three gears mounted on the smaller drill spindles, which contain the smaller tapered holes to receive small drills. These smaller spindles are flanged on the ends and recessed to receive two bronze washers to allow for the taking up of wear. Mounted on the flanged end of the large spindle is a Hess-Bright thrust ball bearing, which takes care of the increased thrust.

All the parts are enclosed in a dirt-proof casing, which is made in two parts, the upper part C being bored out so as to make a push fit on the bushing A. Provision may be made for the feed trip rod, which is shown at D.

The device is held in place by the friction of the tapered end of the shaft B. This will be sufficient when the construction is not too heavy, but should the attachment be too heavy and the taper fail to hold it, a set-screw or two, through the upper part of the casing C and tightened against the bushing A, will hold it in place. A brass plug should be placed between the end of the set-screw and the bushing to prevent marring the surface of the latter.



Multiple-spindle Drilling Attachment.

All that is necessary to place the attachment in the machine is to push it into place and perhaps give it a few taps with a soft hammer, following practically the same procedure as in setting a drill.

In detaching it, a drift does the trick and the machine remains the same as before, with the exception of the ball bearing, which must remain, but this is an advantage, increasing, as it does, the thrust on the sleeve.

NOTICE OF MEETING, &c.

August 6th.—The North of England Institute of Mining and Mechanical Engineers. Annual meeting.

New Type of Fishing Boat.—A new type of fishing boat suitable for the County Down coast winter work has been built at Kilkeel, County Down, from designs of Lord Newry, heir to the Earl of Kilmorey, who has made a special study of the difficulties of the men from October onwards each year. The new boat is 30ft. long with 8½ ft. beam, and is decked 3 ft. from the bow. She will hold up 40 crans of herring, and will be driven by a small motor engine.

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"A Text Book of Applied Mechanics and Mechanical Engineering." By A. Jamieson, M.Inst.C.E. Vol. V. Theory of Machines and Practical Mechanisms. Seventh Edition. Revised and Enlarged. London: Charles Griffin and Co. Ltd.

This is the last volume of the above series, which has been specially arranged for those qualifying for the Institute of Civil Engineers, the Technical Colleges and Universities, the various Boards of Education, and other examinations, besides engineers generally.

We have on a previous occasion drawn attention to the earlier volumes. They cover practically the whole range of applied mechanics, reserving only the theory of machines and practical mechanisms to be dealt with in the current volume. Hence kinematics occupy a considerable space, and it includes the mechanism and notions of all the principal mechanical movements of practical value to the engineer. Among the miscellaneous mechanisms are Hooke's coupling, epicyclic trains, ratchet, and other feeds, also counting wheels and parallel motion. Other lectures are given on quick-return and reversing motions, efficiency of machines, various types of gearing, forms of wheel teeth, their friction and strength. Belt, rope, and chain gearing for the transmission of power, velocity ratio, the inertia forces of moving parts, with crank effort diagrams of reciprocating parts, concludes the volume of about 500 pages. There are several appendixes giving information in connection with the several examinations, the latest examination papers pertaining to theory of machines, also tables of logarithims, etc., which are not only useful but necessary in working out examples.

Throughout the book, there are numerous questions, based on the lectures, and which form the integral part of a text book of this nature.

Mr. Jamieson's books have justly attained prominence through the thoroughness with which he tackles his work. He takes every opportunity of keeping them in the front rank by constant revision, and the five volumes constitute in themselves a library in the literature of mechanical engineering which has no equal.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 28th July, 1910.

Aberdeen.—*First class:* J. W. Morrison. *Second class:* J. Brown, R. Boyce, W. Barron.

Bristol.—*First class:* E. Richards, N. Slater. *Second class:* A. R. Evans.

Greenock.—E. P. Mitchell. *Second class:* J. A. Alexander, J. S. Girvan, J. A. McDonald, J. H. Watt, E. J. Nicol.

Hull.—*Second class:* G. Christian.

Liverpool.—*First class:* J. A. Kirkham, P. J. Cram, J, W. Mack, R. J. Latham, J. T. P. Jones. *Second class:* S. Buxton, J. E. Roberts, H. Mossman, G. C. Whitton, C. Jones, F. J. Butler.

London.—*First class:* D. Simpson, R. E. Penney, J. L. Stephens. *Second class:* A. F. Sugden, E. E. Vick, R. A. Garrett.

North Shields.—*First class:* S. E. Mendham, C. N. S. O. Buckton, H. C. Wilson. *Second class:* G. W. Mason, S. C. Liddell, J. O. Waddell, A. P. Ellis, J. A. Terviel, J. E. Meffet, A. Johnson.

Sunderland.—*First class:* W. H. Booth. *Second class:* W. Peacock, R. F. Swan.

Passings in Steam.

Aberdeen.—A. B. Connon.
London.—C. S. Dendy.

THE LALLIE BITUMINOUS POWER GAS PRODUCER.

[SPECIALLY CONTRIBUTED.]

The manufacture of power gas from bituminous coal has been engaging the attention of gas engineers and inventors for a number of years, and, more or less, success has been attained. The qualification, more or less, applies as much to the fuel as to the producers devised by the different operators, for while a number of very satisfactory producers are on the market as efficient gasifiers of bituminous coal, the fuel employed is usually, less than more, bituminous, for in few cases can the whole range of bituminous fuel available be dealt with satisfactorily; usually a non-caking class is only suitable.

Besides the problem of so arranging the feed and grate that the fuel shall pass evenly and regularly through the producer without clogging or scaffolding, either when running light or at full power, the device must include the decomposition of all condensible gases in the grate, or else require an addition to the plant of apparatus which will perfectly arrest all tarry or other condensible products.

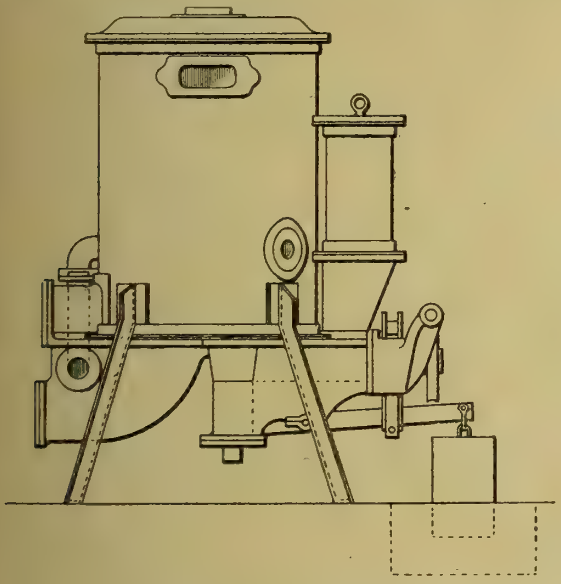


Fig. 1.—Elevation of Lallie Producer.

The Mond system, with ammonia recovery plant, and similar producers, may be considered as having proved highly efficient where the plant is of a sufficient output to warrant the initial capital expenditure; as representing the latter class, while in the case of producers of the former type, generally a special class of coal is used that will not cake or give off a high proportion of tarry matter.

There is, therefore, still room for improvement in design of producers to gasify bituminous coal of wider range of quality than is mostly used at present, which can dispense with the expensive cleaning and condensing plant required when the condensible matters are not efficiently decomposed.

If all the green gases evolved from bituminous coal can be made to pass through the hottest part of the fuel in the grate, condensible matter and tar become completely decomposed and issue as fixed gas free from hydro-carbons which condense on cooling, and a number of producers have been devised to make use of this system, the underfed type being especially arranged with this object.

M. N. Lallie, of Nantes, has lately been experimenting in this direction, and his method of introducing the fuel to the grate will be appreciated by workers in this direction.

On reference to figs. 1 and 2, where Lallie's producer is shown in elevation and section, it will be noticed that the fuel is fed into the fire by a combination of a screw conveyor and a reciprocating piston applied to a suction producer, with the object of delivering the fuel into the bed above the grate without clogging the mechanism; the screw receives a supply of fuel from the hopper in the form of small pieces or slack in such a proportion that nearly occupies the space formed by the descending piston at a point slightly lower than the grate, and on the upward stroke of the piston this fuel is placed convenient to the grate bars.

In most *underfed* systems the delivery of the fuel is somewhat at right angles from the direction of the screw feed, and accompanied by a crushing action, whereas in Lallie's producer the delivery is first horizontal by the screw and then vertical by the piston, with a lifting and opening of the bed of fuel in the situation of the hottest part of the fire, and thus preventing the clogging of the fuel, however bituminous. Coals containing from 12 to 22 per cent of volatile matter are said to have given good results, as well as caking coal as used for forges, without any trace of tar being found in the pipes or gas engine valves. Not only is the caking coal completely burnt, but an examination of the fireplace shows no signs of caking or clogging. This type of producer is considered suitable for stationary engines and motor-driven boats, as well as for heating purposes and for driving road vehicles, as no further gas cleaning is necessary other than a wet scrubber to remove dust and sulphurous gases, as the fuel is continuously sustained by the piston, which has a stroke of greater amplitude than is necessary for providing for the fuel introduced by the screw, and the pressure exerted on the fuel contained in the lower part of the fireplace is periodically released, and the fuel subjected to a pulsation which prevents clogging and allows of free development of the gases by the penetration of the air and steam, and all crushing of the fuel and formation of dust is avoided by the screw or worm, of increasing pitch, combined with the pulsating lift of the piston. The quality of the gas evolved depends upon the class of fuel and the proportion of steam, while the invention can be applied to most of the present forms of producer.

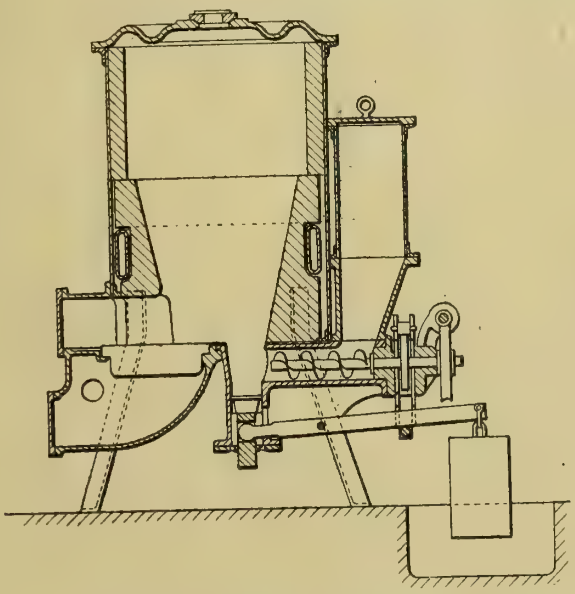


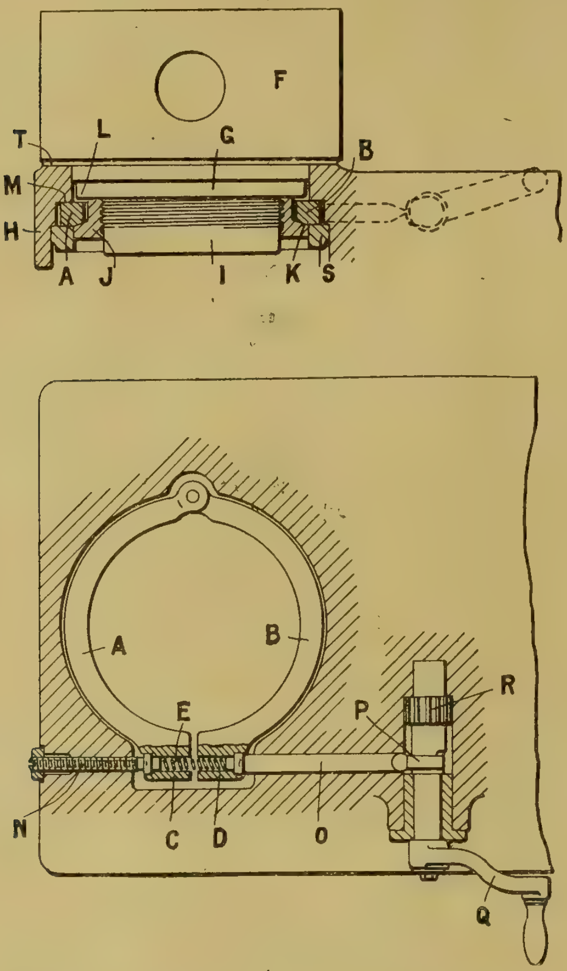
Fig. 2.—Section of Lallie Producer.

Lectures on Law Relating to Engineering.—The council of the Junior Institution of Engineers (Incorporated), in conjunction with the council of the Society of Engineers (Incorporated), have arranged for a course of six fortnightly lectures on "The Law Relating to Engineering," to be delivered by Mr. L. W. J. Costello, M.A., LL.B. (Cantab.), the first to be given on the 10th October next.

CLAMPING LATHE TURRETS.

In order to clamp lathe turrets and similar parts, devices have been used wherein a ring or ring-like body formed as a single structure is wedged between an annular surface which is rigid with the turning device which is to be clamped, and an annular face which is rigid with the part within which the turning device is mounted, thereby clamping a shoulder of the turning device, which presents a substantially continuous bearing surface against a shoulder of the part within which such device is mounted, which also presents a substantially continuous bearing surface.

This has been accomplished by expanding the ring circumferentially by means of a wedge forced between the ends of the ring which has been cut through at one side.



Lathe Turret Clamping Device.

A ring does not lend itself to expand truly in this manner, and thus only wedges between the annular surface in the neighbourhood of the ends, whilst the remainder of the ring remains unwedged between the surfaces for a considerable portion of its circuit. The clamping is then a very inadequate one.

In order to overcome this difficulty the present device has been designed by the Austin Motor Company and Herbert Austin, of Northfield, and the main feature resides in the fact that the ring is contracted by the ends being brought together. This action may be provided for in many ways, and either by hand or automatically.

In one arrangement, which is shown in the illustration, the ring is formed in two halves A B pivoted together and formed at the free ends with lugs C D, which ends are normally pressed outwards by a spring E. F is the turret head and G the plug, which passes down into the opening of the turret holder or rest H, within which the turret swivels. The plug is formed with a portion I of reduced diameter, and upon this portion is screwed a collar J which has a bevelled shoulder K which faces upwards, leaving between itself and a shoulder L of the plug an annular groove. The portion of the opening within which the plug is a turning fit terminates in a shoulder M which faces downwards, and between this shoulder and the bevelled shoulder is the ring A B, which has a plain upper surface to bear against the shoulder M, and a bevelled surface to bear against the bevelled shoulder K of the collar J.

In order to move the free ends of the ring together, means are provided which consist of an abutment adjusting screw N, against which the back of the lug C abuts, and a rod O, which may be moved endways to press the lug D towards the lug C. The rod O may be moved to clamp the ring by a cam P operated by the handle Q, or automatically from any convenient operative part of the machine through the medium of a rack and a toothed wheel R. A ring S may fill in the annular space between the inner wall of the turret holder and the collar J, to exclude dust and to retain the lubricant, and this ring may be fixed in any convenient manner. When the ring A B is tightened up between the shoulders M and K it securely clamps down the turret against turning, and as the shoulder M which runs around beneath the shoulder T of the turret head, which bears upon the top of the holder H, is consequently at its inner corner nearly of the same diameter as the turret head, the leverage through which any tool which is carried by the turret head, can act with a tendency to tilt the head, is largely counteracted by the leverage through which the shoulder M acts in resisting the force tending to tilt the turret. The use of the ring S also, filling in the annular space between the collar J and the surrounding wall of the opening through the turret holder, tends to prevent any tilting of the turret while it is being turned or otherwise while it is not clamped by the ring, and thus tends to keep it true with the holder.

The parts may be so constructed that the clamping ring, when in place, may be expanded sufficiently to allow the inner end of the plug of the swivelled device to be passed through.

A JIG FOR BORING QUADRANT LINKS.

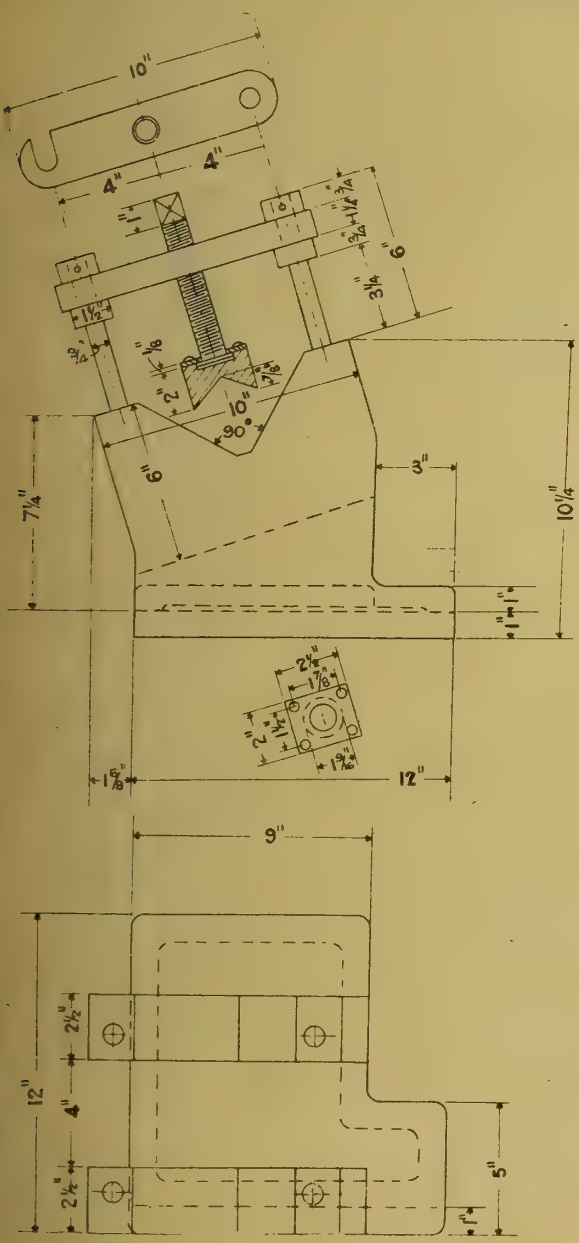
[CONTRIBUTED.]

In order to bore correctly the holes for the bolts supporting the distance pieces in the ordinary type of marine engine quadrant link, very careful setting up is required, unless a jig of some sort is used. The following is a simple type of jig which can be used for boring links of various sizes, and can also be arranged to suit either a vertical or horizontal spindle boring machine.

The jig essentially consists of two strong cast-iron brackets, with two perfectly parallel vee grooves in each. These vee grooves are separated by a sufficient distance to allow the quadrants to be placed between them, the pins (to which in the finished engine the eccentric rods are attached) resting in the vee grooves. Above each vee groove is mounted a crosshead with an adjustable vee block for clamping the pins into the cast-iron brackets.

The method of setting up the quadrant links is as follows:—One of the brackets is fixed in position on the machine table, the other being placed in its approximately correct position. One of the pins of one of the quadrant links is then placed in the vee of the fixed bracket, and the other pin, in passing into the vee of the loose bracket, sets it in the correct position. The fixing blocks are then screwed down on the two quadrant pins, and the second quadrant link placed in position (back to back with the first one) and the fixing blocks screwed down on to its pins. The loose bracket is then properly fixed to the machine table. If there are several quadrant links of the same dimensions to be bored, the jig will be in the correct position for all the ensuing links, which simply require to be placed in the jig and fastened down by the fixing blocks.

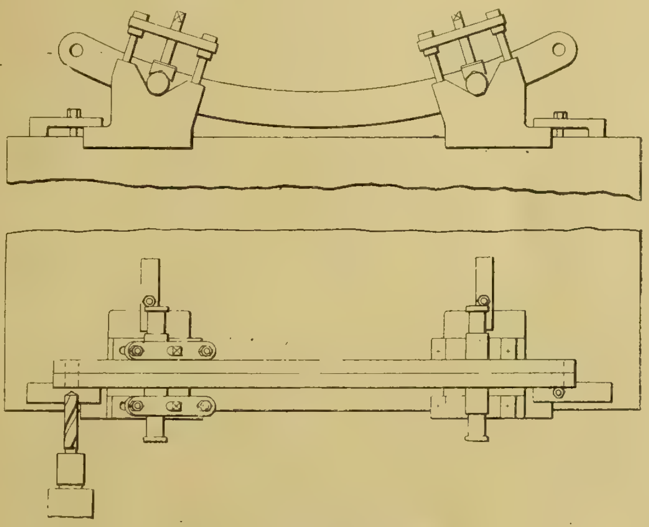
The brackets shown are made specially to suit a horizontal spindle machine. They are cast with a flange on the front side, which is made to bear against the edge of the machine table, and this ensures the links being square with the spindle of the machine. The vees are cast at an angle with the base of the bracket, so that the links may lie better between them. At each end of the vee a ¾ in. diameter stud is screwed in, and these studs support the cross head. The crosshead is made from a piece of flat mild-steel bar, 2 in. by 1¼ in. section, the ends being rounded off. At one end a ¾-in. hole is bored for one of the studs, and at the other end a $^{13}/_{16}$-in. slot is cut for the other stud. The slot allows of the crosshead being swung clear when the fixing block is drawn off the quadrant pins, and saves any unnecessary time being wasted in unscrewing nuts, etc.



Bracket for Jig for Boring Quadrant Links.

In the centre of the crosshead a 1 in. diameter tapped hole is made for the fixing screw. This screw is made from 1½ in. diameter bar turned down to 1 in. diameter and screwed, a collar 1½ in. diameter by ¼ in. being left at one end, and at the other end a ¾ in. square 1 in. long is cut. The adjustable vee block on the end of screw is made from a mild steel block 2½ in. × 2 in. × 1⅝ in., the vee being machined out, as shown, on one side of it, whilst on the opposite side a recess $1^9/_{16}$ in. diameter by $^5/_{32}$ in. deep is turned to receive the collar on the end of screw shaft. A piece of ⅛-in. steel plate is bored $1^1/_{32}$ in. diameter and fixed to the top of this block by four ¼-in. screws, the collar on screwed shaft being first of all placed in the recess before the plate is finally fixed in position.

The brackets should be made of hard cast iron. In machining them, the base and side flange are first machined in a plane or shaper, and the brackets are then fixed on to the machine, and the sides of vees, against which the quadrant links rest, are planed up. These must be very carefully machined, so that the height from the side flange to this face may be the same in both brackets. In order to ensure this it is best to machine the two brackets together, which can quite easily be done on a small planing machine. After this face has been machined the vees are machined, care being taken to ensure them being machined quite square with the side flange.



Jig for Boring Quadrant Links.

CONDENSING WATER ARRANGEMENTS.

[SPECIALLY CONTRIBUTED.]

It is known that while it is an easy matter requiring little water to get, say, a 12-in. vacuum, it is very difficult to maintain 27 in. or 28 in. and to keep within an inch or an inch and a half of the barometer taxes the makers of condensing plant to the highest degree. It is essential that much cold water shall be used, especially for steam turbine equipments; thus it is seen at once that the water arrangements for dealing with these items must inevitably play a not unimportant part in the success or otherwise of any power producing plant, whether it be cooling ponds, cooling towers, or the condensing plant proper.

The arrangement of the cooling ponds depends very largely on the slope and general arrangement of the site upon which the cooling ponds are to be erected; for instance, if the site consists of anything like a hollow or pond an arrangement of dam, shown in fig. 1, would most likely be adopted, or, if not, as shown in fig. 2, or, if on a sloping site, a combination of the two, the exact arrangement being left to the designer's discretion, bearing well in mind that economy in this particular means ultimately the economy of the steam engine equipment. Fig. 4 shows the plan of a cooling pond which is suitable for cooling the condensed steam for engines under, say, 2,000 I.H.P., the exact size of the reservoir being calculated in accordance with the rules given below. For dealing with larger engines or a group of engines of aggregate power exceeding 2,000 I.H.P., it is advisable to arrange the pond into two sections, as shown in fig. 5, in order to secure more efficient cooling of the water. It is unnecessary to dwell on the various piping arrangements, which the illustrations sufficiently explain, otherwise than point out that it is very desirable to sink a separate well, as shown in the illustration, from which to draw the injection water to keep the water free from any obstacles that may be in the ponds, and which may have a tendency to choke the condensing plant and cause a lot of inconvenience. Further, that the outcoming water should be taken, by means of the tracks provided, as far away from the injection well as possible, in order to secure more thorough cooling of the water.

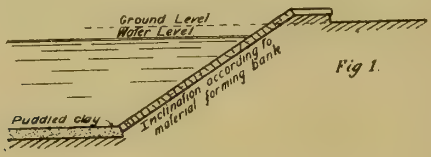


Fig 1.

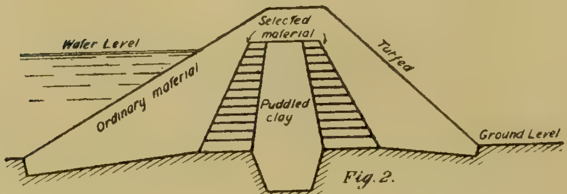


Fig. 2.

In ascertaining the dimensions of these ponds, the writer has found the conclusions of Mr. Baker, given in the proceedings of the Institution of Civil Engineers, to work very well in practice. It was here found, upon an examination of ponds actually in use, that the water surface varied from 13·5 square feet to 57·6 square feet, giving on the average a water surface of 33·3 square feet. This at first sight might seem a very considerable difference between different plants, but the writer thinks that it can be explained by the desire of many of the designers of these ponds to provide very much extra surface than was absolutely necessary where it could be foreseen that such an increase would not mean an extra first cost that would outweigh any advantage otherwise gained. The water capacities varied from 61 cubic feet to 351 cubic feet per indicated horse power; average, 198 cubic feet. Mr. Baker, in his conclusions, says that the surface of the reservoir should not be less than 1·79 square feet per 1,000 thermal units per hour if a moderate amount of condensing water is to be used. This will mean that for an engine using, say, 13 lbs. of steam per indicated horse power per hour, to be generous, that the minimum surface should be 235 square feet per indicated horse power. The capacity, it was found, should not be less than 19·9 cubic feet, say, 10 cubic feet per 1,000 thermal units per hour, and in the case cited above the mean capacity per indicated horse power would be 130 cubic feet. These figures were based on the assumption, which the writer thinks is sufficiently accurate where the size of a reservoir is concerned, that each pound of steam conveys with it into the reservoir 1,000 thermal units, the whole of which is to be dissipated. Provided that it can be done without unduly increasing the first cost of the equipment, these capacities may be increased with advantage, and it is owing to designers taking advantage of these conditions, as already mentioned, that the sizes and capacities differ as much in actual ponds.

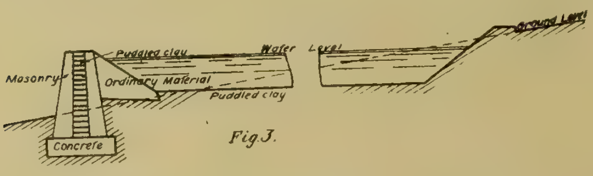


Fig. 3.

Depth is an advantage where it is not provided at the expense of surface, since it means colder water at the bottom of the reservoir, whence the condenser in many instances draws its supply, and in the cases mentioned above the mean depth would be about 6 ft.

As to the reservoir walls, the foundations should be laid on an impervious stratum, or the whole interior of the reservoir must be covered with puddled clay on concrete, otherwise the dam may be undermined and carried away. Figs. 1, 2, and 3 show sections of dams in common use, but in cases where space is very scarce, as in many large industrial centres, and land is only to be got at a very high figure, it is advisable to erect a rubble wall, as shown in fig. 6, but very careful calculations have then to be made to ascertain the dimensions and to see that the wall is safely bedded upon a suitable foundation. In the case of figs. 1, 2, and 3, careful calculations as to the size are unnecessary so long as the following slopes are not exceeded for the different materials:—

Description of earth on which dam is built.	Inclination of dam, in degrees.
Sand	26
Vegetable earth	30
Vegetable earth, very wet	20
Clay, dry	30
Clay, damp and well drained	45
Clay, wet	20
Gravel	45

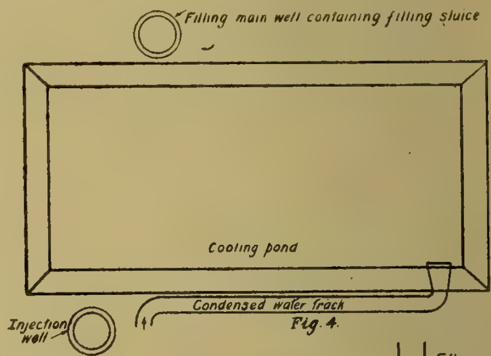


Fig. 4.

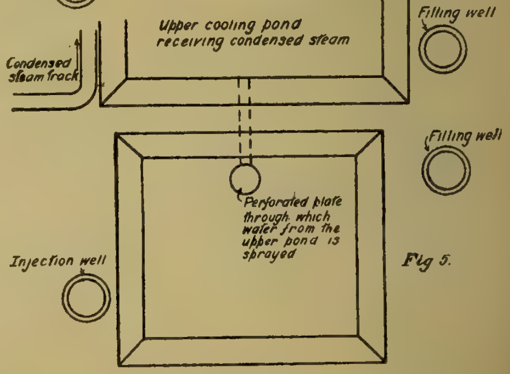

Filling well
Upper cooling pond receiving condensed steam
Condensed steam track
Filling well
Perforated plate through which water from the upper pond is sprayed
Injection well

Fig. 5.

The sizes of the rubble walls may be ascertained as follows: Assuming the reservoir shown in fig. 6 to be full, the water presses with a force varying with the depth, being $62\frac{1}{2}$ lbs. per square foot of depth; or over the whole wall $P = \frac{1}{2} w h^2$ where P = the total pressure on the wall face in lbs., and w = the weight of a cubic foot of water = $62\frac{1}{2}$ lbs.; h = height of wall in feet. Now this force must be compounded with the force corresponding with the weight of the wall for a slice of the wall 1 ft. in length, assuming the stone to weigh 125 lbs. per cubic foot, acting through the centre of gravity of the wall. The centre of gravity of the section is found by adding the bottom width of the wall on each side of the top, and the top width on each side of the bottom, and drawing diagonals, the intersection giving the centre of gravity, as shown in fig. 8.

The force P acts at the centre of gravity of the ordinates of pressure, as shown in fig. 7, at one-third the height from the base, and the distance x, say, of the resultant of the two forces P and weight of wall will be

$$x = d + \frac{P\,h}{3\,W} \quad . \; . \; . \; . \; . \; . \quad (1)$$

because $W : P : \frac{1}{3}h : x - d$. This resultant, in order that the wall may be stable under the forces acting upon it, must lie within the middle third of the base of the wall, otherwise the width at the bottom of the wall must be increased. The line of thrust, shown in fig. 6, is found by finding the point of intersection of this line with horizontal beds at different levels from top to bottom with the reservoir both full and empty, and the complete design or arrangement of section is accordingly in many cases thus arranged as shown in illustration.

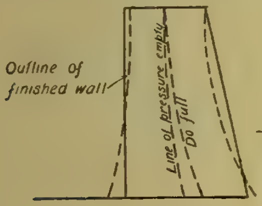


Fig. 6.

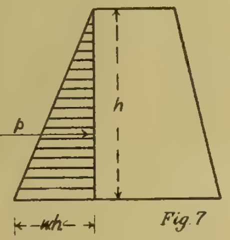


Fig. 7

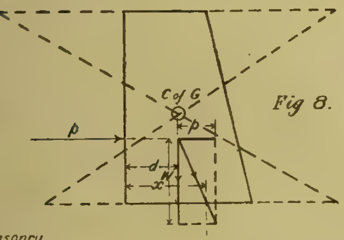


Fig 8.

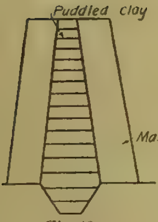


Fig 10

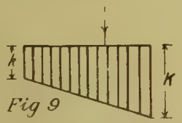


Fig 9

To secure the perfect bedding of these necessary walls the pressure in the foundations caused by the forces acting must be ascertained and may be very safely assumed to be for the maximum pressure at the inner edge,

$$K = W\left(\frac{4\,t - 6\,d}{t^2}\right) \quad . \; . \; . \; . \; . \quad (2)$$

and for the maximum pressure on the inner edge

$$k = \frac{w}{t}\left(\frac{6\,d}{t} - 2\right) \quad . \; . \; . \; . \quad (3)$$

the pressure over the base of the wall being distributed as shown in fig. 9 in these formulæ.

K = the maximum pressure per square foot on the base, in pounds,
W = the resultant of the superincumbent forces, in pounds,
t = the thickness of joint in feet,
d = distance of resultant from nearest edge of base.

Then the size of the foundations have to be arranged to accommodate the value of K, bearing in mind that the safe load for cement concrete is 2 cwts. per square inch, and for ordinary clayey earth 1½ tons per square foot. A very common section of dam used in congested areas is also shown in fig. 10, the process of ascertaining the measurements and general stability being the same as given for the previous wall.

Recourse has to be had in many congested areas to cooling towers to save space, but when installing these it is essential that all points must be taken into consideration and care taken not to incur too large a first cost in the indiscriminate use of cooling towers. Thus, as an illustration, assuming the vacuum to be 28·5 in., this is equivalent to an absolute pressure of 0·207 lb. per square inch and a temperature of 90 deg. Fah. in condenser, Assuming the water to be ejected from the condenser at 80 deg. Fah., and that the amount of water in circulation is, say, 100 times the weight of steam condensed, then the water will have to be cooled down to 70 deg. Fah. practically in the cooling towers, which means a capacity of cooling tower practically prohibitive as regards area occupied and power expended in lifting water and driving fans which, if electrically driven, seldom consume less than 1½ per cent of main engine horse power. In cases such as these it will generally be found advisable to erect a barometric jet condenser, which, complete with circulating pumps, air pumps, chimney draught towers, etc., could be erected at a cost of about 35s. per kilowatt to give 27·5 in vacuum when the steam consumption is 18 lbs. per kilowatt hour. Generally the extra expense of installing cooling towers in crowded districts is more likely to be balanced by a gain in fuel economy as against non-condensing running, the higher the load factor of the plant, and the price of coal used. Cooling towers are always of the counter-current type; that is to say, the water falls whilst the air for cooling purposes rises, so that the air leaves when the temperature of the air and the water are a maximum and enters the tower when they are both a minimum, thus tending to the highest possible thermal efficiency. The cooling towers occupy about one square foot of floor space per horse power, generally speaking, and the cost, including foundations and a small concrete tank in the base 8 ft. × 9 ft., is only 16s. per horse power, as compared with from £2 10s. to £3 and over in many cases for a cooling pond, these figures being compiled on the basis that each horse power requires the condensation of 20 lbs. of steam—a high figure. The figures do not include the cost of land, which would have to be taken into consideration in congested areas. As a general rule the higher the tower the lower will be the final temperature of the water, but the last few degrees are more difficult to obtain, requiring a greater increase in the height for a lower temperature, consequently there is a limit to the economical height of the tower. Probably also the floor space can be decreased somewhat by speeding up the fans, and the steam required for this purpose will be offset by the reduced size of the tower and floor space, the last item often being very important.

The atmospheric evaporation which of necessity goes on in the tower usually amounts to about 3 per cent of the water passing through the tower, or about equal to the amount of the condensed steam. The fans usually are guaranteed not to consume more than 1½ per cent to 2 per cent of the total indicated horse power of the engines. The water is usually cooled at about 80 deg. Fah., which means that a large and expensive condenser will be required at high vacuum.

As to the condensing plant proper, it is unnecessary to dilate upon the detailed descriptions of condensers or their auxiliaries which are upon the market, but to point out a few general principles underlying the choice of condensers under various conditions imposed in practical working.

(To be continued.)

New Signalling Station.—The Admiralty are prosecuting an inquiry with a view to the selection of a suitable site on the Haddingtonshire coast for the erection of a new signalling station. Negotiations have been in progress with various proprietors, and there is now some prospect of a site being fixed upon between Dunbar and North Berwick. It is understood that the new station has been found necessary in connection with the Rosyth Naval Base arrangements.

THE CUNARDER FRANCONIA.

It has been said that in the gradual development of the Cunard Line may be traced the shipping industry generally, and in the substitution of new ships of superior types the advance of science in relation to the steamship and marine steam engine may be closely followed.

Further evidence, if necessary, of the enterprise and spirit of progression that animates the Cunard Company is provided by the new vessel Franconia, which was launched on July 23rd, 1910, and which is to be ready to be placed in commission early in 1911.

Though not so large in point of gross tonnage nor built with the object of attaining the unrivalled speed of the express Cunarders, Lusitania and Mauretania, yet the Franconia will embody many features that will place her in the very front rank of modern liners.

She will primarily be attached to the Boston service, now being carried on by the Ivernia and Saxonia, and she will be larger and faster than either of the two latter boats; in fact, she will be the largest boat to enter Boston Harbour. During the winter season she will be attached to the Cunard fleet cruising between New York and the Mediterranean.

The Franconia has been constructed at Wallsend-on-Tyne, by the well-known firm of Messrs. Swan, Hunter, and Wigham Richardson Ltd., who, besides being responsible for the famous Mauretania, have also built for the Cunard Company the Ultonia, Ivernia, and Carpathia. She is to be engined by the Wallsend Slipway and Engineering Company.

When complete and ready to start on her first voyage early next year, the Franconia will have been constructed and fitted out in something like record time. It is expected that she will be finished in little more than fifteen months, counting from the time when the keel plates were laid.

The principal measurements of the Franconia are: Length over all, 625 ft.; breadth over all, 72 ft.; depth from top of houses to keel, 90 ft.; gross tonnage, 18,000 tons; displacement, 25,000 tons; height of funnels, 140 ft. above lowest furnace bars; diameter of funnels, 17 ft. 6 in.; Height of masts, 200 feet above the keel.

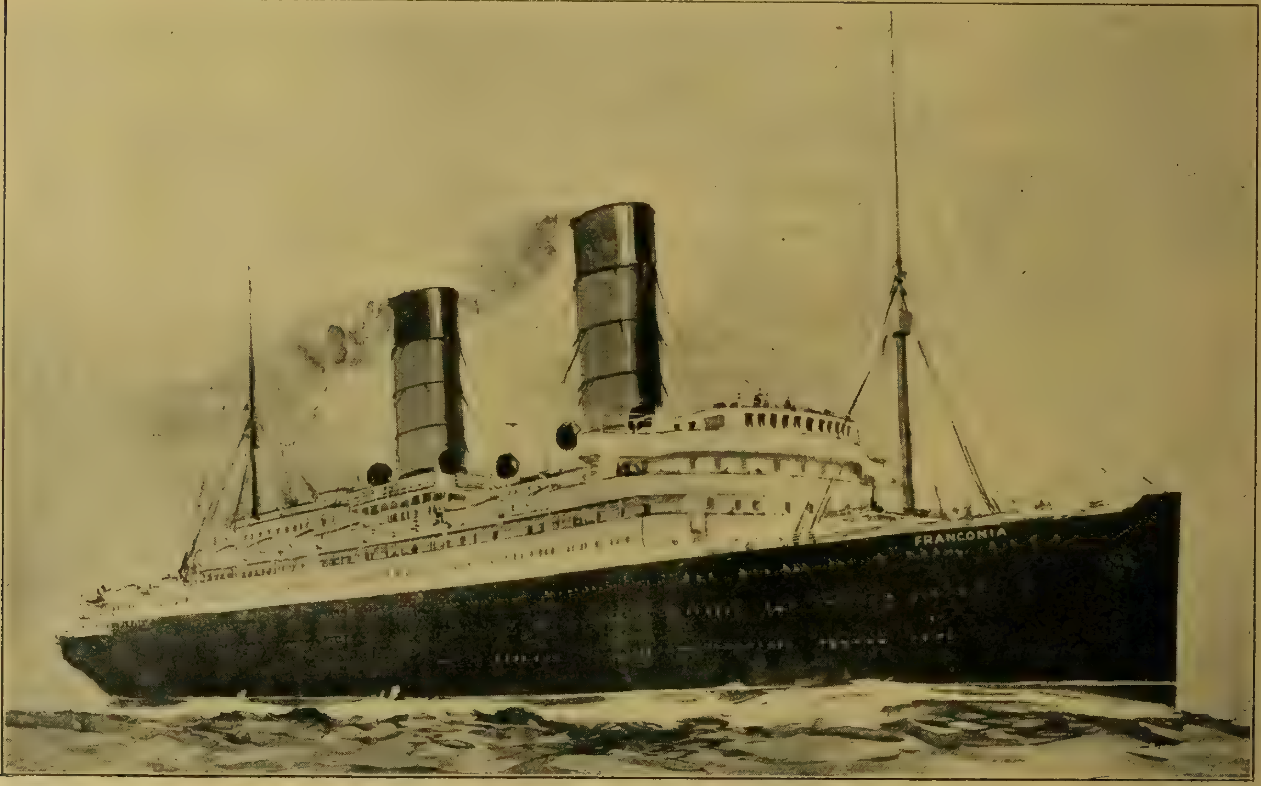
The Franconia has been designed on the graceful lines for which the Cunard boats are noted, at the same time embodying all those features necessary to ensure steadiness and seaworthiness in all kinds of weather. In all, there will be no less than seven steel decks.

She is, of course, fitted with bilge keels for resisting rolling when in a seaway. Watertight transverse bulkheads divide the ship into a number of watertight compartments, thus securing, as far as possible, her unsinkability should the bottom by any means be pierced.

The Franconia will be propelled by twin-screw engines of the inverted, direct-acting, quadruple-expansion type, balanced on the Yarrow, Schlick, and Tweedy system, having four cranks to each set.

There will be four cylinders to each set of engines, namely, one H.P., one 1st M.P., one 2nd M.P., and one L.P. Approximately the diameters will be as follows: 33 in., 47 in., 67 in., and 95 in. respectively, with a stroke of 60 in. The horse power developed will be about 12,000.

From the end of each thrust block, with its 10 rings for conveying the thrust of the propeller to the framework of the ship is attached 200 ft. of shafting of 19¾ in. diameter, made by Sir W. G. Armstrong, Whitworth and Co. Ltd., Openshaw, Manchester, at the end of each of which there is a propeller of manganese bronze with four blades, having a diameter of approximately 20 ft. The condensers are Weir's uniflux, the feed heaters and evaporators are by Messrs. G. and J. Weir Ltd., and the circulating pumps are supplied by Messrs. W. H. Allen, Son and Co. Ltd., Bedford. The boilers, of which there are six in number, are of the double-ended multitubular type, each boiler having eight furnaces, four at each end. The diameter of the boilers is 17 ft. 6 in., and the length 21 ft. 6 in. The vessel will have two funnels, which will reach a height of 140 ft. above the base of the ship. This



R.M.S. FRANCONIA.

makes the eighth Cunard vessel to be engined by the Slipway Company, and brings the total horse power supplied to the Cunard Company to 150,000.

An efficient system of mechanical and natural ventilation will be provided in the engine and boiler rooms, consisting of a large number of electrically-driven fans, each capable of delivering 800 ft. of air per minute.

The stokeholds are large and airy, precaution having been taken for the provision of fresh air to all parts.

A suitable workshop has been provided for the engineers, with a large lathe and a universal drilling machine.

Two atmospheric silent hoists are fitted in each of the boiler-rooms, also a Stone-Lloyd expeller, which forces the ashes through the bottom of the ship.

Provision has been made for carrying about 1,500 tons of fresh water on board, and, in addition, two distillers are installed, which produce 90 tons of pure drinking water per day, should it be required.

The Franconia will be equipped with the Marconi wireless system and submarine signalling apparatus.

There will be the very latest types of refrigerating plant, and some idea of the care to be taken of the various items of table diet may be gathered from the fact that each is to be stored in its own separate compartment, where the temperature is regulated to suit the particular commodity. In this way, neither the flavour nor nourishing qualities are in any way affected.

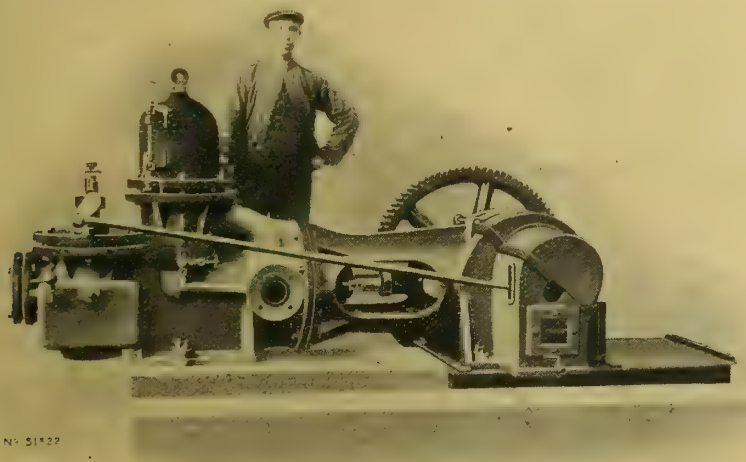
The launch of the Franconia recalls an interesting page in the history of the Cunard Company, and in the development of ocean-going liners. Sir Samuel Cunard, who was born at Halifax, Nova Scotia, in 1787, and who died in London in 1865, was the founder of the line of steamships that bears his name. He was trained in the pursuits of commerce. In the early days of steam navigation the English Government made known a desire to substitute steam vessels for sailing vessels then employed in the mail service between England and America. Mr. Cunard, as he then was, came to England, entered heartily into the scheme, and accepted the Government's tender for carrying it out. In connection with this contract, four steam vessels were built, and from that modest beginning sprang the magnificent fleet of Cunarders as we know it to-day. The first ship of the Cunard Company to cross the Atlantic was the Britannia, in the year 1840. She made the passage in 14 days 8 hours, and the reception of the vessel in Boston is a matter of history. This vessel was 207 ft. long and 34 ft. broad, and with her sister ships, the Arcadia, Columbia, and Caledonia, was built of wood at Port Glasgow. They were all driven by paddle engines. It is interesting to note here that right through the 70 years' career of the Cunard Line the names of its ships have always adopted the termination "ia." The Mauretania, the greatest modern development, with her 800 ft. of length, would be able to carry the Britannia on her deck without any great inconvenience, and the same remark might safely be said of the new Cunarder.

THE JAPAN-BRITISH EXHIBITION.—V.

(Concluded from page 147.)

One of the most interesting and attractive Stands in the Machinery Section of the Exhibition is that of **Messrs. Andrew Barclay, Sons and Co. Ltd.**, of Kilmarnock, Scotland.

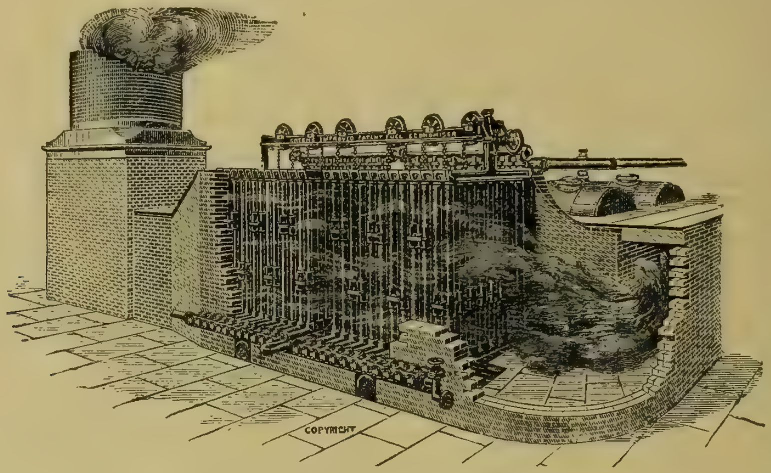
Up till recently a locomotive was shown on the stand. This locomotive was of the 0—6—0 type, of light design, for a sugar plantation in Japan. As the firm in Japan was requiring it for their work, it had to be sent off, and its place has been taken by one of their Oddie-Barclay patent high-speed pumps, as shown in accompanying illustration. This pump is of the single-packed differential type, with ram $3^3/_{16}$ in. and $4\frac{1}{2}$ in. diameter by 6 in. stroke, capable of delivering 60 gallons per minute against a head of 300 ft. when running at a speed of 180 revolutions per minute. Mechanically-controlled suction valves are fitted, also air charger for the air vessel. Very excellent results have been obtained from this pump, and as high as 90 per cent efficiency has been attained in ordinary working. There are no studs in any part of the pump. All the bearings are ground, and the motion pins and joints case hardened. They are adapted for electric driving, either by belt or rope, or through spur gears if space is limited. No intermediate shaft is required. The efficiencies obtained from this pump are much higher than obtained in slower running pumps, because the latter, for electric driving, are cumbered with gearing and many working parts. The chief advantages claimed for this pump are: Smaller first cost, large bearing surfaces, forced lubrication, small floor space occupied, low upkeep, and much more handiness and portability than the usual reciprocating pumps.



ODDIE-BARCLAY HIGH-SPEED PUMP.

This firm is unique in respect that they manufacture in their own works nearly all mountings required for the completion of a locomotive, and many of the smaller steam mountings, such as injectors, steam distribution valves, etc., are shown connected on a dummy locomotive firebox. Perhaps the most important of these mountings is the new Barclay combination automatic restarting injector, which is capable of handling water at 120 deg. Fah., and works dry from 15 lbs. to 160 lbs. pressure per square inch, with a lift as high as 12 ft. The Barclay injector is the most accessible on the market, and the cones can be taken out and cleaned with full head of steam in the boiler without danger of scalding the fireman. It is worthy of note that all Messrs. Barclay's injectors are tested on a specially-designed apparatus before despatch, and certificates of the actual performance can be supplied with each injector.

Besides the above-mentioned exhibits, a large and interesting collection of photographs adorn the walls of the stand. These photographs show the extremely large range and variety of machinery made by Messrs. Barclay. An attractive souvenir post card has been prepared. We have seen a specimen, and should say that it would be much appreciated by recipients. Copies may be had from the attendant at the stand. The stand is tastefully arranged, and there is ample room for the examination of the pump, the fittings, and the inspection of the photographs. Messrs. Barclay have a technical representative in attendance, who will extend a hearty welcome to all visitors, and answer any questions on any points which may be raised. Their London agent, Mr. John Cawley, 53, Victoria Street, Westminster, S.W., is also a frequent visitor to the stand, and may be seen there any time by appointment.



GREEN'S ECONOMISER IN OPERATION.

Messrs. E. Green and Son Ltd., of Wakefield, exhibit a full-sized economiser containing 96 tubes. These tubes are arranged in two groups, thus rendering all parts of the machine easy of access. The scraper mechanism is worked by a 1-H.P. motor fixed on bedstone at the base of the economiser, the reduction of the speed of the motor to that of the economiser driving shaft being made by means of countershafting and belting.

The heating of the feed water of steam boilers by means of waste heat in flue gases is the object for which this apparatus is designed. A series of cast-iron tubes 9 ft. in length by $4^{9}/_{16}$ in. in diameter are arranged in sections of various widths across the main flue between boilers and chimney. These sections are formed by forcing the tubes simultaneously into longitudinal "top and bottom boxes" by means of powerful hydraulic presses, and the tube ends and sockets are respectively turned and bored to standard measurements. The sections, when in position, are connected by branch pipes running lengthwise, one at the top and the other at the bottom, on opposite sides, the latter being outside the brickwork which encloses the apparatus, and the former secured at the flanges of top boxes. The cold water feed enters the economiser through the bottom branch pipe at the end nearest the chimney, and is delivered to the boiler from the top branch pipe at the other end. The difference in temperature arising as the hot waste gases pass through the economiser chamber on their way to the chimney is absorbed by the apparatus and communicated to the feed water, which is forced into the economiser by a boiler pump or injector.

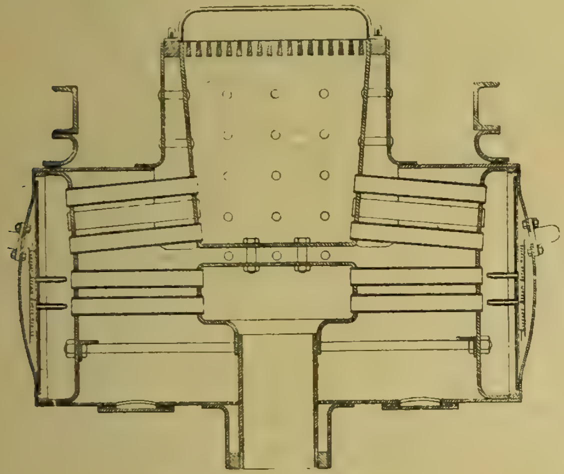
By feeding the boilers with water at a high temperature, abnormal expansion and contraction is prevented.

The installation of this apparatus not only ensures a considerable saving in the wear and tear of boilers, but it economises in the matter of fuel to the extent of from 15 per cent to 25 per cent of the total amount used.

Provision is made for keeping the pipes clean from soot or ash, a light sleeve-like scraper being slipped over each vertical tube, and being worked up and down by means of chain connections. The scrapers may be worked by a small engine or motor. This firm also exhibits a small high-speed horizontal steam engine and a number of sample castings.

The Yorkshire Patent Steam Wagon Co., Vulcan Works, Leeds, are exhibiting on their Stand, No. 228, a very fine specimen of their patent steam motor wagons with tipping body, suitable for millers or general carriers. It has a carrying capacity of three tons, and is fitted with two gears, giving a travelling speed of four and eight miles per hour. Its over-all length is 15 ft., width 6 ft. 6 in., wheel base 9 ft., and width over outer edge of tyre 6 ft. The body of the wagon is 10 ft. long by 6 ft. 6 in. wide, and has lattice sides about 4 ft. 6 in. high. The engines, which are compound, are placed vertically at the back of the driver, and are easily detachable from the lorry; all the engine parts are encased, and running in an oil bath. The casing is fitted with covers, easily removable, giving perfect facility for getting at any of the parts for examination and adjustment. The high-pressure cylinder is 4 in. in diameter, low-pressure 7 in., and stroke 6½ in. The engine runs at 350 revolutions per minute, and gives 30 I.H.P. with a boiler pressure of 175 lbs. per square inch. Two independent brakes are fitted, one acting direct on the driving wheels, the other being a band brake, which is actuated by a foot lever on the driver's footplate. From the second motion shaft is a chain transmission gear to the back axle, which can be adjusted to take up any stretch of the chain. The wagon is capable of taking, upon a good macadam road, a gradient of one in seven, with a full load of three tons The road wheels are of pressed steel. Those on the front are 2 ft. 10 in. diameter by 5 in. on tread, while the hind wheels are 3 ft. 3 in. diameter by 7½ in. wide.

The wagon on exhibition is fitted with two injectors, but the latest type is fitted with one pump and one injector. It is found that a more continuous feed is obtainable with a pump. The boiler as illustrated is the firm's patent, and is on the locomotive principle as regards the firebox, but has two short barrels instead of one long one, and is fixed across the front end of the wagon frame, making a most compact arrangement; two sets of fire tubes connect the firebox with the chambers at each end of the barrels, and return tubes convey the gases to another chamber at the base of the chimney. Instead of a steam blast pipe in the chimney, the exhaust steam enters the two chambers formed in the smoke-box doors, where it is thoroughly superheated, and escapes through a series of small jets into each return tube; by this means an absolutely silent and invisible exhaust is obtained, and an equal proportion of flame or gases is drawn through each tube, making the boiler both economical and a rapid steamer without throwing sparks out of the chimney.



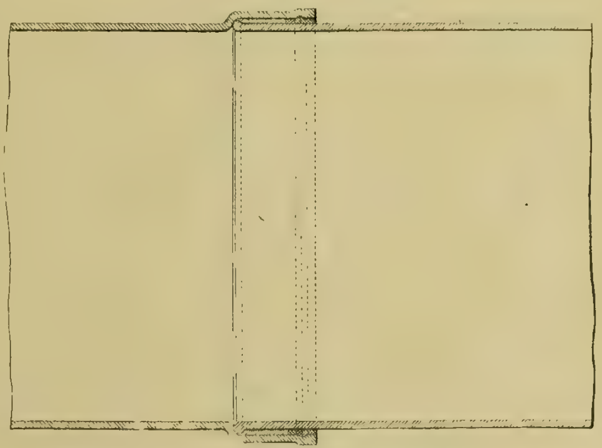
Boiler for Steam Motor Wagon.

It is claimed that this boiler will stand more forcing than any other type. It has been tested to evaporate as much as 20 lbs. of water per square foot of heating surface per hour without the slightest injury, and can always maintain its pressure and water level on the longest and steepest gradients with very indifferent gas coke as fuel. With fuel consumption of one ton of coke, a distance of 280 miles can be covered. The height of the chimney is 9 ft., and the tare weight of the wagon complete is 2 tons 19 cwts. The wagon is fitted with a water tank having a carrying capacity of 170 gallons. The "Ackermann" type of steering gear is used, for which is claimed perfect locking of wheels and an absence of shock under all conditions of working, due to sudden stoppages and starting. The whole of the driving mechanism is arranged in a compact form, and the driver has all the starting and steering gear, levers, and brakes under perfect control. The chief points claimed for this wagon are: Simplicity of design, freedom from complication, accessibility combined with protection from dust and dirt, ample strength in all the details, and compliance in all respects with the regulations and requirements of the Local Government Board. The firm already possesses several diplomas and medals obtained at various exhibitions, including a diploma of honour at the Franco-British Exhibition, 1908; gold shield award for Automobile Club trial at Turin, 1908; and gold medal for actual trial commercial vehicle, awarded by the Royal Automobile Club, 1907. For the wagon on show they have been awarded a gold medal by the authorities at the present Japan-British Exhibition. Mr. W. G. Pickering is representing the above-mentioned firm at their stand, opposite that of The Humber Co.'s exhibit, where further particulars of this useful wagon and other specialities can be obtained.

Messrs. Clayton, Son and Co., of Hunslet, Leeds, have a stand between the firm just referred to and that of Messrs. W. R. Sykes Interlocking Signal Company. Amongst their exhibits is shown a specimen of a welded steel water main, 3 ft. 6 in. diameter by 18 ft. 6 in. long, made out of one solid plate ⅜ in. thick. This tube is similar to one supplied to the Leeds Corporation to cover a distance of 22 miles, and was of a diameter of 33 in. This contract is just being finished. Another contract this firm has in hand is for 3,650 tons of 44 in. diameter piping for the Manchester Corporation. All the tubes of this firm's make are hydraulically tested under a pressure of 550 lbs. per square inch. In conjunction with the straight tubing will also be seen on the stand a collection of "Kimberley" bends and collars. A very fine collection of framed photographs of various works carried out by this firm is also on view, comprising gas holders, boilers, tanks, roofs, pithead gears, and compartment bolts for canals. It may be of interest to mention that amongst the main photographs is one showing a large elevated water reservoir during process of construction. It is being built for the town supply of the Corporation of Calcutta, and will be completed in January, 1911, after having taken about 12 months to manufacture. It is claimed to be the largest in the world, the height of the structure being 110 ft., and the tank 321 ft. square by 16 ft. deep. The holding capacity when finished with be nine million gallons, weighing 40,000 tons. The approximate weight of steel used in the structure will be about 7,000 tons.

Messrs. Clayton also show a photograph of "The largest gasholder in the world," built for the South Metropolitan Gas Company, London. It is 300 ft. in diameter, and has six lifts, each 30 ft. deep. The working capacity of this huge structure is no less than 12,158,600 cubic feet.

We give an illustration of a section of the patent coupling joint manufactured by this firm, and used in connection with their welded-steel water mains.



Coupling for Welded Steel Water Main.

The V-shaped recess in socket forms a key for the lead, and the socket edge, by being thickened, is considerably strengthened, making it perfectly rigid to resist the pressure when caulking-in the lead.

The spigot end, by being beaded or thickened, is thereby strengthened and kept true.

The bead, besides strengthening the tube, also forms a stop for the yarn stopping.

The bead also facilitates the true laying of the pipes, as it acts as a guide and keeps the pipes in alignment; and thus the wedges hitherto employed for this purpose are dispensed with.

The V-shaped recess also prevents the drawing of pipes after being laid.

The Float Electric Co. Ltd. have a useful collection of their electric specialities on view. Their portable lamps for mining and all underground purposes should prove of great utility. The miner's "Unit" is in every sense of the term a safety lamp, and can be used freely under all conditions. It is compact, light, and easy of manipulation. It is interesting to note that several float lamps and a quantity of electrolytes to last 20,000 hours were supplied to Captain Scott for his Antarctic expedition, the whole outfit weighing under 400 lbs.

Messrs. T. and J. Jackson and Co., 14, Park Road, Regent's Park, London, are showing an electric lighting plant for country houses. The engines will work on gas, petrol, or common paraffin. The dynamo is made for lighting at 16 volts, their standard voltages being 12, 16, and 25, giving freedom from shock, and an almost equal immunity from fire risk. The other items include a regulating switch for country house lighting; an electric comb; an automatic switch for use with storage batteries, which will stop the engine if the dynamo ceases to work, either from a wire breaking or coming loose, a fuse burning out, a belt breaking or slipping off the pulleys, or from any other cause. Also an electric motor car tail lamp, which combines lamp, number, and danger signal in one. An electric headlight for motor cars is also shown.

Messrs. J. H. Richards and Co., of Birmingham, have an interesting exhibit showing the various purposes and uses to which their plastic metal is put. It is used chiefly for lining up all kinds of bearings, of which there is a varied collection shown on the stand. The chief qualities and advantages claimed over other metals are: Durability, adhesiveness, self-tinning, and anti-frictional properties, and the ease with which it may be applied to many kinds of metal, including gunmetal, steel, wrought and cast iron, etc., from which, when properly applied, no abrasive force will remove it, thereby dispensing with the trouble and expense of recessing or pegging, an important matter when time for repairs is limited. It can also be used for lining up worn parts of machinery, in addition to bearings.

The Dowsing Radiant Heat Co. Ltd., of 21, Budge Row, London, E.C., have an attractive show, their "Solarium" electric sun bath being especially interesting. This is an electric light bath fitted with special electric lamps, and marks a great advance on all cabinet baths where hot air only is employed. Patent reflectors are employed to direct the light and heat rays upon the person, and means are provided for heating the air as well. The bath can be got ready for use in about a minute, and can quickly be turned off at will. It should prove a useful addition to the many contrivances adopted in hospitals, hydropathic institutions, and elsewhere. Radiators of various kinds are also specialised by this well-known firm.

In concluding the series of articles on the Japan-British Exhibition, we have been unable to do more than touch a few of the leading exhibits, and generally describe various specialities. In the department of ordnance, Messrs. Vickers, Son and Maxim Ltd. stand alone. Rarely we should think in the history of exhibitions has there been seen such a collection of guns of various kinds, from the heavy 12 in. down to the those of the smallest calibre. Messrs. Sir W. G. Armstrong, Whitworth and Co.'s stand also deserves special mention, and the models sent by the various Clyde firms of steamers, dredgers, etc., are of an interesting and useful character, as illustrating the recent developments in ship construction over the old methods.

CUNARD CO.'S SUBSIDY.—The annual subsidy paid to the Cunard Steamship Co. out of Navy Votes is £150,000, viz., £75,000 each in respect of the Mauretania and the Lusitania. In consideration of this payment the company is bound during the term of the agreement to hold all their vessels at the disposal of his Majesty's Government to be hired or purchased upon certain conditions. The agreement is for 20 years from 16th November, 1907.

THE ELECTRIFICATION OF RAILWAYS.*

AN IMPERATIVE NEED FOR THE SELECTION OF A SYSTEM FOR UNIVERSAL USE.

By GEORGE WESTINGHOUSE.

IN less than 25 years a new industrial and economic situation has been created by the development of apparatus to generate, distribute, and utilise electricity. Not less than 2,000 million dollars have been invested in plants to manufacture apparatus, in power houses to generate electricity, in lines of copper wire to transmit this mysterious energy, in construction of railways and their equipment, and in the manufacture of products unknown before the advent of electricity.

It is my intention in this paper to direct attention to the necessity for the very early selection of a comprehensive electrical system embracing fundamental standards of construction which must be accepted by all railway companies in order to ensure a continuance of that interchange of traffic which, through force of circumstances, has become practically universal, to the great advantage of transportation companies and of the public.

Although the facts clearly show the contrary, there exists a popular impression that the electrification of railways is a simple matter, and that it requires only decisions by boards of directors to ensure the immediate substitution of the electric for the steam locomotive.

The great difficulty in the electrification of standard railways is no longer the engineering problem of developing a locomotive and an electrical system which will operate trains, but it is a broad question of financial and general policy of far-reaching scope, considering the future electrification of railways in general as distinguished from isolated cases of limited extent, and requiring a combination of the highest engineering and commercial skill.

REQUIREMENTS FOR INTERCHANGE OF TRAFFIC.

To ensure interchange of traffic, the fundamental requirements, so far as operation by steam is concerned, with full regard for safety, speed, and comfort, are very few in number and are covered by the following:—

(*a*) A standard gauge of track.

(*b*) A standard or interchangeable type of coupling for vehicles.

(*c*) A uniform interchangeable type of brake apparatus.

(*d*) Interchangeable heating apparatus.

(*e*) A uniform system of train signals.

The additional fundamental requirements for electrically-operated railways are:—

(*f*) A supply of electricity of uniform quality as to voltage and periodicity.

(*g*) Conductors to convey this electricity so uniformly located with reference to the rails that, without change of any kind, an electrically fitted locomotive or car of any company can collect its supply of current when upon the lines of other companies.

(*h*) Uniform apparatus for control of electric supply whereby two or more electrically fitted locomotives or cars from different lines can be operated together from one locomotive or car.

Outside of economy in capital expenditure, and economy and convenience in operation by steam or electricity, it matters not whether each locomotive and car and the apparatus upon them differ from every other locomotive and car in size or details of construction, so long as the constructions are operative and the materials employed are used within safe limits.

DEVELOPMENT OF ALTERNATING-CURRENT APPARATUS.

Having acquired a considerable experience in the introduction upon railways of the compressed air brakes and in the development of automatic electro-pneumatic signals, I was led in 1885, because of its general analogy to operations with which I was familiar, to interest myself in the American patents of Gaulard and Gibbs (a Frenchman and an Englishman), covering a system of electrical distribution by means of alternating currents, with static transformers to reduce these currents from the high voltage necessary for economical transmission of electrical energy to the lower voltages required for the operation of incandescent lamps and other purposes.

No inventions ever met with greater opposition in their commercial development than those relating to the generation, distribution, and utilisation of alternating currents, and it is a matter of record that the opponents of those interested in developing the alternating system even sought, through public meetings and the appointment of commissions, and by various extraordinary means, to influence and prejudice public opinion.

Realising the limitations of the continuous or direct-current system, I became thoroughly convinced that the extended distribution of electricity for industrial purposes could be secured only by the generation of alternating currents of high voltage and their conversion by static transformers into currents of various voltages. Notwithstanding, therefore, the frank disbelief in its practical value by eminent scientific authorities, among them the late Lord Kelvin, I entered actively into the development of the alternating-current system of generation and distribution of electricity which is now almost universally accepted as the ideal.

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* Abstract of a paper read before the Institution of Mechanical Engineers and the American Society of Mechanical Engineers, July, 1910.

By 1888 Nikola Tesla had demonstrated the practicability of his induction motors, Oliver B. Shallenberger had perfected his meter for measuring alternating currents, and it had been proved that a direct-current motor with laminated armature and fields could be operated either by alternating or by direct currents. I then became thoroughly imbued with the belief that further invention and discovery would in time make alternating-current apparatus practically universal for almost every purpose.

In 1892 two single-phase motors of about 10 H.P. were built by the Westinghouse Co. to determine the possibilities of using alternating current for traction work. These motors were designed for 2,000 alternations per minute and about 200 volts. They were of the series type, with commutators, and had a relatively large number of poles. These were placed upon a car and tested on a short piece of track with very short curves and rather steep grades. There was a transformer on the car on which there were several taps and the voltage was varied by means of single-pole switches. It was considered at that time that the system would be ideal for locomotive work, but as there were no such projects in view, no large motors of this type were built.

All so-called continuous or direct-current generators really generate alternating currents and transform them by a commutator into continuous current, and such a machine will by the application of collector rings upon its armature deliver both alternating and continuous currents. The use of the commutator, however, so limits the voltage that large quantities of power cannot be generated for economical transmission by direct current. A machine so constructed can also receive alternating currents through the collector rings and transform them into direct current. As thus used, the apparatus is called a rotary converter. When the supply of alternating current is at very high voltage, there has to be interposed between this supply and the rotary converter a static transformer to reduce the high primary voltage to the permissible lower voltage.

Electrical Systems for Railways

As soon as these qualities of the alternating current had been demonstrated, active minds were directed toward the development of apparatus to meet conditions constantly presenting themselves, among the most important problems being the electrification of railways. In the 20 years that have elapsed, three important electrical systems for the operation of railways have been put into practical operation, all using alternating current in whole, or in part. These systems are:—

(*a*) The continuous or direct-current system, usually spoken of as the "third-rail" system, which employs alternating current for transmitting power when the distance is considerable.

(*b*) The three-phase alternating-current system with two overhead trolley wires.

(*c*) The single-phase alternating-current, high-tension system with a single overhead trolley wire.

In a notable case of the latter system, namely, that of the New York, New Haven, and Hartford Railroad, the motors and controlling apparatus are arranged to utilise single-phase current from an overhead trolley wire at 11,000 volts, and also to be operated by current from the 650-volt third-rail system of the New York Central and Hudson River Railroad, thus making a demonstration of the wonderful flexibility of alternating-current apparatus.

The problem before the officials of the New Haven road was not merely the electrification of a division of a few miles of its track, rendered compulsory by legal requirements, but the selection of a system which would meet the needs of a great railway covering several States and having other congested centres of traffic which it might soon be desirable to electrify. In view of the fact that there had been no considerable demonstration of the single-phase system by actual use, and that the New Haven trains would be obliged to operate upon 12 miles of lines already equipped with the direct-current third-rail system, it must be conceded that the directors and management of the New York, New Haven, and Hartford Railroad showed great courage and confidence in the judgment of their experts, and rendered to all other railroads a service of the highest character, when they selected the single-phase system for the electrification of the line mentioned.

The results of the working of the three-phase system in Italy and Switzerland have been very prominently before the world for several years, and its successful use there has been a material factor in the development of confidence in electricity for the operation of railway trains. At the present time the Italian Government is installing upon the Giovi line, which is a heavy grade branch leading out of Genoa, a service for which 20 locomotives rated at 200 H.P. are now being constructed in Italy. The operation of this much more extensive plant will afford additional valuable information as to the cost of installation and operation and the advantages of the three-phase system.

The equipment of the power houses which generate the current is essentially similar in the three systems which I have enumerated, but the systems differ in the kind of motors and the auxiliary apparatus for controlling them, and in the methods and apparatus for transmitting the current from the power house to the locomotive or car.

(*To be continued.*)

LAUNCHES AND TRIAL TRIPS.

Boukadra.—On July 21st the steel screw steamer Boukadra, built by Messrs. Wm. Gray and Co. Ltd., to the order of Messrs. Frank C. Strick and Co. Ltd., of London and Swansea, for La Tunisenne Steam Navigation Co., of Paris, had her trial trip. The vessel has been built to Lloyd's highest class, and is of the following dimensions, viz.: Length overall, 362 ft.; breadth, 50 ft.; and depth, 25 ft. 11½ in. Triple-expansion engines have been supplied by the Central Marine Engine Works of the builders, having cylinders 24 in., 38 in., and 64 in. diameter, by 42 in. stroke, and two large steel boilers, adapted for a pressure of 180 lbs. per square inch, worked under Howden's system of forced draught. The port openings in the cylinders are large to ensure an easy passage for the steam, and so obtain the maximum efficiency from it. The engines are fitted with a "Contraflo" main condenser, a "Contraflo" atmospheric condenser being installed for the auxiliary machinery. A Morison surface feed heater, combined with oil and air extractor, is also fitted, the engine room auxiliaries, including a number of duplex pumps of the builders "C.M.E.W." type, being very complete and carried out in accordance with the requirements of the owners' superintendent engineer. The leading feature of the condenser design is a new method of temperature regulation, by means of which the air-withdrawing capacity of the air pump can be so adjusted to the demand that the thermal efficiency of the engines is at a maximum under all conditions of working, this arrangement having a favourable influence on economy. A speed of 11½ knots was obtained.

Eggesford.—On Saturday, the 16th July, this steel screw steamer, built by Messrs. Craig, Taylor, and Co. Ltd., Stockton-on-Tees, for Messrs. W. J. Tatem and Co., of Cardiff, was taken to sea for her trial trip, which proved highly satisfactory. The vessel is of the following dimensions, viz.: 373 ft. by 51 ft. by 23 ft. 6 in. moulded. She is built of steel to the highest class in Lloyd's under special survey. The engines have been constructed by the North-Eastern Marine Engineering Co. Ltd., Sunderland, the cylinders being 25 in., 42 in., 68 in., by 45 in., with two large steel boilers working at 170 lbs. pressure. During the whole of the trip everything worked with the greatest smoothness, and over a series of runs a speed of 10½ knots was maintained, the vessel at the time being fully loaded.

Tadorna.—The Tadorna, the latest addition to the fleet of the Cork Steamship Co. Ltd., of Cork, went for a very successful trial trip off the Tyne on Tuesday, 26th July. The steamer has been built and engined by Swan, Hunter, and Wigham Richardson Ltd. at their Neptune Works, Newcastle-on-Tyne. She is 275 ft. in length by 36 ft. beam. She is fitted with triple-expansion engines, supplied with steam by two boilers, which have also been constructed by Swan, Hunter, and Wigham Richardson Ltd. at the Neptune Works. During the trial trip the machinery worked without the slightest hitch, giving satisfaction to all concerned, and driving the vessel at a speed of over 12½ knots per hour. Immediately on the conclusion of the trial the vessel sailed under the command of Capt. Walsh for Rotterdam, where she will commence her service between Manchester, Liverpool, and Dutch and Belgian ports.

Indian Prince.—This new screw steamer, built by Messrs. John Readhead and Sons Ltd., West Docks, South Shields, to the order of the Prince Line Ltd., of which Mr. James Knott, M.P., is managing director, has been taken to sea on her official trial trip. The vessel is of the following dimensions: Length, 352 ft.; breadth, 46 ft. 2¼ in.; depth moulded to shelter deck, 31 ft. 8½ in. She is of a superior type, and is built to Lloyd's highest class and under their special survey during construction. The engines and boilers have also been constructed by Messrs. John Readhead and Sons Ltd., the cylinders of which are 25 in., 42 in. and 69 in. diameter, by 45 in. stroke, steam being supplied by two large steel boilers of 180 lbs. pressure, and fitted with Howden's forced draught. The engines and boilers have been built to the Board of Trade as well as Lloyd's requirements. Special winch, condenser, double-cased funnel, independent feed pumps, increased diameter of shafting, and other specialities adopted by the Prince Line, have also been fitted by the builders. The vessel was run several times over the measured mile, the trial being in every way successful to both owners and builders.

San Remo.—The new steel screw steamer San Remo, built by Messrs. Wood, Skinner, and Co. Ltd., Bill Quay-on-Tyne, to the order of Mr. Otto Thoresen, of Christiania, Norway, for his special trades, left the Tyne on Saturday, July 23rd, for her official trial trip. This vessel is of the single-deck type, with large carrying capacity, and has poop, extended bridge, and top-gallant forecastle. She has been built to the requirements and under special survey of Norske Veritas for their highest qualification. The propelling machinery, which has been constructed and fitted at the Northumberland Engine Works of Messrs. the North-Eastern Marine Engineering Co Ltd., Wallsend-on-Tyne and Sunderland, consists of a set of their latest type of triple-expansion engines, having cylinders 20 in., 33 in., and 54 in., with 36 in. stroke, steam being supplied by two large steel boilers working at a pressure of 180 lbs. per square inch. During the trial run the machinery worked most satisfactorily, a mean speed of nearly 11 knots being easily maintained.

Canadian Transport.—On Tuesday, 26th July, the steel screw cargo steamer Canadian Transport, built by Sir Raylton Dixon and Co. Ltd., of Cleveland Dockyard, Middlesbrough, to the order of the Empire Transport Co. Ltd., London, proceeded to sea for her official trials. The vessel is of the single-deck type, with poop, bridge, and top-gallant forecastle, and has been constructed under special survey to class 100 A1 at Lloyd's. Her principal dimensions are 377 ft. 6 in. by 51 ft. 2 in. by 28 ft. 4½ in. moulded, and she will have a deadweight carrying capacity of over 7,400 tons on a light draught of water. Triple-expansion engines having cylinders 25 in., 40 in., and 67 in., by 45 in. stroke, supplied with steam by three large single-ended boilers working at 180 lbs. pressure, have been fitted by Messrs. Richardson, Westgarth, and Co. Ltd., Middlesbrough.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2257. **Welding by the Electric Arc.**—I should be glad to hear of a practical book on the subject of welding by electric arc. In the absence of such a book, would any reader say whether a rotary transformer or a storage battery would be the better means of reducing a voltage of 220 continuous to the proper voltage for welding plates up to, say, ¾ in. thick, and what current would be required?—DYNAMO.

2258. **Boosters.**—Will a reader kindly give me some working data for boosters for supplying the extra volts when charging accumulators from dynamos used on lighting circuits; also diagram of connections for same?—ATTENDANT.

2261. **Manganese and Chrome Steel.**—I shall be very much indebted to any reader for a reliable method for distinguishing manganese and chrome steel from ordinary cast steel, and from each other?—M. K. H.

2268. **Dimensions of Engine.**—Should esteem it a great favour if any reader could give me suitable dimensions for inlet, transfer, and exhaust ports for two-stroke engine 2¾ in. bore by 3 in. stroke, also compression ratios in cylinder and cylinder case. Do you know of any simple method of ascertaining these dimensions?—A. P. S.

2269. **Brazing Sheet Brass.**—Can a reader of *The Practical Engineer* inform me of a firm where I can buy metal suitable for brazing sheet brass up to $\frac{1}{32}$ in.? Also metal for repairing aluminium utensils, or books relating thereto?—F. T.

MISCELLANEA.

H.R.H. PRINCESS LOUISE, Duchess of Argyll, has graciously consented to become the patron of the School of Art Wood Carving, South Kensington.

NATIONAL GAS ENGINE.—Dividend at the rate of 5½ per cent per annum on the preference shares and at the rate of 20 per cent per annum on the ordinary shares.

SUEZ CANAL.—The traffic through the canal for the month of June was: Total vessels, 335; total tonnage, 1,239,146; revenue (francs), 9,723,235.

WE have been favoured with a copy of the *Vacuum Review*, a periodical published by the technical department of the Vacuum Oil Co. Ltd., Caxton House, London, S.W. It is an illustrated quarterly, containing articles upon various tests carried out upon oils and other matter, well worthy of attention by engineers.

THE cruiser Ikoma, which has lately arrived in the Thames as a special envoy to honour the Japan-British Exhibition, is the first Japanese warship ordered abroad since the Japanese-Russian War. The vessel was built at the Imperial Dockyard, Kure. After visiting Portsmouth and Plymouth she will return to Japan, starting on August 16th.

DOCK WORKS.—A sum of £60,000 is to be spent on providing safe launching accommodation for the White Star liners Olympic and Titanic and also in deepening the Victoria Channel. Messrs. Harland and Wolff Ltd. are also strengthening Victoria Wharf at a cost of £10,000. This work, though necessary, has been hastened by the liners.

THE fifth annual meeting of the Automobile Association was held on July 19th at the Hotel Cecil, London, Sir Archibald J. Macdonald presiding. The annual report furnished evidence of the progress of the association. The membership, it stated, was over 14,000, some 4,000 members having joined during the year. The work of the association had been extended to Ireland.

ENGINEERING AND MACHINERY EXHIBITION, MANCHESTER, OCTOBER 14TH TO NOVEMBER 5TH, 1910.—The Rt. Hon. Sir George Reid, High Commissioner for the Commonwealth of Australia, is coming to Manchester for the purpose of opening this exhibition, and we understand that during his visit to Manchester he will be accorded an official reception by the Corporation.

THE Government Trade Commissioner for Canada reports that it is proposed to establish at Sydney, Nova Scotia, a steel shipbuilding plant and a floating dock, and repair, wrecking, and salvage plant. The dock will be of the second-class sectional steel pontoon floating type, capable of taking a vessel of 15,000 tons. It is also proposed to erect a steel marine slip capable of hauling out a ship of from 4,000 to 5,000 tons.

NORMANBY IRONWORKS.—Net profits for the year ended June 30th, £15,745, less adverse balance of £936 brought forward. A dividend of 6 per cent is recommended on the preference shares, bringing the arrears up to June 30th, 1909. It is also proposed to write off half of the past year's special expenditure (£6,788), and add £2,500 to the depreciation fund, carrying forward £1,921.

PRESENTATION.—Mr. F. W. Bridges, the organiser of the Naval, Mercantile Marine, and General Engineering Exhibition, to be held at Olympia in September next, has just had the satisfaction of receiving a very handsome illuminated address, which was presented to him at the final meeting of the Advisory Council of the Printing Exhibition by all the exhibitors as a mark of their appreciation of the efficiency, unfailing courtesy, and distinguished success of his management.

SCHEME FOR DEVELOPMENT OF HOKKAIDO, JAPAN.—With reference to the notice on page 159 of the *Board of Trade Journal* of 28th October, 1909, relative to a scheme for the development of the Hokkaido, H.M. Acting Vice-Consul at Hakodate (Mr. G. M. Royds) has forwarded a memorandum on the scheme, which has now been sanctioned by the Japanese Diet, compiled from a recently-issued official report. The scheme provides for an expenditure of 70,000,000 yen (£7,145,800), spread over a period of 15 years from 1910. The fund set up is divided into six main divisions, providing for (1) immigration (£655,840); (2) encouragement of industries, etc. (£287,634); (3) construction of roads and bridges (£2,598,620); (4) improvement of lands (£247,070); (5) river conservancy (£1,049,746); and (6) improvement of harbours and bays (£2,306,890). Under the last-mentioned heading, harbour works are to be carried out at Rumoe, Hakodate, Abashiri, Wakkanai, Muroran, and Nemuro. Particulars are given of the works to be executed at Hakodate, estimated to cost £170,500, and at Rumoe, to cost £400,500. The memorandum may be seen by British firms at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

PATENTEES' CHRONICLE

OF

Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

JULY 23rd, 1910.

17483 Swath turner. Austin.
17484 Blood pressure instruments. Hawksley.
17485 *Automatic door locking apparatus. Heys and Ducket.
17486 Cams. Johnson, Hurley, and Martin Ltd.
17487 Cycle head locks. John Marston, Ltd.
17488 Sheet metal receptacles. Taylor.
17489 Railway door safe lock. Brownlow and Lever.
17490 Collars. Kalson.
17491 Folding easel. Lord.
17492 Motor dust attachment. Partington.
17493 Treatment of brewery residue. Andreas.
17494 Saws. Junge.
17495 Bobbin changing device. Gabber.
17496 Improved screw. Holman.
17497 Advertising device. Sibley.
17498 Tramcar trolley changing connection. Clapham.
17499 Automatic reducing valve. Latham and Cooles.
17500 Advertising device. Marshall and Fuller.
17501 Pnematic tyres. Swift.
17501 Submarine. Ralcan.
17503 Revolving heel tips. Schofield.
17504 Ottoman couch. Williams.
17505 Boot sewing machines, etc. Bates and British United Shoe Co.
17506 Shaft protection from water action. Continental Tyre and Rubber Co. and Willenius.
17507 *Improved priming or paint. Earle and Fenelon.
17508 Motor car control device. Moore.
17509 Electric ovens. Thomas.
17510 Aeroplane. De Courcy.
17511 *Friction clutch. Albion Motor Car Co. Ltd.
17512 Plate doubling machine. Summers.
17513 Cord parcel protector. Hermann.
17514 (?) Motor car device for curves. Molyneux.
17515 Rock drills. Nicholson and Devenport.
17516 *Water heaters. McLaughlin.
17517 Water heater gas regulator. McLaughlin.
17518 Combination plug tap. McLaughlin.
17519 Furnace fire bridge. Sargeant and Baker.
17520 Boot attachment. McQue.
17521 Ratchet wrenches. Fuller.
17522 *Internal-combustion motors. Altenhoff.
17523 *Telegraph relays. Judd and Hardie.
17524 *Concrete mixer. Pocock.
17525 *Breech mechanism. Krupp, Akt.-Ges.
17526 Milk apparatus. Bryan and Noble.
17527 Aeroplane device. Chidell.
17528 *Furnace fire bridges. Butterworth and Philp.
17529 Belt gripping composition. Shufflebottom and Kenworthy.
17530 Detachable wheels. Jackson.
17531 Change box motion for looms. Hacking and Hibbert.
17532 Tram and rail time indicators. McClean.
17533 Window fasteners. Frampton.
17534 Clock dials. Bosman.
17535 Rotary engine or pump. Adams.
17536 *Waist band fastener, etc. Aufermann.
17537 Carriage heating and ventilating. Stone and Darker.
17538 *Electrical cooking vessel. Cooper.
17539 Pipes for conveying abrasive material. Clark.
17540 Pneumatic tyres. Shaw.
17541 Door closing devices. Stamm.
17542 Davit gear. Preston and Allen.
17543 Locks and latches. Harris.
17544 *Life saving apparatus. Lentz.
17545 Steam engine lubrication. Wakefield.
17546 Turbines. Da Costa.
17547 *Coke ovens. The Otto Coke Oven Co. Ltd.
17548 *Separating tar from gases. The Otto Coke Oven Co. Ltd.
17549 *Automatic small arms. Bloxam.
17550 Expression of liquids from solids. Berrigan.
17551 *Transferring coloured impressions. etc. Rosier.
17552 Aerial propellers. Wrench.
17553 Curtain hanging device. Best.
17554 *Massage apparatus. Johansen.
17555 Capping tins, etc. Waller.
17556 Absorber. Tyler.
17557 Sensitive balance. Zuckermann.

JULY 25th, 1910.

17558 Hat presses. Ashworth.
17559 *Folding boxes. Volz.
17560 Steam generators. Bone.
17561 Bottle filling machines. Meadowcroft
17562 Dust removing device from cereals. Fowler.
17563 Cyclist's boot attachment. Lacy.
17564 Anti-rheumatic rings. Jenner.
17565 Detachable wheel rims. Boulton.
17566 Hairpins. Bettney.
17567 Hub gears. Slaughter.
17568 Satchels and bags. Anderson.
17569 Self-closing measuring tape. Bow.
17570 Ship and air propellers. Pickles.
17571 Improving grain of leather. Forster.
17572 Iron and steel construction. Yeeles.
17573 Wheel resilience. Culverwell.
17574 Fur hat machines. Wilson.
17575 *Gas recording apparatus. Cross.
17576 Submarines. Macnamara.
17577 Wheels for vehicles. Brown.
17578 Portable kettle and stand. Soutter.
17579 Hanging book carrier. Trantner.
17580 Combination instrument and rule. Lamont.
17581 Folding scaffold or trestle. McCormick.
17582 *Turbines. Clark.
17583 Fairy lamps. Clifton and Freckleton.
17584 Loose-leaf ledgers. Miller.
17585 Washing machine. Tatton.
17586 Casement fastener. Reoch.
17587 Zinc extraction from ore. Beauchamp.
17588 Motor hood fitting. Smith.
17589 Respiration apparatus. Blackett.
17590 Rolling mills. Blakesley.
17591 Flying machines. Swingler, junr.
17592 Liquid receptacles. Huckle.
17593 Soap substitutes. Bartelr.
17594 *Separation of solids. Du Pont.
17595 *Separation of solids. Du Pont.
17596 *Treatment of hides. Browne.
17597 *Electric brakes. Cross.
17598 Box closing device. Champerois.
17599 *Hand bag. Theuser.
17600 *Tin opener. Minte.
17601 *Separation of solids. Du Pont.
17602 *Liquid recoverer. Du Pont.
17603 *Separation of solids. Du Pont.
17604 *Skirt cutting chart. Robin.
17605 *Perforating metals. Boulr.
17606 Trolleying perambulators. Woakes.
17607 *Shoe forming machine. McFeely.
17608 Displaying advertisements. Boles.
17609 *Gravity liquid separation of ores. Du Pont.
17610 *Dental appliance. Hackett.
17611 Steam generators. Da Costa.
17612 Controlling submerged bodies. Da Costa.
17613 Rubber heel pads. Taylor.
17614 *Dyestuffs. Bloxam.
17615 *Colour cakes. Bruning.
17616 Motor transmission gear. Beacham.
17617 Buckets, etc. Smith.
17618 *Liquid separation of solids. Du Pont
17619 Oil separator. Egelin.
17620 Lighting motor lamps. Whittall.
17621 *Rubber heel pieces. Paber.
17622 *Clocks. Phimiy.
17623 *Dust separator. Baldwin.
17624 *Magnetic measuring instruments. Dunoyer.
17625 *Liquid separation of solids. Du Pont.
17626 Self-levelling bunks. Bonzaier.
17627 *Folding garment stretcher. Lowther.
17628 Oxygen manufacture. Harger.
17629 Water displacing apparatus. Mullan.
17630 *Capping bottles. McViety and Nilson.
17631 *Preserving jars. Greensill.
17632 *Titaniferous iron ores. Larsen.
17633 Lifting apparatus. Morris.
17634 Aeroplanes. Vernham.
17635 *Cigars. Wolf.
17636 Signalling devices, Christopher.
17637 Vapour burning lamps. Gray.
17638 Flying machines. Twining.
17639 *Treatment of tar. Bartel.
17640 *Preservation of porous bodies. Bartel.
17641 Secondary batteries. Haravodine.
17642 *Improved garment seam. Bratke.
17643 Hat fastenings. Haslam.
17644 *Breathing appliances. Fleuss.
17645 *Treatment of waste rubber. Allsebrook and Alpine.
17646 *Building foundations. Considère.
17647 *Steel manufacture Heskett.
17648 *Bolt locks. Lindner.
17649 *Belt pulleys. Sloor.
17650 *Electric furnace. Helfenstein.
17651 *Nut locks. Greer.
17652 Amusement apparatus. Owen.
17653 Controlling helicopters. Smith and Philaerian.
17654 *Supporting vehicle frames. Kortz.
17655 Hornless cabinet gramophone. Williams.
17656 Carriage door locking device. Barrow.
17657 Self-extinguishing match. Heseltine.
17658 Electric switches. Venner and Griesbach.
17659 Side delivery rakes, etc. Bamford.
17660 Sign letter manufacture. Atlas Bedstead Co. and Bladen.

JULY 26th, 1910.

17661 Vacuum door lock. Fryat and Powell.
17662 Cycle carriers. Ashby.
17663 Pneumatic throat valve. Wright.
17664 Spoon support in jars. Paul.
17665 Air humidifying device. Stott, Heywood and Schofield.
17666 *Type casting machine. Homans.
17667 Gas engine fault detector. Harris and Jackson.
17668 Aeroplane. Booth.
17669 *Collapsible table. Riley.
17670 Metal balconette. Conway.
17671 Carburetters. Rotherham and Johnson.
17672 Aerial propellers. Jones.
17673 Milk churning apparatus. McLarty.
17674 Window blind and roller attachment. Cowan.
17675 Picture supports. Head.
17676 Spades, shovels, etc. Park.
17677 Internal-combustion engines. Leicester.
17678 Trouser stretcher. McHarrie.
17679 Boot nailing machine. Heaton.
17680 Weir shutters. Ashford.
17681 Sluice gate rollers. Ashford.
17682 Combustion engine valves. Fielding.
17683 Lace comb machines. Walker.
17684 Heating apparatus resistances. Venner.
17685 Boot clips. Hodgkinson.
17686 Galvanic batteries. Richmond.
17687 Hose pipe clips. Girling.
17688 Motor gear box attachment. Orleans Motor Co. and Jenner.
17689 Body roller for horses. Chennell.
17690 Tramcar guide rope device. Ashworth.
17691 Internal-combustion engines. Bell.
17692 Motor change speed gears. Bell.
17693 Steam hammer valves. Massey and Clayton.
17694 Electrical fuses. Malson.
17695 Door draught excluder. Loxham.

17696 Gas or vapour apparatus. Fowler and Medley.
17697 Motor traffic signal. Gaston.
17698 Folding lavatories. Levick.
17699 Golf ball core-winding device. Whitesmith and Milne.
17700 Wire gate. Warnes.
17701 Confetti distributor. Townley.
17702 Flower stand. Hunter.
17703 *Casement fastener. Yorks.
17704 Cutting blanks for paper bags. Ross.
17705 Paper bag machine. Ross.
17706 Quarry picks, etc. Torbut.
17707 *Motor steering gear. McDonald.
17708 *Cycle brakes. Yoxall.
17709 *Grinding bottle necks. Forrester.
17710 Slow combustion engines. Jobson.
17711 Lamp brackets or pendants. Wolf, Foden, Bowbury and Bernardy.
17712 *Gas pressure apparatus. Tremlett.
17713 Automatic advertising device. Huckle.
17714 Transmission gears. Dailey.
17715 *Carpenters' benchs. Greaves.
17716 *Measuring rules. Bargery.
17717 *Draining rack. Cooper.
17718 Submarine indicator. Angers.
17719 Submarine life-saving device. Angers.
17720 Flying machines. Scurdy.
17721 Consolidating small diamonds. King.
17722 Broom and brush tidy. Adams.
17723 Tramway rails, etc. Stubbs.
17724 *Resilient wheels. Gammon.
17725 *Flood protection. Alexander.
17726 *Hob grinding machines. Caturce.
17727 *Load transferring apparatus. Miller.
17728 *Gas turbines. Freysag and Alexander.
17729 *Motor plough road wheels. Standinger.
17730 Glass frame presser. Piercy.
17731 *Motor speed controller. Siemens Bros.
17732 Coke improvements. Jones.
17733 *Luminous signal indicator. Viette.
17734 *New caoutchouc substance. Bayer.
17735 Airships. Eppstein.
17736 *Coin-controlled mechanism. Ballard.
17737 *Clockwork advertising devices. Schneider.
17738 *Cone and tube winder. Comings.
17739 Removable handle for bottles, etc. Nash.
17740 Drying and heating apparatus. Hines.
17741 Copping rails of twining jennies. White.
17742 Boat construction. Rough.
17743 Combination match box. Willmott.
17744 *Speed bell alarm indicator. Dutordoir.
17745 *Spark plugs for combustion engines. Cherry.
17746 Outer pneumatic tyre covers. Allasia.
17747 Fertilising. Mordey and Hansard.
17748 Crushing machines. Jack.
17749 *Grain ventilator. Goettel.
17750 Improved wheel. Chapman.
17751 *Cement pipe moulds. Zwicher.
17752 Boot hammer apparatus. Tierney.
17753 *Tube cleaner. Vickers, Sons, and Maxim and Matthews.
17754 Fire escape. Batts.
17755 *Oil lamps. Dryden.
17756 Colouring solid substances. Kenna.
17757 *Music sheet holder. Dow and Bennett.
17758 Spring wheels for vehicles. Williams.
17759 Telephone line laying device. Leete.
17760 *Pipe joints. Doulton and Morris.
17761 *Motor differential mechanism. Perman.
17762 *Combined throttle valve and oiler. Lake.
17763 Turbine blades. Stettiner, Masc. Act.-Ges.
17764 Internal-combustion engines. Whildbourne and Lishman.
17765 *Seed separator. Pawlowitsch.
17766 Gas fuel generator. Southey.
17767 Gas fuel generator. Southey.
17768 Printers' frames. Strachan.
17769 Checking target holes. Jones.
17770 *Lead pigments. Ramage.
17771 *Clothes cleaning machine. Nevels.
17772 *Door hangers. Mann.
17773 Rope and stay tightener. Stone and Jakeman.
17774 Invalid handling device. Skeffington.
17775 Vehicle wheels. Whitehead.
17776 *Aeroplanes. Penteads.
17777 Cycle inner tubes. Thorn.
17778 *Cork body and extractor. Balliet, Schaffer, and Hunsberger.
17779 *Gas heaters. Withers.
17780 *Gas heaters. Withers.
17781 *Gas burners. Withers.
17782 *X-Ray screen. Myers.
17783 *Rotary engines. Franklin.
17784 *Plastic form tapering apparatus. Pemberton.
17785 Treatment of siliceous zinc ores. Dice.
17786 Automatic milling machinery. Evans.
17787 Water purifying apparatus. Siemens Bros. Ltd.
17788 Advertising device. Harding.
17789 *Scratch headed fuses. Gillies and McPhee.
17790 Amusement apparatus. Willson.
17791 *Steam boilers. Barrow.
17792 Hand tools. Preston.
17793 *Spray producer. Andreas and Wolf.
17794 *Grain decorticator. Grohs.
17795 Shaft hangers. Haddan.
17796 *Non-oxidising paints. Cline.
17797 *Smoke purifying apparatus. Cline.
17798 *Pneumatic percussive implements. Wittekind.
17799 *Forge hammers. Schmidt and Hugo.
17800 Removing drain obstructions. Jobson.
17801 Folding cabinets, etc. Hanff.
17802 Boiler clack valve. Cooke.
17803 Wheel rims. Baier, Clark, Stalyenberger and Gardner.

JULY 27th, 1910.

17804 Steam turbine blades. Thomson.
17805 Golf balls. Waggott.
17806 Colling and heating apparatus. Hadfield and Eccles.
17807 Compressed air cylinder scavenger. Cotterell.
17808 Bolt staple. Hausing.
17809 *Oxygen mixtures. Zeiss.
17810 Securing cabinet handles. Harrison.
17811 Belt buckles. Martin.
17812 Belts. Martin.
17813 Internal-combustion engines. Whidbourne and Lishman..
17814 Cricket bats. Moren.
17815 Carpet dust cleaning device. Marsh.
17816 Ball game. Paterson.
17817 Bleaching of fats. Knecht and Petraczek.
17818 Fusible cut-outs. Hope.
17819 Electrical cord grips. Goldstone and Lightfoot.
17820 Map displayer. Waigh.
17821 *Submarine boats. Lake.
17822 Bedstead fittings. Moore.
17823 Signalling apparatus. Lomas, Ashton, and Hughes.
17824 Time recording apparatus. Lomas, Ashton, and Hughes.
17825 Ferro-concrete construction. Burnett.
17826 Brakes and clutches. Fletcher and Atkin.
17827 Boot protector. Tilly.
17828 Choppers or axes. Dixon.
17829 Engineers' stand. Berry.
17830 Locomotive smoke boxes. Berry.
17831 Ventilation of railway carriages. Berry.
17832 Umbrella clip. Angell.
17833 *Potato digger. Watson.
17834 *Plate cleaner. Fagerlund and Borjesson.
17835 *Projecting lantern slides. Beaudouin
17836 *Fire extinguishers. Taylor.
17837 Electro-plating. MacFarlane.
17838 *Roller castor. Bassett.
17839 Night lights. Segal.
17840 Nails. Hill.
17841 Military equipments. Mills Equipment Co. and Wise.
17842 Hair dressing device. Paterson.
17843 Tip-up seats. Paterson.
17844 *Adjustable propellers. Havilland.
17845 Miniature traction systems. Winteringham.
17846 Drawing apparatus. Winteringham.
17847 Boots and shoes. Thompson.
17848 Door locks. Beresford and Pryce.
17849 Woodworking machinery. Haigh and Sharmer.
17850 Drills. Osborn.
17851 *Jewellers' gripper. Silé.
17852 Axle bearings. King.
17853 Waterproof seat. Lawson and Tom.
17854 Hydraulic valves. Rice.
17855 Distance measurer. Purvis, Hall, and Leach.
17856 Ladies' hat boxes. Atkinson.
17857 Pneumatic tyres. Schulainère.
17858 *Internal-combustion motor. Lamplough.
17859 Linen collars. Rice.
17860 Chimney pots. McCarrick.
17861 Closet disinfector. Reynolds.
17862 *Pneumatic hammers. Belgian Pneumatic Tool Co.
17863 *Turbines, pumps and compressors. Kienast.
17864 Centrifugal fan casings. Cousans.
17865 Combustion engine valve gear. Hay.
17866 *Weavers' knot device. Bajer.
17867 Anti-rheumatic socks. Almond.
17868 Grain drier. Brown.
17869 Sealing cans or tins. Thompson.
17870 *Tanks. Boult.
17871 *Silme drainer. Richter.
17872 *Cinematograph apparatus. Allysse.
17873 Removing and replacing electric bulbs. Upton.
17874 Electric traction systems. Munro.
17875 Rotary pumps, etc. Raworth and Browett.
17876 Internal-combustion engines. Tartrais.
17877 Tobacco pipes. Josephs.
17878 *Egg detecting device. Munro.
17879 Photograph developer. Forbes.
17880 Colour photography. Forbes.
17881 Gas burners. Withers.
17882 *Fenders. Shue.
17883 *Button fastener. Joachim.
17884 *Automatic piano actions. Lake.
17885 *Securing rail tracks. Winley.
17886 Printing on confectionery. Loza.
17887 *Tube fastener. Politz.
17888 Cleaning water mains. Adamson.
17889 Non-refillable bottles. Appleyard.
17890 Detachable wheels. Hurd.
17891 *Typewriting machines. Fairweather.
17892 *Typewriting keys. Fairweather.
17893 *Governing apparatus. Barton.
17894 *Swimming arrangement. Farkas.
17895 *Hinges. Hill.
17896 *Harvesters. Houck.
17897 *Printing sheet mechanism. Henderson
17898 *Treatment of flax, hemp, etc. Schewelin.
17899 *Separating solids from liquids. Madeley.
17900 *Flow of liquid through orifices. Madeley.
17901 *Mud remover. Madeley.
17902 Adjustable reflector. Belshaw.
17903 Boot clip. Kiefer.
17904 Electric switches. Scholefield.
17905 Combined button hook and shoe horn. Kirke.
17906 Tyre valve tester. Girling.
17907 Twin spring. Berry.
17908 Bell and gong pianos. Cracknell.
17909 *Ships' windlasses. Kelly.
17910 Match [illegible] device. Hall.
17911 Door bolts. Evered and Jefferson.
17912 Returnable envelope. Thorne.
17913 Boot lace fastener. McFarlane.
17914 Concentrating metals. Wynne.
17915 Switch device for tramways. Taylor.
17916 Garments. Humphreys.
17917 Electric light tracing copier. Alliott and Cheers.
17918 Hosiery stand. Waite.
17919 Sand moulds for castings. Harvey and Cubby.
17920 Cold water paste flour. Topping.
17921 Cylinder door locking device. Davis and Mather.
17922 Boilers. Yates.
17923 Acetylene generators. Lucas and Egginton.
17924 Wheel tyres. Rose and Rae.
17925 Weighing machines. Clayton.
17926 Flower holder. Crossley.
17927 Pumps. Wilkinson.
17928 Sheep shears. Haverland.
17929 Artificial whalebone. Tonning.
17930 Hat fastener. Besser and Scherzinger
17931 *Internal-combustion engines. Crossley and Webb.
17932 *Watches. Bassett.
17933 Interlocking device for hoists. Walker.
17934 Carburetters. Dunlop.
17935 Screw propellers. Halliday.
17936 Surgical truss. Day.
17937 Hopper for looms. British Northrop Loom Co.
17938 Shuttle mechanism. British Northrop Loom Co.
17939 Loom carriers. Hollingworth.
17940 Pneumatic tyres. Aldridge.
17941 Resilient tyres. Coir Tyre Co. and Rose.
17942 Motor alarm sounders. Renouf.
17943 Motor tyre covers. Cassell.
17944 *Tubular spirit levels. Zeiss.
17945 *Plant receptacle. Sexton.
17946 Cycle stands. Triumph Cycle Co. and Hathaway.
17947 Luggage cycle carriers. Triumph Cycle Co. and Hathaway.
17948 Music sheet turning mechanism. Stanley.
17949 *Distilling ovens. Bolz.
17950 Wardrobes. Jones.
17951 Curtain ring. Noble.
17952 Automatically selling newspapers. Harris.
17953 Piston rings. Oubridge.
17954 *Scrap metal compressor. London Electron Works and Kardos.
17955 View finder and level. Wollhein.
17956 Wheel holder. Robertson.
17957 Pneumatic tyres. Worth.
17958 *Calculating machine. Rauchwetter.
17959 Unloading coal. Fowler.
17960 Sea wall construction. Lynde.
17961 Pavilions, buildings, etc. Edelsten.

17962 *Submarine boat driving mechanism Schule.
17963 Boot and shoe pillar or stand. Hughes.
17964 Boot and shoe pillar Goff.
17965 *Draft gear. Hemmingsen.
17966 *Penholder. Guttorm, Son, and Hast.
17967 Pipe filler, scraper, etc. Rignall.
17968 Envelopes. Rignall.
17969 Aviators' shock shifter. Jones.
17970 New azo-dyestuffs. Newton.
17971 *Azo-dyestuffs. Bayer and Co.
17972 Railways. Drummond.
17973 Pistons. Knight.
17974 *Printing presses. Martin.
17975 Velocipedes. Pogh and Rudge-Whitworth Co.
17976 Window fasteners. Willis.
17977 Improved railway. Willis.
17978 Flue cleaner. Mower.
17979 *Crockery washer. Staines.
17980 *Ticket advertising device. Livingstone.
17981 Automatic advertising device. Huckle.
17982 Tobacco cartridges. Grierson.
17983 Internal-combustion motor. Lamplough.
17984 China clay. The Exploration Co. Ltd. and Salaman.
17985 Separators. Nicholson.
17986 Hydrocarbon machines. Smith.
17987 *Hand fire extinguisher. Schwarzhampt.
17988 Rubber stamps. Fairbrother.
17989 Swath turners. Thomas.
17990 Brazing tools. Bland and Young.
17991 Electric generator. Simpson.
17992 Cap wrenches. Dibben.
17993 Internal-combustion engines. Jones.
17994 *Telephone exchange circuits. Siemens Bros. Ltd.
17995 *Car controlling device. Siemens Bros. Ltd.
17996 *Compressing gas mixtures. Pawlikowski.
17997 *Sulphuric acid. Dior.
17998 *Alkaline carbonates. Dior.
17999 *Vehicle suspension device. Ringel.
18000 *Street lamp extinguisher. Wertz and Hinne.
18001 Stamp and label affixer. Kennedy.
18002 Stamp and label affixer. Abram.
18003 Stuffing boxes. Wells.
18004 *Salving sunken submarines. Lavezzare.
18005 Ball and socket adjustment gland. Pook.
18006 *Two-cycle engine. Mirault.
18007 Reciprocating pumps. Anderson.
18008 *Wearing apparel fastener. Veale and Longstaff.
18009 Pens and pencils. Longstaff.
18010 *Steels and other metals. Cinille.
18011 Furnaces and boilers. Morton.
18012 Contact mechanism. Hallstream.
18013 Biscuits, etc. Sich.
18014 Coals. Wacks.
18015 Sewing cotton reels. Schroeder and Thorley-Gibson.
18015 *Gas purifiers. Berlin Anh. Masc. Act. Ges.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to September 5th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

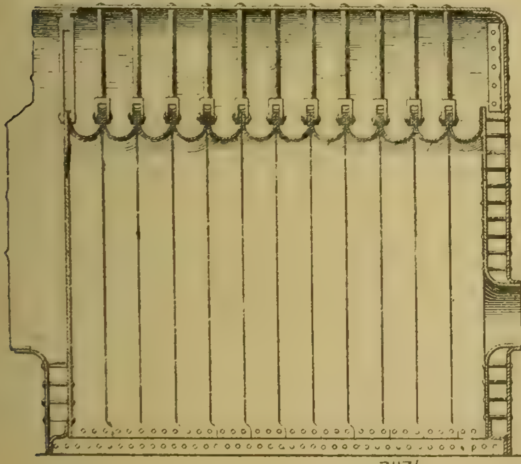
Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

4966 Parkinson: Pure air and germ proof ventilator. [Post-dated August 12th, 1909.] 6986 Smith and Reader: Gas and like cooking stoves.

7117 Jacobs and Shupert: Steam generators and fireboxes therefor.

With the primary object of considerably increasing the efficiency of the steam generators, the firebox crown sheet is made of individually complete and transverse U-shaped sections having their flanges fastened together and their surfaces on the opposite side from the water bulged away from the water, and stays connect the flanges with the outer shell whose side walls and also those of the crown sheet are vertical.

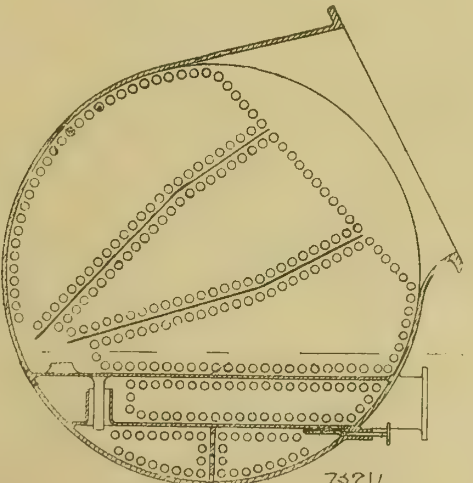


7117/09

7121 Berry: Apparatus for use in the distribution of alternating electric current. 7205 Zell: Automatic mechanism for changing bobbins, spools, and the like in the shuttles of looms for weaving.

7321 Morison: Apparatus for condensing steam. [Cognate Application. 21472, 1909. Request under Section 19 of the Act not granted.]

The condenser, or a main condensing compartment, provided with guide plates so disposed as to divide the cross section thereof into sections that are arranged in parallel, and each of which terminates in a narrow area in cross section as at the thin edge of a wedge, so that the aerated vapour in each section is caused to flow in a practically uniform and even manner through the sections and be guided directly towards and delivered uniformly into the next condensing compartment, or into the outlet chamber, as the case may be. The guide plates may be arranged in a more or less horizontal or inclined position, or in a more or less vertical or upright position, from near the steam inlet of the compartment, or suitably lower down, to the outlet or outlets therefrom, and be of flat, curved, or angular shape to suit the requirements of the particular condensing compartment in which they are placed. By these means the aerated vapour is not only equally distributed, but is uniformly guided to and concentrated at the point of discharge with a minimum of confusion or eddying.



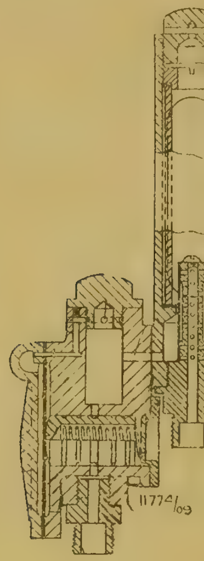
7321/09

7401 Link and Hyde: Type-casting machines. 7434 Robson: Apparatus, controllable from a distance, for automatically operating gas burners. 7481 Justice (Plant): Treeing devices for boots and shoes. 10012 Skeffington: Apparatus for handling invalids, deformed persons, or the like. 10013 Boult (Toledo

Computing Scale Co.): Weighing and computing scales. 11085 Ross: Strap fastener. [Post-dated November 11th, 1909.]

11774 Hamill: Liquid supply regulators. [Post-dated November 19th, 1909.]

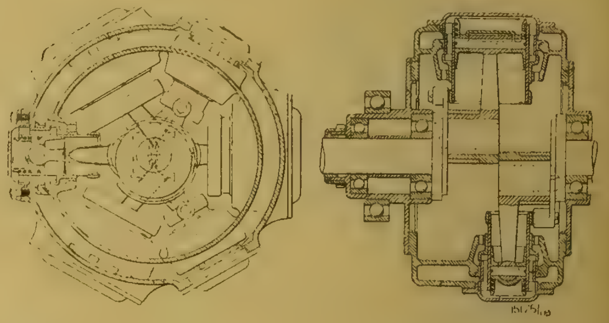
The regulator, which is interposed between the receiver and the liquid supply, is provided with a valve automatically controlled by the variations of a column of liquid in the regulator co-acting with elastic means, such as compressed air or springs, the liquid column being in connection with the source of supply and with the receiver and being maintained at or about a predetermined level independently of the diminution in the head or pressure of liquid in the supply tank or equivalent constituting the source of supply. The arrangement is such that any variation in the demand for liquid causes a corresponding variation in the level of the liquid column and actuates the valve, the supply being thereby automatically controlled according to the demand. In cases where the liquid in the receiver is to be maintained at a constant level, the regulator is fitted in position so that the predetermined level of the liquid column corresponds to the required level in the receiver, and means are provided for altering, if desired, the level of the column of liquid and also for adjusting the regulator in position when it is desired to vary the ultimate level of the liquid in the receiver.



12226 Feld: Treatment of metallic cyanides for the obtainment of hydrocyanic acid therefrom. 12249 Bennett: Tunnelling machines. 12266 Wynne: Process and apparatus for the separation of ores and the like. [Cognate Application, 27364, 1909.] 12377 Denton: Ring, washer, and disc-cutting machine. 12583 Bowing: Retorts for the production of gas and gas coke. 12666 Allery: Emergency apparatus for use with submarine boats. 12685 Field and Ferranti Ltd.: Generation, transmission, and distribution of electricity. 13371 Baxter: Ejecting mechanism for breech-loading guns. [Post-dated November 20th, 1909.] 14700 Fry: Trouser press and stretcher combined. 14722 Soc. Lacoste and Battmann: Motor-driven vehicles. [Date applied for under International Convention, December 12th, 1908.] 14772 Gower: Cleaning of buildings. 14780 Drucquer and Wattleworth: Indicating devices for use with adding, calculating, typewriting, and like machines, applicable also to printing and measuring machines. 14805 Wetter (Rutgerswerke Akt.-Ges.): Meta-cresol ortho-oxalic acid ester and process for the production of the same. 14812 Smallwood: Furnaces for heating metals, and which are also applicable for the roasting, calcining, and smelting of ores. [Cognate Application, 14813, 1909.] 14813. *See* 14812, 1909. 14814 Smallwood: Stoves, kilns, ovens, muffles, or other plant used for drying moulds and for other heating purposes. 14816 Smallwood: Water-tube boilers, economisers, and other plant in which heat is applied to a plurality of tubes. 14830 Seelau: Combined clocks and talking machines. 14833 Howgrave-Graham: Electric switches. 14880 Zambuhl and Hall: Cleansing and polishing liquid. [Post-dated July 7th, 1909.] 14903 Stone: Pressure gauging apparatus for indicating the liquid level and pressure in closed vessels. 14914 Hailwood: Miners' safety lamps. 14937 Grunwald: Electrical induction furnaces. [Date applied for under International Convention, October 2nd, 1908. Application for Patent of Addition to 3599, 1909.] 14956 Gillberg: Means for operating valves for a vapour burner. 14973 Blake: Gas controllers or regulators. 14975 Mattei: Resilient tyred wheels for vehicles. 14983 Sahm: Plate gratings. 14990 Boultbee: Aeroplanes, flying machines, gliders, and the like. 15003 Hutchinson, Hutchinson, and Forrester: Method of and appliances for vaporising petroleum or the like. 15008 Winder: Appliances for use in testing steel and the like. 15064 Jeffery: Repeating firearm. 15071 Lessing: Method of decomposing hydrocarbons. 15077 Willetts: Strainers for coffee pots and the like. 15082 Mills: Lids of tins, jars, and the like. 15086 Hansford and Wright: Apparatus for automatically establishing and cutting off the supply of electricity, gas, or other fluid. 15102 Tyrrell and Jensen: Means for automatically closing and locking the doors of railway cars and such like vehicles. 15111 Schooling and Wykeham-Fiennes: Indicating appliances. 15142 Wyler, and Levinstein Ltd.: Dyestuffs of the indigo series and the production thereof. 15144 Shaw: Domestic fireplaces. 15167 Potts: Telegraphy.

15175 Lamplough: Hydraulic transmission of power.

Radial cylinders are employed which are fixed to and rotate with the casing. Each shaft is provided with an ordinary crank, one of which is connected to the pistons of the primary motors and the other is connected to the pistons of the second set of motors. By this construction the apparatus automatically adjusts itself to varying loads without employing any special device to control the automatic action. When the apparatus is started the primary motors are driven by the crank on the driving shaft, and as they are of smaller capacity than the second set of motors, these latter operate at a reduced speed and rotate the driven shaft at a reduced speed. As the resistance decreases, the flow of liquid gradually decreases, due to the casing rotating at an increased speed, until finally the casing and two shafts all rotate at the same speed, when the motors cease to operate and the whole mechanism rotates as a solid piece.



15204 Reed: Cutting machines for paper, leather, fabrics, and the like. 15244 Hall-Jones and Jones: Aluminium cooking utensils and water bottles for travellers. 15271 Johnson: Aeroplanes or flying machines. 15278 Porteus: Method or process of and apparatus for treating malt for mashing purposes. 15283 Lamplough and Bliss: Rotary pressure blower and exhauster. 15289 Spencer and West: Trumpets for gramophones, phonographs, and the like.

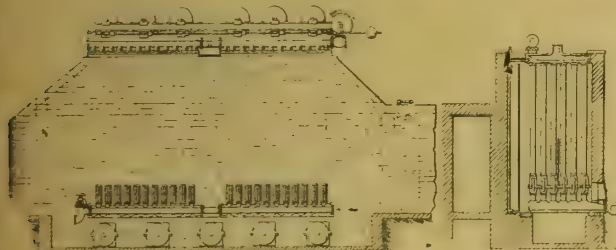
15297 Daimler and Daimler Motoren Ges.: System for starting explosion motors.

The heated fuel supply for starting is auxiliary to the main supply from a carburetter and is entirely separate therefrom, and according to one construction the auxiliary fuel supply pipe terminates in the suction pipe or directly in the combustion chamber, and the supply pipe has a heating device inserted therein. This fuel supply pipe may either be fed from the main fuel reservoir or from a special reservoir, and the heating device may be of any suitable construction. The hot vapours from the auxiliary supply mix with the air drawn in by the piston and being ignited are consumed in the cylinder, so that the latter in a short time is heated sufficiently for the explosive mixture produced in the ordinary carburetter to be ignited with certainty.

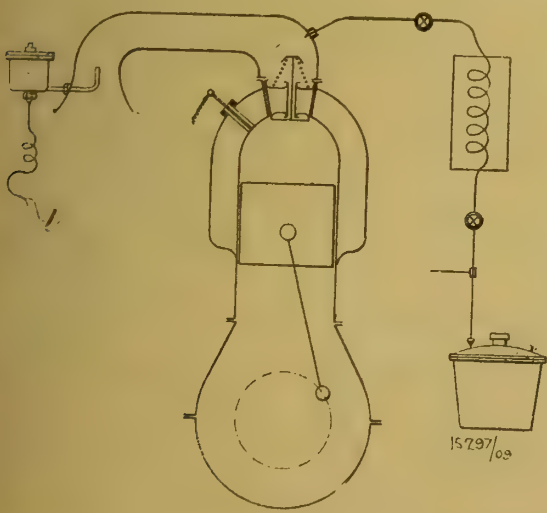
15313 Fellows: Transmission mechanism. 15319 Pohl, and Phœnix Dynamo Manufacturing Co.: Dynamo electric machines constructed with commutators. 15325 Leitner: Systems of train lighting. 15343 William Newman and Sons Ltd., and Newman: Floor springs and checks for use in connection with swing and other doors.

15355 Archdale and Clayton: Fuel economisers or feed-water heaters.

In one or other of the walls of the economiser and opposite to the lower parts of the spaces between transverse rows of pipes, suitable openings are formed through which an appropriate tool can be passed and manipulated from the outside in order to clear such spaces of any deposited soot or flue dust. The openings when not in use are closed by covers of a particular construction which are easily removable when the tool is to be passed through the wall for use. When the deposit is cleared away from the transverse spaces between rows of pipes, that which is in the spaces between the longitudinal rows of pipes falls down owing to the removal of support, or is drawn away by the draught, or the tool or implement may be shaped to enter such latter spaces.

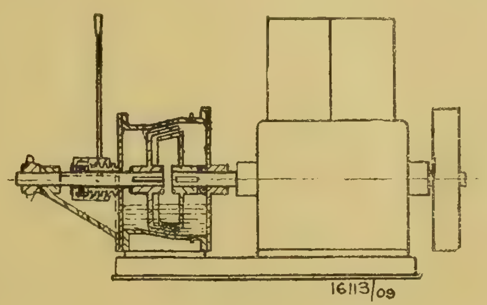


15395 Drummond: Atmospheric gas burner. 15478 Williamson: Davits. 15492 Alexander and Paterson: Means for supplying carburetted air to internal-combustion engines. 15494 Crompton and Co., Macfarlane and Burge: Motor control systems and rotary electric transformers or motor generators therefor. 15497 Boyer, Cavaillon, and Barishac: Process for preparing lubricating oils having a basis of castor oil and mineral oils. [Date applied for under International Convention, July 3rd, 1908.] 15500 Yarrow: Means for steering ships. 15506 James: Means for generating gases. 15528 Rigby: Pressing and friction motions of slasher sizing machines. 15552 Rose and Siddall: Rotary machine for extracting essential oils from limes, lemons, oranges, bergamots, and other fruits. 15585 Austin Motor Co., and Austin: Means for use in clamping a turret or capstan or swivel rest of a lathe or in clamping other swivelled device (of mechanism) which requires clamping in different positions into which it may be turned about its axis. 15601 Foye: Machines for inserting tacks or like fasteners. [Date applied for under International Convention, July 6th, 1908.] 15604 Stumpf: Valve gear of steam engines. 15640 Spencer: Pneumatic tyres for the wheels of road vehicles. 15647 Lessing: Manf. of electric carbons. 15668 Colley: Means to support children whilst learning to walk. 15675 Tattersall: Construction of airships and means for operating same. 15677 Tattersall: Apparatus for balancing aeroplanes and airships. 15686 Maconochie: Adjustable shelves or supports. 15693 Messter: Mechanism for the feeding of cinematograph films. 14736 Astor: Vibratory gas producer for generating gas from peat. [Date applied for under International Convention, May, 10th, 1909.] 15740 Krieger: Process and arrangement for treating malt returns or drafts, so as to secure a more complete utilisation of the malt. 15769 North: Gas governors. 15886 Schevardo: Ash tray. 15915 Hann and Morris: Respiratory apparatus. 15926 Weller: Vehicle bodies. 15932 Goddard: Casement windows and the like.



16113 Electromotor Equipment Co., and Meacock: Combined friction clutches and brakes.

Upon the axis is secured an annular dished part having a peripheral flange with coned frictional surfaces formed upon its outer and inner diameter; the frictional surface of the inner diameter can be made to engage with a similar surface formed upon a conical disc secured upon the axis of the prime mover or upon an intermediary axis or sleeve in gear with the axis of the prime mover; by this means the prime mover can be engaged with or disengaged from the mechanism. The frictional surface of the outer diameter of the annular dished part can be made to engage with a corresponding frictional surface formed upon the interior of the casing containing the aforesaid working parts; by this means the load can be retarded in its movement, caused by gravitation or momentum, or the load can be brought to a state of rest, as the casing to which frictional connection is made as aforesaid is not permitted to rotate, being secured to the framing carrying the said mechanism.

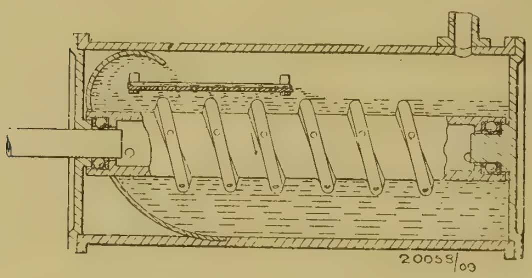


16185 Ramsden: Studded tyres. 16240 Best, Best, and Best: Heating and melting furnaces. 16322 Smith: Means for applying and securing capsules to the necks of bottles and similar receptacles. 16544 Bennett: Gauge for determining the pressures in pneumatic tyres. 16546 Landau (Landau): Apparatus for dissolving metals and other substances. 16604 Saunders: Lamps for motor vehicles and the like. 16654 Morgan: Ventilators. 16845 Soc. Anon. Raffinerie Moderne Procede Natta: Apparatus for the concentration and boiling of green syrups. [Date applied for under International Convention, July 22nd, 1908.] 16976 Rhodes: Perforated containers for use as tea infusers, for holding vegetables while cooking, and for other purposes. 17168 Sayer: Apparatus for supplying water to a boiler or the like. 17285 Ure: Tyres for vehicle wheels. 17597 Sayer: Aerostatics. 17601 Williams and Toothill: Louvre boards of ventilators and the like. 17647 Higgs and Wyatt: Concrete mixers. 17689 Jordan: Photographic plate, film, and print washer and drier. 17978 Mackintosh: Handles for hammers, picks, axes, and the like. 18348 Le Maitre: Variable-speed gearing. 18388 Fletcher: Ventilator bricks and means for manufacturing same. 18517 Heap: Fixing blocks or means for facilitating the fixing of woodwork in building construction. 18578 Heath: Screw propelelrs and method of manufacturing the same. 18654 Adams: Trucks for railway, tramway, and like vehicles. [Date applied for under International Convention, January 7th, 1909.] 18694 Heydenhauss, Banhegyi, and Glaser: Celluloid substitute and process for manufacturing the same. 18765 Lucas and Steeley: Indiarubber bulbs for motor and cycle horns. 18891 Lovell: Game. 19003 Thomas Holcroft and Sons Ltd., and Holcroft: Strainer covers for use with saucepans and similar cooking utensils. 19054 Owen: Motor car and other seats. 19191 Lamplough, and Browne Engineering Co.: Liquid or gaseous fuel burner for steam engines and other purposes. 19195 Barton: Show card frame. 19200 Bates: Construction of box or like bedstead, applicable also for use as a chair couch.

19237 Iddon: Method of attaching protectors of rubber or other suitable material to the heels of boots, shoes, and the like. 19341 Allden: Cold storage chambers. [Post-dated December 29th, 1909.] 19636 Hollingworth (Crompton and Knowles Loom Works): Filling detector mechanism for weft-replenishing looms. 19816 Bobe: Means for excluding draught and preventing rattling in windows and the like. 19891 Taylor and Taylor: Pastime and apparatus for use therewith. 19900 Hyatt-Woolf: Double shirt collars. 19955 Kaiser: Mechanism for indicating the speed of vehicles and machinery. [Date applied for under International Convention, September 1st, 1908.] 19963 Gernaert: Manf. of paper. [Rights under Section 91 of the Act not granted.]

20053 Warwick Machinery Co. (1908) (General Electric Co.): Regenerative steam accumulators.

Improved devices are provided for effecting agitation, and comprises a stationary drum partially filled with water and containing one or more movable agitators which may take the form of rotatable tubular shafts submerged in the water and receiving the exhaust steam from the reciprocating engine. Each shaft contains a plurality of tangential holes or nozzles, through which the steam blows into the water and by its reaction causes the shaft to rotate, so that the jets of steam are projected in many directions and sweep through the water at a rapid rate. The shaft may be provided with helical projections so as urge the water toward one end of the drum, where it flows up an incline and is projected upon a perforated shaft from which it trickles down through the steam in a plurality of streams and rapidly absorbs the heat.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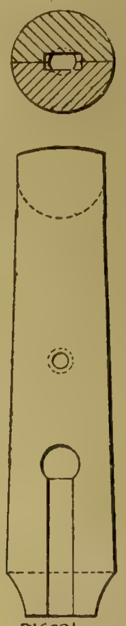
20126 Sir W. G. Armstrong, Whitworth, and Co., Matthews and Wale: Apparatus for the loading of ordnance. [Cognate Application. 4909, 1910.] 20130 Bary: Apparatus for the production of combined rotary motions, applicable to grinding and to mixing machinery and for other purposes. 20219 Edge: Automatic feed regulator and high and low-water alarm for steam boilers. 20342 Clarke: Means by which the swaying and spinning of electric shades are prevented. 20368 Eloff: Automatic couplings for railway vehicles. 20449 Eadie and Tannahill: Faucet end for wrought-iron, steel, and like pipes. 20492 Duchanoy, Bosquet, and Davicion: Gas producers. 20811 Robinson: Roller skates and the like. 20840 Kingsbury (Western Electric Co.): Automatic sequence switching device and its control. 20844 Montagnon: Skeleton framework for reinforced concrete structures. 21058 Klein: Means for positioning the shuttle in looms having automatic pirn, cop, or the like changing motions. 21073 Butterworth: Apparatus for regulating the admission of air to the furnaces of steam boilers and the like. 21304 Shipman: Foot check for platen printing machines. 21472. *See* 7321, 1909. 21518 Ayton: Casement stays. 21520 Hipkins: Weighing machinery. 21571 Laffly: Motor-driven road roller. [Date applied for under International Convention, April 2nd, 1909.] 21657 Lake (Hutchison): Water-tube boilers. 21674 Betts: Process for utilising unmined coal.

21699 Judge and Phillips: Removable drill shank.

A solid shank is suitably tapered to fit into a Morse socket, and a centre hole is bored to receive and fit upon the drill which it is desired to hold. The shank is divided longitudinally and centrally through the centre hole into two half parts, and a shallow recess is bored in each flat face at the end of and cutting into a concave or semi-circular groove to about half its depth. When these two parts are put together they are held in position by a set screw, being further held by the machine socket into which the shank is placed when the drill is to be used. The broken drill is prepared for use by grinding or otherwise forming two flats upon the broken end to fit into the shallow recess.

21747 David: Dobbies and healds of looms for weaving. 21751 Djounkowsky: Harvesting machines. 21773 Ainsworth, Johnson, Ingham, and Bolton: Shuttle-checking appliances of looms for weaving. 21870 Carl Zeiss: Combinations of a system of plane reflectors with two telescope systems. [Date applied for under International Convention, September 29th, 1908.] 22062 Mercer: Boots. 22065 De Macedo: Driving mechanism for bicycles. 22087 Munro, and Railless Electric Traction Co.: Trolley arms or collectors for electrically-propelled vehicles running without rails.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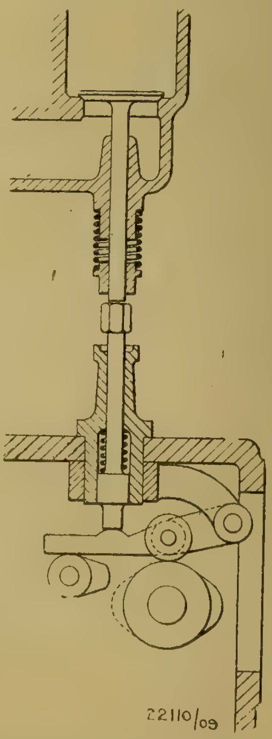
22110 Gardner and Gardner: Reversing gear for internal-combustion engines.

In the application to a multi-cylinder internal-combustion engine, in which the cams actuate the valve or like parts through levers and tappet rods in a known manner, a supplementary or second cam shaft is provided extending the length of the engine, the cams thereon being so disposed with relation to the tappet-rod operating levers that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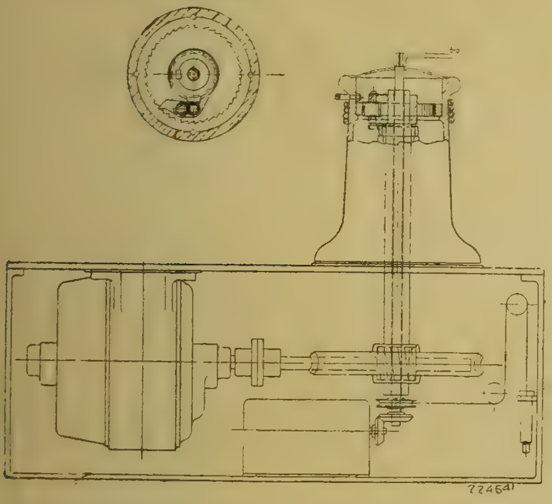
a partial rotary movement of the second cam shaft will result in the levers being lifted clear of both sets of valve or like operating cams, thus permitting of the changing of the latter to suit the desired direction of rotation of the engine. After the latter operation the second cam shaft is partially rotated to move its cam clear of the tappet-rod operating levers, when the latter fall and rest upon their respective cams.

22276 **Tyers**: Sawing machines of the reciprocating saw type. 22321 **Hardy, Hardy, and Hardy Bros. (Alnwick) Ltd.**: Line guides for fishing rods. 22398 **Newton** (Farbenfabriken vorm. F. Bayer and Co.): Producing meta-aminobenzaldehyde and its salts besides the anhydro-compound of ortho-aminobenzaldehyde. 22425 **Radford**: Carrier cycles.

22454 **Royce Ltd., and Hulley**: Electrical capstans, electrical cranes, and other electrical lifting, winding, or hauling appliances.

The barrel is freed by means of a lever or foot pedal operating a reversing controller, reversing motor, suitable gearing, and a ratchet and pawl device, which may be fixed in the top of the barrel or below on the gearing. Preferably one lever or foot pedal and the engaging or disengaging of the pawl from the ratchet is automatically effected by the direction of rotation of the motor—*i.e.*, when the motor is running in a predetermined direction, the pawl automatically engages with the ratchet and drives the barrel for winding or hauling the rope or chain, but when the motor is reversed the pawl automatically disengages from the ratchet, and the barrel is quite free to be rotated in either direction.

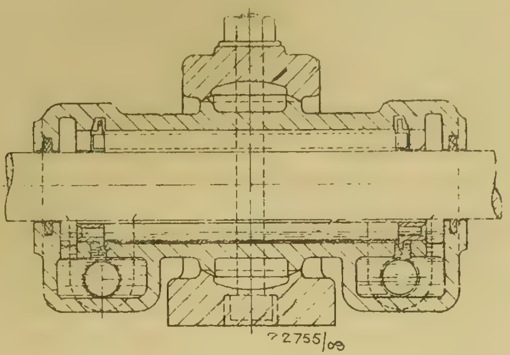


22485 **Lamotte**: Nut locks. [Rights under Section 91 of the Act not granted.] 22603 **Hopper**: Stoving or baking of articles coated with japan, varnish, or the like. 22720 **O'Brien**: Manf. of metal-studded bands and treads for elastic tyres. [Cognate Application. 2, 1910.]

22755 **Bromilow, and Kynoch Ltd.**: Roller bearings. [Post-dated March 22nd, 1910.]

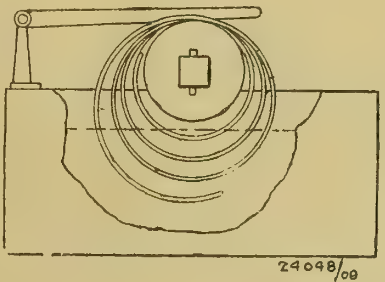
The bearing is provided with an oil reservoir under the bearing connected by passages to the roller race at the ends; this obviates the use of a groove or passage within the roller race and allows the rollers to take bearing on the whole of their length. The ends of the bearing are closed by flanges which nearly touch the shaft. The cage may have projections or flanges which run in grooves connected to the oil reservoir so that a large variation in the working level of the oil is obtained. By these means a large quantity of oil is contained in the bearing which is being continually taken up and carried round by the rollers and cage, thus giving a continuous circulation of the oil which carries with it any particle of dust or dirt which finds its way into the reservoir from which it can be removed through a connection for the purpose.

22805 **Sparks**: Pressure controllers for operating gas-lighting systems. 22833 **Fleitmann**: Fireproof metallic parts for incandescent lamps. 22976 **Thewlis**: Roundabouts or carousels. 23069 **Weisse**: Steering wheel drives for motor-driven vehicles. 23251 **Knight**: Detachable wheels for vehicles. 23424 **Tourtel**: Barrel locks and their keys. [Cognate Application. 2126, 1910.] 23488 **Burton and Nelson**: Frogs of fast-reed looms. 23504 **Fredericks, Fredericks, Russell, Wedding, and Connelly**: Trolleys for use on electric tramways on the overhead conductor system. 23576 **Carter**: Back rests for motor cycles or other vehicles. 23611 **Booth**: Automatic shuffler of playing cards. 23985 **Ruti**: Casement windows.



24048 **Beever, Beever, and Beever**: Method of and means for immersing coils of flat steel, wire, or the like in acid, technically called pickling.

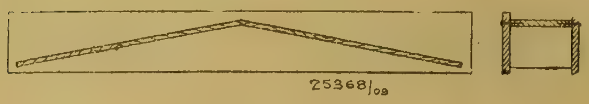
The coils are placed over the projecting end of a roller and a pivoted arm placed between each two adjacent coils. When thus suspended the lower part of the coils, which are immersed in acid, separate from each other by gravitation and the natural tendency to uncoil, and thus afford a free passage for the acid to flow between the convolutions. As the roller revolves, it turns the coils, and the convolutions are continually being closed where they rest upon the upper side of the roller, and separated from each other below the roller, so that eventually every part of the material is acted upon by the acid and cleansed.



24151 **Vicars, Vicars, and Vicars**: Biscuit-cutting and panning machines. 24298 **Newton** (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of beta-methyladipic acid. 24499 **Tompkins**: Propelling and steering apparatus. [Date applied for under International Convention, December 30th, 1908.] 24531 **Briggs**: Machines or apparatus for dewing or similarly treating fabrics, fibrous materials, and the like. 24770 **Waterhouse**: Electrical fittings, such as ceiling roses, fuse boxes, switch cases, and the like. 24793 **Mason and Mason**: Billiard cue suspender for keeping cues straight. 24795 **Oxley and Walsh**: Pneumatic tyres for motor cars, bicycles, and the like. 24851 **Leroux and Cazes**: Hydrocarbon locomotives. [Date applied for under International Convention, October 28th, 1908.] 24860 **Williams**: Wagons. 24930 **Green**: Construction of book marker. 24934 **Maw**: Tassels and the like. 25015 **Triumph Cycle Co., and Hathaway**: Adjustable nozzles for use with squirts, oil cans, and the like. 25214 **Boufford**: Travellers for ring and traveller spinning machines and the like.

25368 **Gumpert**: Construction of concrete arches for roofs or the like.

The girder-like mould or permanent centering consists of two permanent continuous board-like lateral parts placed edgewise, of a third continuous member which is inserted longitudinally so as to conform more or less to the shape of an arc, nearly the whole available distance given by the height of the lateral parts being utilised. Such a device by its formation is adapted to act as a mould for concrete or the like, whilst since the lateral parts are permanent they are adapted to take up strains as beams. After the setting of the concrete mass the girder-like mould or permanent centering does not necessarily support



the weight of such mass, as the concrete mass can support itself in the approximately arch-shaped form; consequently the framework can be made of comparatively small thickness, although at the same time great strength and resistance are obtained.

25495 Blum: Mixing and kneading machine. 25741 Froment: Tool for watchmakers. 25767 Fitts: Valves. 25829 Kinch: Oilers. 26013 Lake (Neue Berliner Messingwerke Wilhelm Borchert, jun.): Hydraulic squirting presses. 26219 Miersch: Adjustable feed gauges for platen presses. [Date applied for under International Convention, November 12th, 1908.] 26221 Tyler: Wrench: 26489 Bernheim and Bernheim: Making of corsets. [Post-dated April 29th, 1910.] 26572 Hills: Locomotive ashpans. 26647 Smith: Wheels for vehicles. 26777 Bevington: Pistol-shaped coin receptacles [Date applied for under International Convention, February 10th, 1909.] 26834 Fairbrother: Lamps for road vehicles generally. 26836 Gousi: Automatic striking mechanism for watches. [Date applied for under International Convention, November 19th, 1908.] 26983 Cartwright and Cartwright: Driving and balancing millstones. 26988 Gillatt: Wick holders, regulators, and extinguishers for oil and spirit lamps and the like. 26989 Barker (Yoshino and Edge): Dumping wagons. 27088 Langh: Tooth brushes. 27098 Thiemann: Heald straps or chains of looms. 27137 Scott: Railway crossings. 27242 Lake (C. B. Cottrell and Sons Co.): Sheet-delivery apparatus for printing machines 27285 Casey: Advertising apparatus. 27312 McLennan: Music stools. 27327 McCollum: Valves and valve gear of internal-combustion engines. 27364. *See* 12266, 1909. 27425 Metcalfe and Dawson: Scissors. 27808 Spiesen: Apparatus for massaging the soles of the feet. 27959 Kiss: Tongue protectors or depressors for use in connection with surgical and medical purposes. 28047 Franke: Process of manufacturing plastic articles of hygroscopic materials. 28048 Franke: Process of manufacturing briquettes of porous, hygroscopic fuels. [Date applied for under International Convention, April 26th, 1909.] 28079 Kingsley: Smoke and gas-consuming devices for locomotive and like boiler furnaces. 28413 Willis: Tobacco pipes. 28483 Liais: Covers for pneumatic tyres. 28532 Robinson, and Kynoch Ltd.: Electric fuses and detonators for blasting and the like. 28535 Peacock: Means for attaching surveyors' plumb lines to the roof, sides, or floor of mine workings, tunnels, or for similar purposes. 28714 James (Compagnie Generale de Phonographes, Cinematographes et Appariels de Precision): Cinematographic apparatus. 28773 Feast: Adjustable sliding seats for road vehicles. 28831 Lee: Propeller mechanism for airships and the like. [Date applied for under International Convention, December 14th, 1908.] 29207 Drayson, Appleby, and J. Tylor and Sons Ltd.: Stand posts for water supply. 29355 Browne: Signal lanterns. 29451 Mathe: Apparatus for the propulsion of ships and the like. [Date applied for under International Convention, December 16th, 1908.] 29696 Re: Apparatus for preventing fraudulent refilling of liquid receptacles. 29786 Lamberg: Safety locks for doors and the like. 29869 Paradis: Shirt sleeves. 29930 Fabry: Apparatus for removing tar from coke oven gas, retort gas, and the like. 30281 Welles: Pencil sharpeners. 30349 Beebe: Washing machines. [Date applied for under International Convention, December 26th, 1908.] 30364 Fairweather (Singer Manufacturing Co.): Sewing machine. 30369 Boyd and Solomon: Screw propellers. 30380 Johnson (Badische Anilin and Soda Fabrik): Manf. of ammonia. [Date applied for under Rule 13, July 5th, 1909.] 30470 Gager: Speaking tube attachments. 30485 Willans and Robinson Ltd., and Peache: Toothed gearing.

1910.

2. *See* 22720, 1909. 50 Barby: Suction apparatus specially applicable for unloading sand and similar material. 147 Schweiter: Cross-spooling machines for yarns and threads. [Date applied for under International Convention, February 12th, 1909.] 758 Garnier: Starting mechanism for motor vehicles. [Date applied for under International Convention, January 12th, 1909.] 773 Boult (Longstreth): Illuminating apparatus for computing weighing scales. 845 Lacroix: Electrolysis of metallic solutions. 847 Delon: Apparatus for obtaining high continuous potential differences. [Date applied for under International Convention, January 16th, 1909. Application for Patent of Addition to 1070, 1909.] 1023 Pradeau: Internal-combustion engine. 1040 Giesserei und Maschinenfabrik Oggersheim Paul Schutze and Co. Akt.-Ges.: Apparatus for elevating liquids by means of gaseous fluid under pressure. [Date applied for under International Convention, July 20th, 1909.] Carl Zeiss: Reflecting prisms for telemeters and their adjusting devices. [Date applied for under International Convention, February 3rd, 1909.] 1178 Krusemann and Pool: Process for producing zinc white. 1191 Rouse: Heel-attaching means for shoes. 1193 Fervers: System of packing bottles and the like. 1195 Overbeck: Process for the de-alcoholisation of beer. 1233 Rossini: Treatment for removing grease from bleaching and polishing buttons or other articles made from nuts of the doom (or doum) palm. 1309 Jaumandreau: Apparatus for conveying skeins of yarn and the like through dyeing, bleaching, and similar baths. 1319 Marks (Hutchison Manufacturing Co.): Vacuum cleaning apparatus. 1444 Junghans: Means for illuminating clock dials and other indicators. 1495 Birch: Portable sewing machine stands. 1540 Negley: Automatic stay for fanlights, casements, and analogous articles. 1611 Siemens Schuckertwerke Ges.: Alternating-current polyphase commutator dynamo electric machines. [Date applied for under International Convention, February 16th, 1909.] 1637 Borchardt: Cartridge ejecting devices for firearms. [Date applied for under International Convention, February 26th, 1909.] 1656 Small, and Small and Parkes Ltd.: Engine packings. 1904 Kehrig: Syphons. 1902 Westfalische Metall-Industrie Akt.-Ges. Lippstadt: Igniting devices particularly applicable for use in connection with acetylene lamps and the like. [Date applied for under International Convention, July 8th, 1909.] 1917 Bailey: Wood-bending machines. 2113 Padernacht: Skirts. [Date applied for under International Convention, January 28th, 1909.] 2126. *See* 23424, 1909. 2337 Mayer: Moulds for casting ingots and the like. 2478 Baginsky: Apparatus for the disinfection of closet seats. 2482 Short, Short, and Short: Pressure gauges, particularly suitable for indicating low pressures such as accumulate in airship and balloon envelopes and the like. 2632 Slee: Resilient wheels. 3322 Westinghouse: Elastic-fluid turbines. [Date applied for International Convention, March 6th, 1909.] 3430 Duckworth, and Twelve Hours Stove Syndicate: Stoves or boilers of the box or horseshoe type for heating greenhouses and other structures. [Application for Patent of Addition to 28196, 1908.] 3593 Down: Apparatus for use on surgical operation tables. 3987 Silcock: Shuttle-checking devices in power looms. 4192 Callaghan: Devices for securing heel pads to boots. 4272 Weiler and Heymann: Pencil sharpeners. 4334 Dallemagne and Dallemagne: Ore-concentrating and separating apparatus. [Date applied for under International Convention, May 8th, 1909. Application for Patent of Addition to 11,684, 1908.] 4391 Jodiewicz: Treading devices for weavers' shuttles. 4425 D'Olier: Electric lamp shades or reflector attachments. 4505 Roch and Challet: Set-off square. 4513 Shaffer: Wrenches. [Date applied for under International Convention, February 23rd, 1909.] 4551 Wilbur: Air-operated fire extinguishers. 4660 Suisted: Apparatus for discharging coal from barges and other vessels. 4909. *See* 20126, 1909. 4915 Gordon: Fastening of buttons to fabrics and the like. 5047 Simle: Harness attachments or cockeyes. 5131 Lohse: Devices for utilising the heat emitted from lamp chimneys. 5196 Reddie (Johnson): Sound boxes of talking machines. 5277 Mote: Rim for the wheel of a vehicle. 5290 Haddan (Colona Manufacturing Co.): Protectors for the threaded ends of pipes, tubing, rods, and the like. 5348 Brenken and Boddecker: Devices for preventing shocks in belt gearings. 5512 Pearce: Tab fastener for linen shirt fronts. 5514 Webb: Cans for the delivery of milk or cream. 5705 Barling: Clips or holders for pipes or cigar and cigarette holders. 5735 Docking: Pendants for electric lamps and gas burners. 5786 Dawson: Loose-leaf binders. 5894 Buchler: Driving mechanism for the carriages of motor-driven

embroidery machines of the Heilmann type. 5946 Blau: Inverted incandescent lamps. [Date applied for under Inter-International Convention, August 16th, 1909.] 6398 Noack: Means for adjusting and locking door knobs on spindles. 6477 Worcester Royal Porcelain Co., and Evans: Plates, dishes, and similar articles. 6490 Marshall: Steam boilers. 7448 Liers: Box staples. 7898 Steel: Poultry houses. 8095 Firm Ernst Kratz: Surgical and other needles. [Date applied for under International Convention, May 28th, 1909.] 8097 Evans: Buckles for bale ties. 8184 Fried. Krupp Akt.-Ges.: Shoulder-piece guns. [Date applied for under International Convention, July 12th, 1909.] 8336 Greither: Spittoon. 8610 Potts: Telegraphy. [Date applied for under Rule 13, June 29th, 1909.] 9262 Kesztele and Maschinenfabrik und Muhlenbauanstalt G. Luther Akt.-Ges.: Machines for cleaning semolina and the like. [Date applied for under International Convention, May 12th, 1909.] 9868 Potts: Machines for recording intelligence. [Date applied for under Rule 13, June 29th, 1909.] 10087 Siemens and Halske Akt.-Ges.: Locking devices for railway semaphore signals. [Date applied for under International Convention, June 5th, 1909.] 10197 Lachat: Ball bearings. [Date applied for under International Convention, May 21st, 1909.] 10803 Miller: Water-closet bowls. 11491 Bowing: Retorts for use in the production of water gas. [Date applied for under Rule 13, May 27th, 1909.] 12762 Boult (Toledo Computing Scale Co.): Weighing and computing scales. [Date applied for under Rule 13, April 27th, 1909.] 12763 Boult (Toledo Computing Scale Co.): Weighing and computing scales. [Date applied for under Rule 13, April 27th, 1909.] 13696 Granichstaedten: Means for stoppering bottles. [Date applied for under International Convention, June 5th, 1909.] 14681 Robson: Apparatus, controllable from a distance, for automatically operating gas burners. [Date applied for under Rule 13, March 27th, 1909.]

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1909.

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1910.

1211 Eden: Stockings and socks. 1782 W. C. Heraeus Ges.: Mercury vapour lamps. 3510 Soc. Metallurgique de Montbard-Aulnoye: Process of machine for manufacturing the barrels of rifles and other small arms. 5496 Soc. Caussemille Jeune et Cie. and Roche et Cie.: Ignition-producing compositions of matter. 7139 General Caoutchouc Co.: Process and apparatus for separating eaoutchouc from resinous products. 7531 Vandercook: Rotary wire-straightening. 7580 Slater and Benham: Vehicle wheels. 8976 Maschinenfabrik Grevenbroich: Apparatus for filling sugar-plate moulds, more particularly those constructed according to the audant system. 9183 Von Nordenkampf: Method of and means for mounting stones for mosaic coverings. 9469 Keymer, Parsons, and Clymo: Boiler attached in the roof of gas ovens. 9513 Dombret: Lubricating systems. 9878 Descalles: Permutation locks. 12535 Weber: Method of producing castable masses from non-plastic substances. 12746 Laures: Spherical gonimeter for measuring angles of gyration relatively to the horizon and magnetic meridian in aerial and submarine navigation. 13304 Queneau: Casting metals of high melting point. 13436 Hess: Ball bearings. 13502 Akt.-Ges. Brown, Boveri, et Cie.: Driving of dynamo electric machinery. 13765 Siemens and Halske Akt.-Ges.: Operating appliance for photographing and examining by means of Röntgen rays. 13982 Akt.-Ges. Hannoversche Eisengiesserei: Tube cleaners. 14024 Allgemeine Elektricitats Ges.: Alternating-current dynamo electric machines of the commutator type. 14409 Bessonet-Favre: Apparatus for raising liquids. 14419 Got: Labels for packages. 14594 Krieger and Biechy: Process of and apparatus for enclosing powders in

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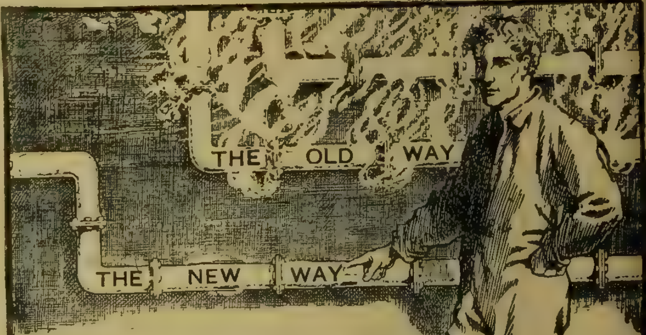

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EFFECTS OF METALLIC FILAMENT ELECTRIC LAMPS.

PROGRESS is being made at a remarkable rate by the lamp makers who are developing and improving upon their metallic filament lamps, and the subject is one which is of very general interest. Still greater efficiencies and ability to better stand vibration and rough usage, however, seem to occupy less attention at the moment than do questions involved in their commercial handling with profit to the maker and the vendor.

A few years ago we used to reckon three and a half watts per candle as the consumption of our carbon filament lamps, and it can easily be seen by those who are quite detached from electrical affairs how serious was the problem to the electricity supply engineer when we got down to one watt per candle as the standard. His anxieties have been serious, and have called forth all his ingenuity to deal with both the commercial and engineering changes involved as a consequence of the new situation. Some station engineers secured a large advance in the demand for energy for motive power purposes, and so were able to show a net increase in Board of Trade units per annum, though the revenue was affected through day load units for power producing less revenue than lighting units. Other engineers adopted a live commercial campaign, and endeavoured to make up by means of new lighting consumers for the lessened consumption on the part of existing customers. Yet others tried to cope with the financial position by announcing higher charges to the public—at least one having a complete monopoly electrically has effected such a change, and hopes thereby to help to earn an ordinary dividend. It is believed that here and there are to be found a few undertakings that have passed through the critical period, and no further loss of revenue is anticipated by their engineers.

A factor that is of some assistance to the electricity supplier is the decided change that is coming over the habits of the people in favour of a greater illuminating power. The fullest possible economy is not so eagerly sought for by some. Our ideas of the effective lighting of our homes and business premises have undergone a remarkable change since the incandescent gas mantle and electric lamp have been so freely obtainable.

It is very interesting to learn that some of the London electricity companies, on the calculations of their engineers, estimate that they are now nearly through the period of transition, and that the adoption of the wire lamps by consumers who are still using carbon filament lamps will affect their revenues only for a further two years. Two years is not a short period in the absence of knowledge concerning probable improvements in lamps and, remembering the past rate of progress, one wonders whether our laboratory workers and inventors have up their sleeves that still more efficient lamp that, we understand, was promised some little time ago. That we have not yet reached finality, it is hardly necessary to say, but we can easily imagine lamp makers and electricity supply engineers alike expressing a pious hope that they will not for some years have a further serious factor in the shape of extraordinarily efficient lamps.

We used to consider that our central station engineers had strained after economies in coal consumption, cost of generation, distribution, etc., until they could hardly make any improvement, but one effect of the pressure brought to bear by these lamps has been to compel the adoption of engineering improvements so as to reduce working expenses. In order to lower the cost, improved methods of production, which have involved a heavy capital outlay, have been adopted. In one instance, at least, new turbo-generators have been installed, with condensing plant, so that the exhaust steam can be fully utilised, and this has reduced the steam consumption by 40 per cent. New boilers with mechanical stokers, enabling bituminous coal to be used instead of Welsh, have also been adopted. Further, there is now going to be a bold scrapping of certain of the plant at two other allied stations. The whole of the steam generating plant is to be removed from one of these stations, which will then serve as a high-tension transformer sub-station. By these means full benefit of the new plant at the main station will be obtained. The old boilers at the second station will give place to new ones with mechanical stokers. In these and some other ways it is expected that such economies will be secured as will pay for the whole of the cost of the improvements in a year or two. And so in one important case, at least, has it happened that engineering work has been created as the result of the more efficient lamps.

Tees Transporter Bridge.—The foundation stones of the new Tees Transporter Bridge between Middlesbrough and Port Clarence were recently laid. The bridge is similar in design to the transporter which Newport Corporation have built over the Usk. The Tees Transporter has been designed by the Cleveland Bridge and Engineering Co., Darlington, and will be of the braced cantilever type, and consists of two groups of piers erected on masonry foundations on each bank of the river, and connected by a pair of open lattice main girders of 371 ft. span, the underside of which will be 160 ft. above the water level. These girders will each carry on their lower flanges two lines of rails. On the four lines of rails there will be supports for a travelling platform. From this a travelling car will be suspended by means of steel wire ropes. The car, the measurements of which will be 41 ft. by 39 ft., will be fitted on each side with passenger cabins, and its centre will be devoted to a "roadway" for vehicular traffic. The car will be designed to accommodate 600 people and one tramway vehicle, and will be about 50 tons in weight. The ends of the journey will be landing stages at the two sides of the river, and the car will be 4 ft. above high water level. The car will be electrically lighted, and its motion controlled from a pilot house placed on the car, but it will also be controllable from the power house on shore. Provision will be made so that in the event of one of the hauling ropes breaking the car will still be able to be brought to one side of the river. The contractors for the bridge are Sir William Arrol and Co. Ltd., of Glasgow.

Gas for Balloons.—According to the report of an American Consul, a new method of manufacturing gas for balloons has been invented in Germany. In this method coal gas is forced through long tubes, the tubes being maintained at a high temperature. Most of the carbon in the hydrocarbons is thus separated out, and the percentage of hydrogen is largely increased, while at the same time the gas is almost entirely deprived of its characteristic odour, and is freed from benzine, which has an undesirable effect on the materials employed to render impermeable the covering of balloons. The most important result is that the specific gravity is reduced from 0·44 to 0·225. One cubic metre of the new gas is able to support 1 kg., whereas one cubic metre of coal gas supports only 0·7 kg. Therefore, a balloon with a capacity of 7,000 cubic feet, inflated with the new gas, has lifting power equal to that of a balloon charged with 10,000 cubic feet of coal gas.

Shipbuilding Yard for British Columbia.—A shipbuilding establishment is about to be established in North Vancouver. This is doubtless the concern with which the name of Messrs. Vickers, Sons and Maxim has been already associated. It has been formally announced to the Victoria Board of Trade that the Canadian Northern Railway Co. intend to construct a line right through the length of Vancouver Island. Land is already rising in the districts to be opened up. A new lumber company has been incorporated with a capital of $5,000,000. A deposit of bituminous coal has been reported about 25 miles south of Princeton, on the Vancouver, Victoria, and Eastern Railway. At the Princeton Collieries it is estimated that there are about 70,000,000 tons of coal in sight.

Motor Road Train.—An interesting demonstration of the new motor road train upon the Renard system has been given at Coventry by the Daimler Motor Co. to a number of engineering representatives. The demonstration included an exhibition of the road train's capacity for cross-country work, two of the trains being taken over rough land, crossing deep ruts, and climbing banks; also ploughing through a sandpit and through an extensive rubbish heap, in which the wheels sank almost to the axles. The accuracy of tracking was shown by one of the trains crossing a gully on a pair of beams laid parallel, after a circuitous approach. The locomotor weighs 4 tons 16 cwts., and is fitted with a six-cylinder 80-H.P. petrol engine of the new Daimler valveless type, designed for this work. The following chasses weigh 3 tons 3 cwts. (passenger), and 3 tons 5 cwts. (goods), and can take a load of 5 tons each, or from 25 to 30 passengers each. The usual train consists of four followers carrying a total useful load of 20 tons, or about 120 passengers, at a speed on a fairly level road of up to 10 miles an hour. The propulsion is effected by means of a universally-jointed shaft running throughout the entire length of the train. From this shaft the drive is conveyed to the centre pair of wheels of each follower chassis (a six-wheeled vehicle) by a differential shaft and side driving chains. A spring drive is provided in the hub of each driving wheel, ensuring smooth starting on rough roads and taking up undue shocks. The steering is also a remarkable feature, being conveyed to the wheels of each of the following vehicles so that they will traverse a single path, forwards or backwards, however tortuous this may be. Each follower's steering mechanism is automatically controlled by the one preceding it through the medium of a steering rod connected to a swivel coupling. The effect of the arrangement is as stated, that the whole of the vehicles are steered by the hand-wheel operated by the driver of the locomotor. The brake control provides for the simultaneous braking of each unit by braking the propeller shaft at the locomotor end. Among the special advantages claimed for the system are the employment of a light motor in lieu of a heavy traction engine, light axle weights enabling the train to get over cross-country surfaces not possible to ordinary heavy commercial vehicles, a long range of spring movement providing for great surface irregularities, also maximum tractive effort and the capacity for negotiating hills up to a 1 in 5 gradient, and comparatively soft roads and tracks. The running cost per ton mile is claimed to be lower than that obtained by any other form of mechanical traction, a specimen day's run of $51^2/_3$ miles of a train weighing 13 tons 10 cwts., and carrying a useful load of 15 tons 8 cwts., working out at a petrol consumption of 1·61 train miles per gallon, and 24·79 net ton miles per gallon, or 47·33 gross ton miles per gallon.

STEAM ENGINE DESIGN.—XXV.

(Continued from page 69.)

Air Pump Valves.

The vital part of an air pump is in the valves; three of the usual types are shown in fig. 135.

The oldest construction, and still much used, is that shown at *a*. The valve itself is of rubber, its lift being limited by the gunmetal guard ring. At *b* will be seen a modification of this valve. It is of geatest value in the head and foot valves of jet condensers.

Unquestionably the most popular form of valve is the "Kinghorn" (by the Metallic Valve Co., of Liverpool), shown at C. This valve has been adopted in the best land and marine practice. The guard ring is circular, and limits the lift of a number (usually three) of thin discs of special metal. The bottom and intermediate layers are perforated with a number of holes, these being so placed that when all the discs or layers are closed together no passage-way through is formed.

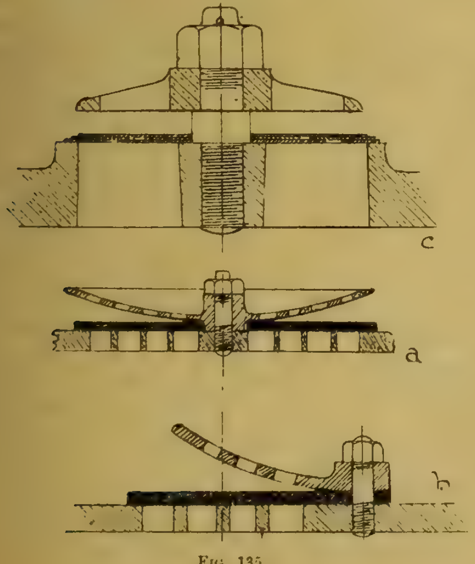


Fig. 135.

These metallic valves can be used for either of the types at *a* or *b*, but for the former only one very flexible disc is fitted, and the guards can be curved on two sides only.

Condensers.

In addition to the types of condensers already described, there are those of the ejector and evaporative type. Neither are as much used as the others, but each, in its own sphere, is of great value.

Ejector Condensers.

Referring to fig. 136, which shows a Korting ejector condenser, water enters the nozzle at A and passes through the condensing tube B, which has a large number of ports for the steam to pass from the exhaust pipe C to the condensing water.

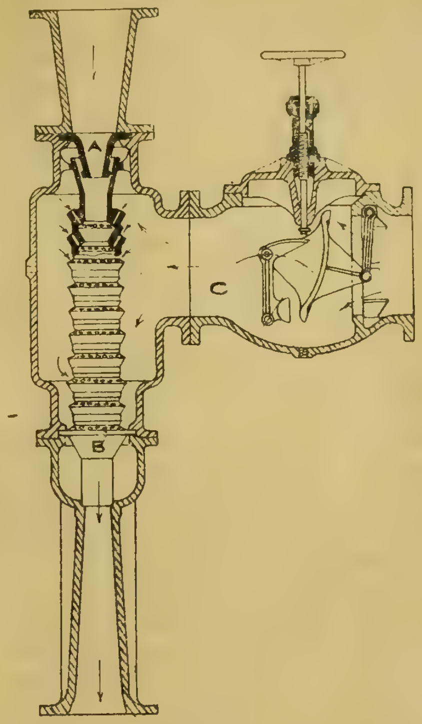


Fig. 136.

The water must be supplied at A under a head of 15 ft., and it will discharge from this nozzle with a velocity equivalent to this head. If there is no steam passing, the air in the pipe will be sucked out and a vacuum formed. If this vacuum is a perfect one, the vacuum pull on the water will be equivalent to a 34-ft. head, and therefore the water has a total head of 15 + 34 = 49 ft., sufficient to discharge the condenser against atmospheric pressure without the aid of a barometric pipe or air pumps. It will be seen that as the vacuum is being formed in the condenser, the water head increases from 15 ft. to an ideal maximum of 49 ft.

The ejector condenser is the simplest and cheapest possible. It has no moving parts, and therefore is not liable to get out of order; in addition, no air pumps are required. Where there is a good supply of cool, pure water it is of much advantage, but it should be remembered that the vacuum obtainable in regular working is seldom above 24 in. Injection water should be supplied from an overhead tank. Centrifugal pumps are the most suitable for elevating the water to the tank. This tank may be dispensed with, but in this case much air is carried through the condenser, which would otherwise separate out. With water at 60 deg. Fah., 27 lbs. to 30 lbs. of water per pound of steam will give a 24-in. vacuum.

In order to prevent the water flowing back into the engine cylinder a non-return valve, like that shown at E, should always be fitted.

EVAPORATIVE CONDENSERS.

It will be seen that all the condensers described depend on a large quantity of injection or circulating water, and, where water is expensive, cooling towers must be provided. Where land is valuable, the space that cooling towers take up is a great consideration. The evaporative condenser, where an average vacuum of about 24 in. will suffice, is advocated as simple, compact, and economical in water and power. The following description is of the condenser made by Messrs. Ledward and Beckett Ltd. The principle on which it depends is that of cooling by evaporation. Water is allowed to trickle over a large surface of pipes, which are connected with the exhaust steam from the engine at one end and to an air pump at the other end. The air pump maintains a vacuum in the pipes, and the exhaust steam which is inside gives up its heat through the metal of the pipes to the film of water on the outside. The latter, being exposed freely to the air, becomes partially evaporated, and so loses the heat it had gained from the steam. By this transfer of heat the exhaust steam becomes condensed, and is discharged by the air pump as with an ordinary surface condenser.

The film of water is continuously renewed by maintaining a slow circulation over the pipes, the excess of water not evaporated falling back into the tank below, from which the circulating pump draws its supply.

The quantity of water circulated is about 1·5 times the weight of steam condensed, and that lost by evaporation is from 66 to 75 per cent of this, the remainder of the latent heat of the steam being dissipated by radiation.

VACUUM INTENSIFIERS.

In any condenser, when at work, there is present water, vapour, and air. The last may be introduced through leaky glands and pipe joints, or, in the case of jet condensers, with the injection water.

The law of mixed vapours (Dalton's law) states that if in a given space there is a vapour (say air) at a pressure p_1 lbs. absolute, and another vapour (say steam) at a pressure p_2, then the total pressure in that space is $p_1 + p_2$. The conditions in a condenser are exactly analogous; p_2 is the vapour pressure corresponding to the temperature of the condensed water, hence in a practical condenser, since there is always air present, the vacuum gauge will always read higher than p_2, and the more efficiently the air is removed the nearer the gauge reads to p_2.

In an ordinary parallel flow condenser (surface or jet) air and water are about the same temperature. Suppose there is a pressure of 1 lb. in the condenser, three-eighths of which is due to air, then the air must be compressed 40 times before it can be discharged, necessitating a pump with very small clearances. It must be noted that as the pressure in the pump rises, the vapour goes back into the water. The usual method in high-vacuum plants is to densify the air and remove it by means of a special pump. The counter current principle has already been explained, both in connection with surface and jet condensers, and from fig. 131 it can be seen how well it conforms with pump and condenser requirements. The hottest steam meets the hottest water—hot well high temperature. Steam and water pass in opposite directions—condensing water most efficient. Air meets coldest water—air densified. Similar arrangements can be made for surface condensers; in many cases the air passes round a special nest of tubes through which the coldest water passes.

The pump used for the air is called a "dry" pump, and that for the water a "wet" pump; the latter may be of any of the usual types. Some makers use only one air pump for surface condensers; in this case both air, vapour, and water are specially cooled in the condenser in order to ensure a high air pump efficiency. The Parsons Company for their turbine sets make no alteration in the condenser, but a small steam ejector draws air from the condenser. The air is passed through a small auxiliary cooler, and is removed by the main air pump.

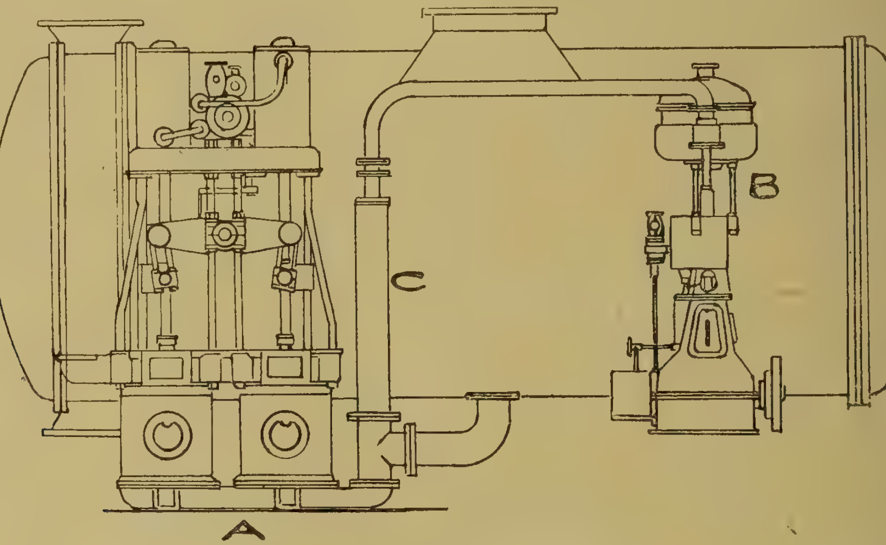


FIG. 134.

Small sets often use the ordinary Edwards pump for the air; on larger sizes special arrangements must be made. It has already been pointed out how important small clearances are. Pumps having positively operated Corliss valves for suction and multiple automatic poppet discharge valves give the minimum possible clearance. Slide valve dry pumps are also much used. To minimise clearance, it is arranged that at the end of stroke there is momentary communication made between the end of the cylinder, allowing the compressed air (at 15 lbs.) in the clearance to expand into the vacuum at the other end, thus improving the volumetric efficiency for very low vacua. It is sometimes advisable to remove the air in two stages—the first pump slightly compresses the air, and then delivers to the other pump. The effect of clearance, especially if the balanced slide valve is fitted, is much reduced.

A good arrangement of dry and wet pumps by Messrs. G. and J. Weir is shown in fig. 134. A is a twin wet pump similar to that shown in fig. 128; B is a rotative dry pump. No change is made in the condenser, but the air suction is taken from the top of a large air vessel C, and a special valve fitted to ensure that no water is sucked over to the dry pump.

It is the custom of some makers to claim that no dry pump is required, even at the highest vacuum. Perhaps this is true under test conditions, but for large installations at high vacua a dry pump should always be fitted, even if only in case of emergency; in many instances the combination is essential.

Circulating Pumps.

For the purpose of circulating the water through surface condensers or elevating it to cooling towers, the majority of makers prefer the centrfugal pump. The pump is very simple and is much cheaper than that of the reciprocating type. Centrifugal pumps can maintain an efficiency of from 50 to 55 per cent at almost any lift needed for condensers, but that of the reciprocating pump is less at low and greater at high lifts. For this reason, some makers recommend reciprocating pumps for all lifts above 30 ft., but the balance of practice is against them.

Reciprocating Pumps.

When the pump is worked from the main engine crosshead, as in some marine engines (fig. 126), the plunger speed will be the same as for the air pump. For separately driven pumps, double-acting, the plunger speed may be from 100 ft. to 150 ft. per minute, and the revolutions (for flywheel pumps like fig. 129) 100 to 60 in large sizes.

$$\text{The ratio } \frac{\text{stroke}}{\text{diameter}} = \cdot 7 \text{ to } \cdot 8.$$

The water velocity through suction and delivery may be from 300 ft. to 400 ft. per minute for land work, to 600 ft. per minute for marine. Reciprocating pumps always require the provision of a large air vessel to give uniformity of flow and to protect the condenser from damage due to sudden pressure.

(*To be continued.*)

HOW TO MAKE A FLUE-GAS ANALYSIS.

Now that the steam-engine indicator has become important in maintaining economy of steam distribution, the operating engineer will the more readily believe that a knowledge of what goes on in his furnaces may result in economy of steam manufacture. Since a saving accomplished in the boiler room is of just as much value as a similar one in the engine room, it is well worth while to give some close attention to the place where the stuff is produced.

Without actually testing the boiler we cannot inform ourselves whether or not its heating surface and grate are acting efficiently. It may be easily determined, however, whether or not the coal is being properly burned, and, if not, how much waste is involved. With this knowledge it becomes simple to eliminate the loss. It is the purpose of this article to describe how such determinations are made and what can be done with them.

The process known as combustion is simply the quick combination of a burnable material with oxygen; the combination produces heat. Coal is composed of some burnable material, chiefly carbon, and some that is not so, which appears as ash. The oxygen the carbon combines with is in the air. What we know as air, however, contains more than oxygen; in fact, the oxgen composes only about one-fifth part of the air, the rest being nitrogen and a small proportion of water vapour and other gases.

As a result of the combination of oxygen and carbon either one or both of two gases may be formed, namely, carbon-dioxide and carbon-monoxide. These gases are commonly referred to as CO_2 and CO, respectively. As will be explained later, if monoxide is formed the combustion is incomplete, and therefore all of the heat possible has not been obtained by burning the coal.

It may be well at this juncture to say something about heat. If it is understood to start with, that heat is a pure relative thing, it will not be difficult to grasp the way in which it is measured. Thus, if you step into a room in which the atmosphere is at a temperature of 60 deg. on a hot day in summer it is felt to be cool, if you come into a room having the same temperature in the winter it feels warm. Because of this relativeness of heat we cannot say that any material contains a certain amount of heat in the same sense that it has weight or length. But we can say that a body has a definite amount more heat in one condition of temperature than another. This enables us to measure heat, and its unit is defined thus: The unit of heat (the British thermal unit, or, more shortly, B.T.U.) is the amount of heat required to raise the temperature of 1 lb. of water 1 deg. Fah.

Using this unit, if 1 lb. of water at 60 deg. is raised in temperature to 70 deg. it will have 10 B.T.U. more heat in it in the second condition than it had in the first. If 10 lbs. of water are heated through the same range of temperature 100 B.T.U. are added to it.

If 1 lb. of coal is burned completely in such a way that all of the heat generated is absorbed by a known weight of water, then, by observing the rise of temperature of the water, it may be determined how much heat it is possible for the coal to produce. This sort of thing is done to determine the heat value of the coal.

All substances do not absorb equal amounts of heat during the same rise in temperature. Thus, if 1 lb. of iron is heated from 60 deg. to 61 deg. the amount of heat it has taken up is about one-eighth of that which the same weight of water would have absorbed. This quantity, one-eighth, is called the specific heat of the iron, and for different materials it has different values. In any case the amount of heat in British thermal units added to or taken away from a body is: Weight in pounds × range in temperature × specific heat.

Now in burning coal for a boiler it is essentially necessary, in order to get all the good out of it, to furnish enough oxygen to combine with all of the carbon so that it may be converted to carbon dioxide. In doing so we have to supply air containing four times as much nitrogen, which absorbs some of the heat of the coal and carries it up the chimney. This cannot be helped, but if we supply too much oxygen, and the accompanying nitrogen, so much more heat is carried up the chimney which might otherwise be saved.

Further, and more important, if there is incomplete combustion we are not getting all of the good out of the coal that might be obtained. This loss does not show in the residue—burnable material appearing with the ash does not show incomplete combustion but non-combustion—but it does show in the flue gas. This, then, is the important thing to watch, and a knowledge of the proportions of its constituents enables one to make many useful calculations.

The most important constituents of flue gas to be determined are—carbon dioxide (CO_2), showing complete combustion; carbon monoxide (CO), showing incomplete combustion; and oxygen (O), showing an excess of air or leakage in the flue. The remainder may be assumed to be nitrogen (N), although there is a number of other gases, originating from both the coal and the air, which form a small per cent of the residue.

It may be noted that it is desirable to have the proportion of CO_2 present in the gas reasonably high, for this indicates little excess of air. There are a number of automatic CO_2 recorders on the market, which enable one to keep track of the percentage of this gas. They should be regarded, however, as giving only a general indication of the efficiency of combustion, for they convey no idea of the possible losses due to incomplete combustion. To judge only by the amount of CO_2 present is about as accurate as it would be to estimate the value of a pile of coins by counting only the gold ones. A general idea may be obtained by so doing, but possibly a very inaccurate one. It is erroneously thought that the higher the percentage of CO_2 indicated by these recorders, the better is the combustion. If the CO_2 is high it may be that too little air is supplied to the coal. If this is the case, incomplete combustion follows and a condition may be obtained where the resulting loss overbalances that from too much air.

The apparatus for analysing flue gases depends upon the separate absorption of the gases named above by certain chemicals. A measured volume of the gas is brought into contact with one of these chemicals which removes from it the CO_2, but does not take up any of the other constituents. If the difference in volume resulting is divided by the original volume of the flue gas, the result is the proportion of CO_2. In this way the proportions of the three principal constituents are determined. The sum of these quantities subtracted from one gives the part of nitrogen, approximately. If the original volume contains 100 units as, for instance, cubic inches, the number of cubic inches of each gas then represents its ~~per~~ cent of the total; that is, parts of one hundred.

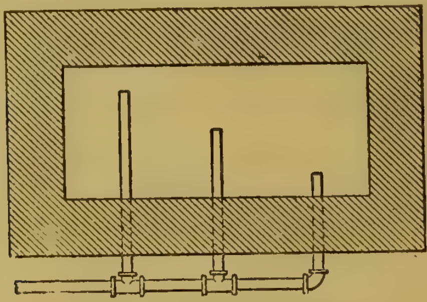


Fig. 1.—Arrangement of Sampling Tube.

The first step necessary in making an analysis is to obtain a representative sample of the gas. A short length of iron pipe may be inserted in the uptake so that it extends about half way across; through this the gas may be drawn. As the proportions are apt to vary at different points in the section of the uptake, it is better to use more than one pipe, as shown by fig 1. Whatever combination of pipes for tapping is used, it should be placed as near as possible to the furnace to prevent dilution by air leaking through the brickwork. Great care should be taken to make the pipe joints tight for the same reason.

To obtain a sample various devices are used, the object of all of them being to collect the gas as it leaves the furnace in such a way as to exclude adulteration with anything else. Fig. 2 illustrates a convenient and easily made apparatus for this purpose. The bottle S is used to receive the sample. Its rubber stopper is pierced by glass tubes T T^1, the shorter one of which is connected by light rubber hose H to the pipe leading from the uptake. The other bottle R is provided with the glass tubes and the hose connections as shown. The combination is placed upon a shelf near the outlet pipe P and a trifle below it. To obtain a sample, S is filled completely with water and R to about one-quarter of its depth. By blowing into R through B, water is forced through the hose connecting R and S, into S and up the hose H leading to the flue. In this way all of the air may be displaced from H. If there is any air in the other hose or in S, this, too, will pass through H. As soon as the pressure is removed from B the water will begin to siphon from S into R, and thus suck gas from the flue through H. The siphoning will continue until the water levels in the two bottles are the same. The gas should be collected very slowly; to do this the tube B may be choked with a cork pierced by a small hole. This causes the air to be displaced from R slowly, and consequently the water from S. When the sample is obtained the pinch cock C is closed and the bottles removed together. This is done so that when the gas is removed from S, water will be drawn in from R to supply the diminished volume in S.

Having obtained a sample of flue gas the next step is to introduce it into an apparatus for analysis. The most widely used one for this purpose is, perhaps, the Orsat, and this will be described. Referring to fig. 3, F is a glass vessel into which the flue gas is drawn and measured. The gas is then caused to flow from F into the flask D in which is a chemical capable of absorbing the CO_2. It is then returned to F, measured, and the reduction of volume noted. This procedure is repeated for the determination of the other constituents, the vessels M and O being used.

To describe the operation in more detail, it is first necessary to displace all the air or other gas in the chamber F and the tube T leading from it. To do this a small bottle B, filled with water and connected with F by a rubber hose H as shown, is elevated. The water then flows from it into F and through T, but does not enter D, M, or O because the glass cocks *d*, *m*, and *o* are closed. When water appears at the outlet to the left of *f*, the hose leading from the sample bottle is attached at this point and the pinch cock on it released. Care should be taken in doing this that as little air as possible be entrained in the free end of the hose. The small bottle B is now lowered to the position indicated by the dotted lines, allowing the water in F to flow back into it. To fill the space vacated by this water, the flue gas enters through T into F, the whole volume of which should be filled with the gas. The cock *f* is now closed and the sampling bottle and connecting hose removed. One minute should be allowed for the walls of F to drain. The bottle B is then raised a trifle until the water level reaches the lowest graduation, 100. The pinch cock *p* is now closed. As the gas has been compressed by this rise of water level, the pressure should be relieved by opening *f* for an instant, allowing a little of the gas to escape. It should be noticed that if the pinch cock *p* is open the gas in F will occupy more or less volume according to whether it is expanded or compressed by lowering or elevating the bottle B. It is therefore necessary when reading the volume to have the water level in B the same as that in F, and this may be accomplished by holding the bottle B so that the levels coincide when the readings are made.

We have now secured a sample of gas in the apparatus which is neither expanded nor compressed. The amount of it by the graduated scale is 100 "c.c.," referring to the French unit of volume, cubic centimeters. This unit is about one-sixteenth of a cubic inch.

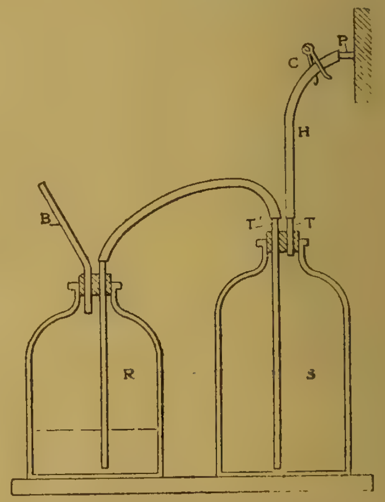


Fig. 2.—Sample-collecting Apparatus.

The next step is to introduce the sample into the flask D. To do this *d* is opened; the bottle B is elevated until the water level in F rises to the mark *n* and the pinch cock *p* is closed. The water entering F forces the gas into D; the entering gas in turn presses the chemical out of D up into D^1 through the connecting pipe at the bottom. Flask D contains a number of glass tubes which remain wet with the chemical, thus furnishing a large area to absorb the

CO_2. The liquid entering D^1 thereby displaces the air previously contained. This air passes into the rubber bag R and expands it. The function of this bag is, first, to keep the chemical from contact with the outside air (such contact would rapidly use it up); and, second, to provide a means, if necessary, to force the chemical back into D.

Having filled D with the sample, it should remain there at least three minutes to allow time for the thorough absorption of the CO_2. The gas is then returned to F by lowering the bottle B and opening the pinch cock *p*. If necessary, the rubber bag is pressed so that the level of the chemical in D returns to the mark *a*. When this is done the cock *d* is closed; the bottle B is held alongside of F so that the water levels are the same, and a reading taken. If, for example, the reading is 87 c.c., the volume of CO_2 that was in the sample occupied,

$$100 \text{ c.c.} - 87 \text{ c.c.} = 13 \text{ c.c.}$$

or 13 per cent of the entire volume.

The procedure described is repeated in each of the flasks O and M. The chemical in O removes the oxygen from the gas; that in M, the CO. What is left is called nitrogen. The difference between the volumes of the gas before and after entering O gives the volume of oxygen. In a similar manner the volume of CO is obtained.

The chemicals used are as follows: For carbon dioxide ½ lb. of caustic potash dissolved in one pint of water. The caustic potash is a solid and is sold in the form of sticks. It should be kept in a corked bottle and should not be freely handled, as it attacks the flesh. This chemical, as used, will absorb forty times its own volume of CO_2.

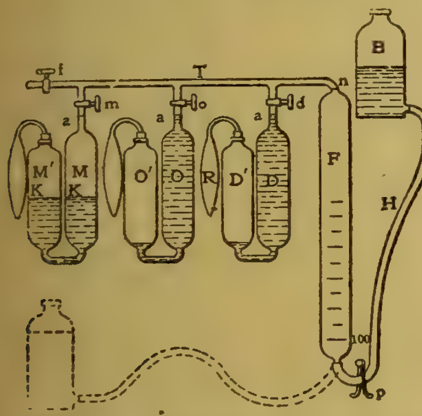


Fig. 3.—Diagrammatic Arrangement of the Orsat Apparatus.

For oxygen, one pint of the caustic potash solution as just described, to which is added ⅝ ozs., avoirdupois, of pyrogallic acid. This is a powder and may be poured into a bottle containing the measured caustic potash and water. This bottle should then be kept corked to prevent the contents spoiling. The absorptive capacity of the mixture is twenty times its own volume.

For carbon monoxide, the necessary solution may be prepared by placing in an open-mouthed bottle one ounce of copper oxide and a bundle of copper wire. To this should be added commercial hydrochloric acid sufficient to cover the wire. The bottle is then corked. When the solution becomes colourless it is ready for use. The absorptive capacity is twice the volume of the mixture.

When pouring these chemicals into the proper vessels of the apparatus, the rubber bags and the corks are removed from them, and the cocks *d*, *o*, *m*, and *f*, fig. 3, opened. The chemicals should be poured in until the level is about half way up in the connected flasks as shown at *k k*. By manipulating the bottle B all of the CO solution, for instance, may be drawn into the flask M, the cocks *d*, *o*, and *f* being closed and *m* open. The cork and attached rubber bag may then be replaced and the cock *m* closed.

The foregoing outlines the procedure of flue-gas analysis by the Orsat apparatus. A little study of and practice with the actual apparatus will result in its complete understanding. There are, however, some common mistakes easily made and not readily detected that may influence the results materially. The following gives a few points in practical operation: Carbon dioxide should be removed first, oxygen next and monoxide last. If this order is not kept the results will be wrong. The chemical that removes oxygen will absorb carbon dioxide also; therefore the latter should not be present when oxygen is dealt with. A similar error would be produced by testing for carbon monoxide first.

The analysis should be made at a uniform temperature of not less than 60 deg. The apparatus, when in use, should not be exposed to a changing temperature, or placed where draughts or sun may strike it. The resulting changes of temperature cause expansion or contraction of the gas under test, and any such change in volume will make the results untrustworthy.

The water that is brought into contact with the gas should be prevented from absorbing any part of it. Water has the property of absorbing the gases, and if any part of a sample is removed by water the analysis will not represent the gas as it came from the flue. To prevent the water used in the appartus from affecting the results, it should be previously saturated with flue gas so that it is incapable of absorbing more. This may be done by connecting the sample bottle, containing a charge, with the apparatus and alternately raising and lowering the bottle B, fig. 3, so that the gas is worked in and out of chamber F. The water used in the sample bottle may be saturated with the gas for the same purpose; or, if preferred, a drop of oil introduced into the sample bottle will cover the surface of the water in it and separate it from the gas.

When removing the sample bottle S, fig. 2, from the flue it is well to siphon back into it some of the water from R, the pinch-cock C being closed. This puts the gas in S under pressure, and if any leakage takes place past the rubber stopper it will be outward and will not affect the sample as would be the case if air leaked inward.

After the chemicals have been used for some time they become weak. If a record is kept of the volume of the gas each has absorbed, it will be known when its absorptive capacity is reached; it should then be discarded.

It is well, after making a measurement, to run the gas back into contact with the chemical it has just left, and allow it to remain a minute. Upon measuring again, if the volume is the same, the result is satisfactory. If, however, a check reading of this kind shows less volume than the previous one, it must be because the gas has not had sufficient contact with the chemical to remove all of the constituent being measured. The treatment should then be repeated until a constant volume is obtained. This precaution is particularly necessary in determining oxygen as the solution acts slowly.

In measuring the water level in F, fig. 3, it will be noticed that where the water meets the sides of the vessel it clings to it and is slightly higher than the level at the middle; that is, a rounded surface is formed instead of a flat one. The lowest point of this surface should be sighted on the graduating lines and the corresponding graduation read.—J. C. Smallwood, in *Power and the Engineer*.

The *Nachrichten für Handel und Industrie* (Berlin) of 9th July states that tenders will be received by the Lourenço Marques Harbour and Railway Board, Lourenço Marques, up to 2-30 p.m. on 5th September, for the supply of seven electric 5-ton quay cranes and one electric 10-ton quay crane. Copies of the conditions, specifications, and plans may be obtained, on deposit of 9 milreis gold (40s. 6d.), from the "Direcçao dos Caminhos de Ferro Ultramarinos," Lisbon (the payment to be made in this case to the "Caixa Geral des Depositos," Lisbon), or from the General Storekeeper, Harbour and Railway Board, Lourenço Marques, or from the agent of the "Caminhos de Ferro de Lourenço Marques," Johannesburg. The English translation of the conditions may also be obtained on payment of 4½ milreis gold (20s. 3d.).—*Board of Trade Journal.*

CONDENSING WATER ARRANGEMENTS.

[SPECIALLY CONTRIBUTED.]

(Continued from page 175.)

THE several types may be classed into surface condensers, barometric injection (or jet) condensers, non-barometric injection condensers, ejector condensors, evaporative surface condensers, the object in each case being two-fold, being first to remove as far as possible the effect of atmospheric pressure from the back of the piston by receiving the exhaust steam and condensing it to water, thus creating a partial vacuum, and secondly to enable the steam which acts on the piston to be expanded to a lower pressure before leaving the cylinder than can practically be done when the steam exhausts into the air. Broadly speaking, they may be divided into two mean divisions:—

(1) Those in which the injection water is mixed with the steam, the combined quantities being discharged into a hot well.

(2) Those in which the injection water and the steam to be condensed are kept separate, the injection water, after passing through the condenser, being either discharged to waste or being used over and over again by means of suitable cooling arrangements, such as cooling towers and cooling ponds, to reduce its temperature, while the water so condensed is available for boiler-feed.

To the first class belong the various class of vertical or horizontal jet condensers, barometric or otherwise, counter-current or parallel-current, and also the ejector condenser, which dispenses with the use of an air pump. To the second class belong the various types of surface condensers, vertical or horizontal, counter-current or parallel-current, steam or water inside tubes. Evaporative condensers may also generally be included in this class, but they should be exact in a separate class of their own, because the condensation within the tubes is brought about by the evaporation of part of the water circulated over the inside of the tubes. Surface condensers are generally used on board ship, jet condensers not being suitable for marine work, these and others of this type being invariably used in land practice on account of their low first cost and the higher efficiency available as compared with the surface condensers.

The surface condenser, as is well known, consists of a chamber through which a number of tubes run carrying the water for condensing the steam. The condensed steam and the condensed water are kept separate, so that whatever the quality of the condensing water the condensed steam can be returned to the boilers.

The barometric condenser consists of a barometric tube sealed under water at the bottom. The steam and injection water enter at the top end, the former being condensed and the two then passing down the barometric tube, whose height to the underside of the barometric head from the water level is about 34 ft., and consequently has very often to be placed outside the engine room. The air is drawn off in a special pipe. This condenser is particularly useful when the dirty nature of the water would render the surface condenser inefficient by reason of the dirt coating the tubes. It has the disadvantage, however, that the condenser discharge cannot be used for boiler feed unless it is first treated to an expensive treatment. It is, however, cheap, simple, reliable, and occupies very little floor space. Moreover, in common with all other injection condensers, it requires less condensing water than a surface condenser, on account of the higher outlet temperature of the said water. The advantage is most marked where the temperature of the condensing water is high to begin with.

The non-barometric condenser consists simply of a chamber into which the exhaust steam and the injection water enter. The air pump has to remove both air and water (condensed steam), and also in this case the injection water as well. It is much inferior generally to the barometric type of condenser, owing to the large pump capacity required.

In the ejector condenser a jet of water enters the condensing pipe by a nozzle, and, condensing the steam, sweeps both the condensed steam and itself out of the pipe against the atmospheric pressure by reason of its kinetic energy. The vacuum is, however, not of the best, but the air pump is not required in this kind of condenser, rendering the arrangement very simple.

The choice of condenser to be used depends upon a variety of different causes, depending not only on the amount of water available, but also on its quality and the vacuum necessary. The various conditions which in practice may arise may be summarised as follows, in accordance with an arrangement given by Mr. W. H. Roy:—

(1) An abundant supply of fresh water, sufficiently pure for boiler-feeding purposes. Some form of jet condenser, or ejector condenser, would be the most suitable to adopt, and, unless it is intended to secure a high vacuum of 27 in. or 28 in., an ejector condenser, with centrifugal pump to lift the water to a height of 15 ft. or 16 ft. above the condenser—unless there existed a natural head of that amount, in which case the pump would not be required—would probably prove to be the lowest in first cost and the most economical in working.

(2) An abundant supply of cheap water, but of quality unsuitable for boiler feed. It is desirable to use a surface condenser, and, if the boiler feed has to be drawn from the same source, some kind of water-softening or purifying plant; or, as in the case of marine engines, an evaporator becomes necessary to make up the loss of feed water due to leakage.

(3) A limited supply of water of quality right for boiler feed, but not sufficient in quantity to be discharged to waste, or relatively expensive to obtain. A jet condenser would be the best to adopt, and some form of water re-cooling plant becomes necessary, of sufficient capacity to reduce the temperature to a point low enough for continuous working.

(4) A limited supply of water unsuitable for boiler feed. A surface condenser would be the most suitable type, combined with water-cooling plant of ample capacity for continuous working, and with water-softening or purifying apparatus to make up the loss in boiler feed.

An alternative to the last two cases would be to adopt some form of evaporative condenser in which the water consumption is reduced to a minimum and the use of re-cooling plant dispensed with.

In proportioning condensers the common rule for surface condensers is to allow about one square foot of cooling surface for every 12 lbs. or 14 lbs. of steam condensed per hour. This would correspond to about 1·8 square feet per kilowatt for a turbine. It is usual, however, in modern practice to use 4 square feet per kilowatt in order to obtain the high vacuum which is considered necessary, but which are only occasionally in many plants commercially economical. The condenser surface must also be increased to about 1½ square feet per indicated horse power.

It is also necessary to increase the volume of circulating water, and so modify the design of the condenser that the velocity of the water through the tubes shall be 4 ft. to 7 ft. per second, so as to secure some measure of turbulent flow and consequently better absorption of heat. The tubes of the condenser should also be so placed as to allow an easy flow of steam among them, and Messrs. C. A. Parsons and G. G. Storey found it desirable to submerge the lower tubes in the condensed water before it goes to the air pump. By this arrangement the condensed water is thoroughly cooled before it reaches the air pump, and a lower air pump temperature is obtained. It is generally necessary to use a larger air pump, but the increase of power required for this and for the larger circulating pump when the circulating water has not been lifted more than 15 ft. or 20 ft., and the return main is water-sealed, will not exceed $1\frac{1}{4}$ per cent of the total power developed. With the foregoing arrangements it is possible to maintain a vacuum of $27\frac{1}{2}$ in. to 28 in., and thus to effect a saving of 5 per cent on the coal consumed. In regard to this item of the saving to be obtained in coal consumption by an increase in vacuum, if coal costs 10s. per ton and each pound of coal evaporates 9 lbs. of water, then the fuel cost per year for a 1,000-kilowatt turbine for each one per cent of the load factor

$$\left(= \frac{\text{yearly output (units)}}{\text{capacity for yearly output}}\right)$$

is decreased by

$$\frac{365 \times 24 \times 560 \times 0{\cdot}5}{2240 \times 7 \times 100} = £1{\cdot}56$$

per extra inch of vacuum. Thus an increase from 26 in. to 28 in. at a load factor of 20 per cent would reduce the fuel cost per year by £62·5.

Another factor, however, enters into the discussion here, and that is the cost of water. In many instances this item can be overcome, because if the canal or river is not available the cooling pond is, and thus this does not enter largely into the discussions in plants of medium rated size, but in large installations for electric lighting and electric traction purposes, say for a town's tram service, the cost of water is going to play a very important part, often so important as to nullify any gain obtained by a condensing plant at all, no matter how efficient the vacuum may be. Thus in the large power-houses we find plants aggregating anything from 5,000 to 25,000 I.H.P. and upwards, and in many instances, not being situated in the manufacturing districts, and the river, canal, and cooling pond not being directly available, recourse has then to be had to water companies' mains and to cooling towers. The volumes of water to be dealt with are tremendous; thus an ordinary condensing engine uses thirty times the feed water to get a good vacuum, and if we take the steam consumption at, say, 15 lbs. per indicated horse power per hour, this means 450 lbs. of condensing water, and for 10,000 I.H.P. 450,000 lbs., or about 2,000 tons per hour, nearly as much as a dock 45 ft. wide, 160 ft. long, and 10 ft. deep will hold; by gallons the quantity is 450,000. All this water cannot be had for nothing, and it cannot be dealt with for nothing; if turbines be used the demand is doubled, and 4,000 tons must pass hourly through the condensers. It is scarcely necessary to say that this water will have to be used over and over again in large cities, and the cooling tower becomes a necessity. It then becomes necessary to pump 900,000 gallons to a height of 40 ft. per hour, and thus a special pumping plant has to be employed. Furthermore it is obvious that the amount of the vacuum will largely depend upon the temperature of the condensing water. To get within 2 in. of the barometer the condenser temperature must not exceed 100 deg. Fah., and to get within 4 in. 125 deg. Fah. But the cooling water must be less than this, and the demand on the cooling tower will be very heavy; so heavy that in any case the extra 250 deg. Fah. demanded by the turbine is a serious matter, whereas with the piston engine water at 75 deg. Fah. may serve very well. It must be brought down to 60 deg. Fah. for the turbine, or pretty nearly to the atmosphere on the average. It is thus evident that condensing must not be decided upon indiscriminately.

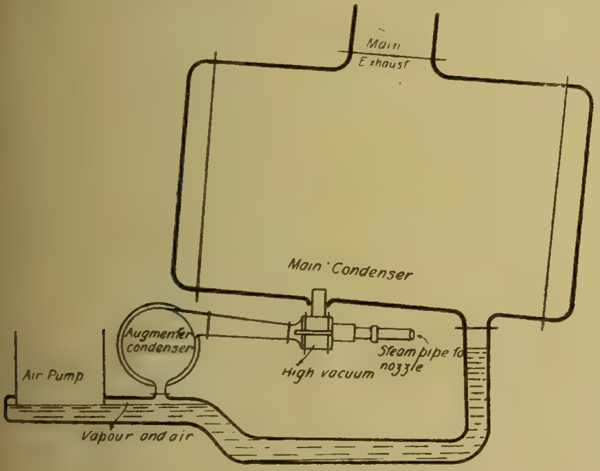


FIG. 11

Because of the importance to the steam turbine of a high vacuum, led Messrs. Parsons and Storey to the design of a new apparatus to assist the ordinary air pump and condenser. This apparatus is shown diagrammatically in fig. 11, and consists merely of a steam jet placed in a contracted pipe between the condenser and the air pump, which draws the air and vapour from the condenser and reduces the vapour density therein to about one-third. The air and vapour is compressed in the contracted pipe to about one-half its bulk, and is delivered to the air pump through a small auxiliary condenser (having about 2 to 3 per cent of the cooling surface of the main condenser), which cools the air and partially condenses the vapour before it enters the air pump. The water of condensation in the main condenser gravitates directly into the air pump suction by a separate connecting pipe, which is water-sealed. The consumption of steam in the jet has recently been reduced to about 1 to $1\frac{1}{2}$ per cent of that being dealt with at normal load in the main condenser, and the observed total net reduction of steam consumption in the turbine is about 8 per cent at full load, the condenser, the volume of circulating water, and the velocity of the air pump being the same.

(*To be continued.*)

CONICAL ROLLER BEARINGS.

IN connection with roller bearings of the type wherein conical rollers are used in conjunction with conical rings or races, and wherein the housing can be removed from the shaft with the bearings remaining in place within its interior, it may be of interest to our readers to note some of the recent improvements in this direction. The principal object of the design shown in the accompanying illustrations is to facilitate the adjustment of the bearings, and allow of the same being adjusted to the correct tightness before the housing is placed upon the axle or shaft, and to permit of the housing and bearings being readily removed from, or replaced upon, the axle or shaft without disturbing the adjustment of the said bearings.

Roller bearings of the above-mentioned type are known which comprise a central sleeve removably fitting upon the axle, and carrying at opposite ends the inner rings or races of two sets of conical roller bearings, the race at the outer end being adjustable by screwing upon the sleeve, and the outer rings of the two sets of bearings being connected together by a screwed ring, or by being screwed directly to one another. Also in some cases the sleeve upon the axle has been dispensed with, and the cones keyed direct to the axle, longitudinal shifting being prevented by fitting adjustment and lock nuts upon the threaded end of the axle, but in this case the housing and bearings cannot be removed from the axle without interfering with the adjustment of the said bearings. According to the arrangement we are describing, the adjustment is effected by arranging one of the race rings of the one set of bearings to be free to slide laterally upon the central axle sleeve or within the housing, the adjustment being effected by a nut or screwed ring screwing on to the said sleeve, or into the end of the housing, whilst to give a simultaneous adjustment to the second set of bearings a separate loose distance sleeve is employed between the inner or outer race rings of both sets of bearings.

Fig. 1 represents the application of the arrangement to the front wheel hub of a motor-driven vehicle.

Fig. 2 is a cross section on line X, fig. 1.

Fig. 3 represents a modified bearing arrangement.

Referring to the application to a wheel hub, as shown in fig. 1, removably mounted upon the axle or shaft 1 with a close sliding fit is a sleeve 2, which is secured in position by a nut 3 upon the extremity of said axle, the inner end abutting against a shoulder 4 on the latter. Two sets of roller bearings are employed, same being located at opposite ends of the hub. The inner race ring 5 of the inside set is mounted upon the inner end of the central sleeve 2 adjacent to a shoulder or flange 6 at the extremity of the latter, whilst the corresponding race ring 7 of the outside set of bearings is adjustably carried by the outer extremity of said sleeve so as to be free to slide longitudinally thereon. The rollers 8, 9 are of a conical formation with the smaller ends directed towards the interior of the hub. The periphery of the inner race rings 5, 7 are coned or tapered to correspond with the rollers, and are provided with broad annular grooves or channels in which said rollers run. The outer race rings 10, 11 are coned internally to correspond with the rollers, but have their outer peripheries cylindrical. Interposed between the said outer race rings 10, 11 of the two sets of bearings is a sleeve or barrel 12, which acts as a distance piece, and as a means of effecting the simultaneous adjustment of both bearings, as hereafter described. The said distance sleeve 12 is preferably provided with an internal collar 13, which surrounds the central axle sleeve 2.

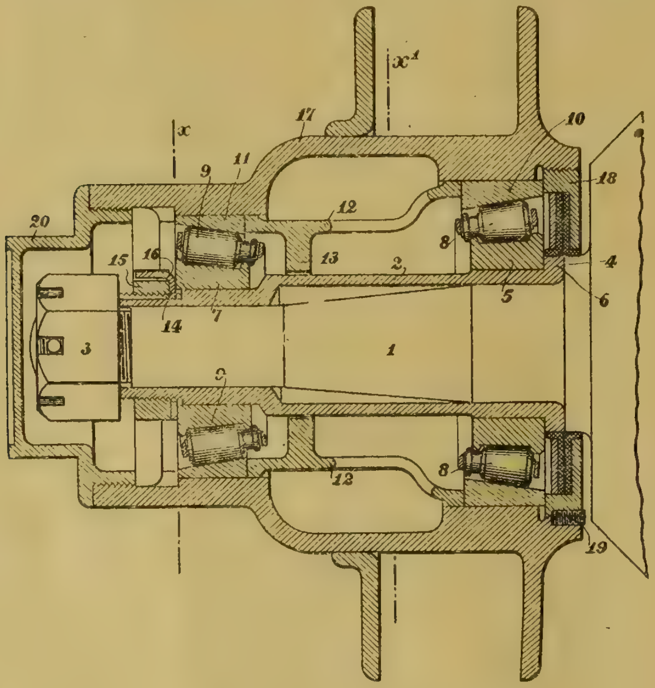


Fig. 1.

The extreme end of the latter is set-down and shouldered at 14, and the outer end of the inner race ring 7 of the outside bearing is arranged to extend a short distance beyond said shouldered part. This latter is screw-threaded and fitted with a nut 15 adapted, through the medium of an interposed locking washer 16, to bear against the end of the race ring. By screwing up this nut 15 the said race ring 7 is moved longitudinally to adjust the outside bearing, and the movement is further transmitted from the outer race ring 11 through the distance sleeve to the outer race ring 10 of the bearing at the inner end of the hub, so that both bearings are simultaneously adjusted.

The hub is completed by the outer shell or housing 17, upon which the wheel is built up and which encloses the sleeve and mounted bearings above described.

The inner open end of this housing 17 is closed by a screwed-in or otherwise attached cap or plate 18, adapted to be locked, after adjustment of the bearings, by a grub screw 19, whilst the outer end is fitted with a screwed hub cap 20, as usual.

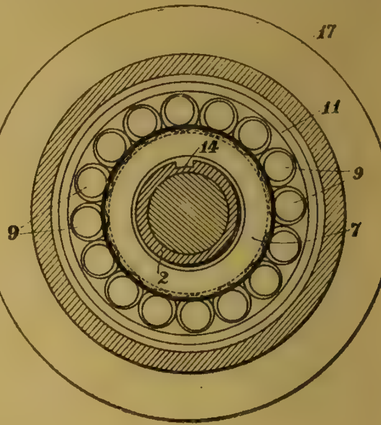


Fig. 2.

The bearings can be mounted and adjusted upon the central sleeve 2 before being applied to the axle or fitted within the hub shell; or the hub shell or housing 17 and the inner sleeve 2 and bearings can be removed laterally from off the axle 1 by simply removing the nut 3 without in any way disturbing the said bearings, and can in the same way be replaced. After adjustment the race rings are prevented from being disturbed from their set position by the end plate 18 and nut 15.

To remove the housing 17 and obtain access to the bearings after having been detached from the axle, it is only necessary to unscrew the plate 18.

Referring to the modification shown in fig. 3, 1 is the axle surrounded by the sleeve 2 removably secured in position by the nut 3. In this case the conical rollers 8, 9 are arranged with their smaller ends directed towards the opposite ends of the axle, the inner race rings 5, 7 and outer rings 10, 11 being arranged to correspond.

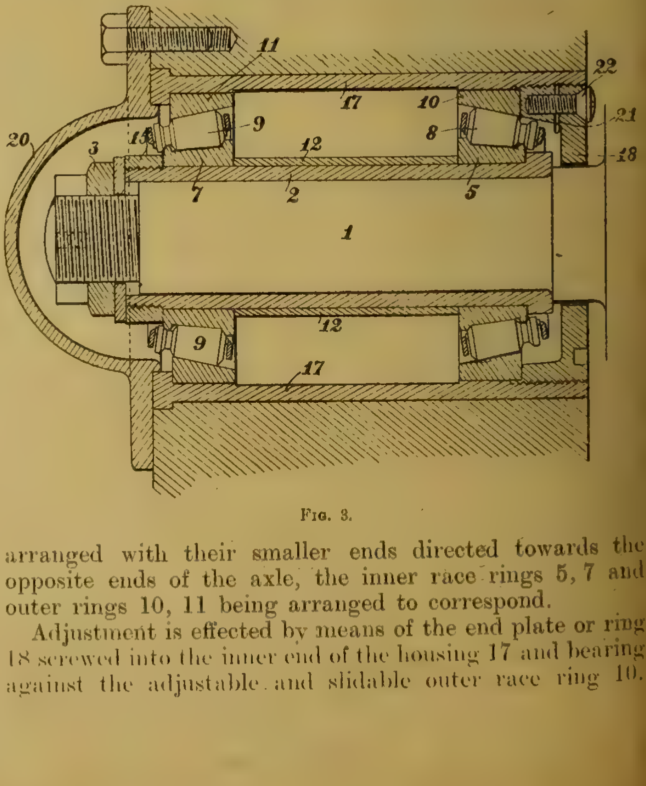


Fig. 3.

Adjustment is effected by means of the end plate or ring 18 screwed into the inner end of the housing 17 and bearing against the adjustable and slidable outer race ring 10.

Between the inner rings 5, 7 is the distance sleeve 12 fitting closely upon the axle sleeve 2. Upon the outer side of the race 7 is a nut 15 screwed upon the end of the said sleeve 2. By screwing in the ring 18 more or less the race 10 is moved longitudinally so as to first take up the slack of the inner set of bearings and then the further screwing-in of the ring draws the housing 17 longitudinally with respect to the axle, so moving the race 11 inwards with respect to the race 7, and thus adjusting the outer set of bearings.

After adjustment the ring 18 is locked in position. For this purpose the said ring may be split at 21 and a screw 22 passing through the two parts is tightened up so as to draw them together and bind the threads; or any other locking arrangement may be employed.

A cover cap 20 is fitted upon the outer end of the bearings. By detaching this cap and removing the nut 3, the whole can be slid laterally off the axle 1.

The designs described above have recently been developed by the Electrical Ordnance Accessories Co. Ltd.

BOILER EXPLOSIONS.

Abstracts from Recent Board of Trade Reports.

Explosion from the Main Steam Pipe on the steamship Bonawe.

Report of Preliminary Inquiry No. 1,926.—The explosion occurred about 11 a.m. on the 12th March last, the vessel at the time being abreast of and half a mile distant from Hook Head, Waterford Harbour. The vessel is the property of Messrs. J. and A. Gardner and Co. Ltd., 65, Great Clyde Street, Glasgow. The steam pipe was of solid-drawn copper, $3\frac{1}{2}$ in. in internal diameter, about ·16 in. in thickness, about 5 ft. 10 in. in length, and was about six and a half years old. The pipe was tested by water pressure to 270 lbs. per square inch, in the makers' works, on the 31st October, 1903. On the 15th January, 1910, at the works of Messrs. D. Brown and Co., Phœnix Copper Works, Govan, a small patch was brazed on the pipe, where it had been rubbing on a bulkhead; it was then annealed, and tested by water pressure to 270 lbs. per square inch. The vessel is classed with Lloyd's, and under the inspection of their surveyors. The pipe was last inspected by one of that society's surveyors at Glasgow during the water test, on the 15th January last. The pipe fractured all round near the flange connected to the boiler stop valve chest, and through the opening thus formed steam escaped with great violence. The explosion was evidently caused by the straining action due to vibration of the machinery and steam pipe during heavy weather.

Explosion from a Boiler on the steamer Birker Force.

Report of Preliminary Inquiry No. 1,927.—The explosion occurred at about 12-15 p.m., on the 2nd April last, when the vessel was about 9 miles north-east of the North Foreland, on a voyage from Shoreham to Wisbeach. The managing owner of the vessel is Mr. William S. Kennaugh, 27, Water Street, Liverpool. The boiler was made of steel, and was of the ordinary single-ended marine type with three plain furnaces. It was 10 ft. 6 in. in length and 13 ft. 6 in. in diameter. The furnaces were 3 ft. 6 in. in diameter and 6 ft. 6 in. long. The shell plates were $^{15}/_{16}$ in. thick, the end plates $^{9}/_{16}$ in. with a $\frac{3}{8}$ in. doubling plate over the wide spaces between stays. The wrapper plates of the combustion chambers were $^{17}/_{32}$ in. and the back plate of the combustion chambers $^{33}/_{64}$ in. thick. The furnace plates were $\frac{5}{8}$ in. in thickness. All the usual mountings necessary for a marine boiler were fitted, including two spring-loaded safety valves adjusted for a working pressure of 140 lbs. per square inch. A few months after the vessel was delivered by the builders, two slight flaws, one on each corner of the top flange of the centre furnace, were repaired by fixing three chain studs in each crack. In February, 1906, the bottom plate and back plate of the centre combustion chamber were cropped, and new plates, with 18 new screwed stays, were then fitted. In August, 1908, one rivet was renewed in the compensation ring of one of the bottom manholes; and in August, 1909, both bottom doors were renewed and the spigot holes chipped fair. The vessel was classed with Lloyd's Register of British and Foreign Shipping, and the boiler was inspected by Mr. B. G. Oxford, one of the surveyors to that Society, in August, 1909, the safety valves being adjusted under steam on the 9th October, 1900, by Mr. R. D. Shilston, also a surveyor to Lloyd's Register. It was also examined by Mr. Thomas T. Kennaugh, the owner's superintending engineer, in January, 1910; and by Mr. John G. Harris, the chief engineer of the vessel, in the first week of March last. A hole of about $\frac{3}{4}$ sq. in. in area was formed at the side of one of the stays in the bottom row of stays in the back plate of the centre combustion chamber through which the contents of the boiler escaped into the stokehold, the pressure at the time being about 140 lbs. per square inch. The explosion was due to corrosion, principally on the fire side of the plate, set up by leakage from the stay, which apparently had not been a tight fit in the hole. There was also corrosion at the same spot on the water side of the plate. The leakage from the stay and the corrosion on the fire side of the plate appeared to have stopped for some time, but that on the water side of the plate was still active; and, in consequence of this, the plate at that part became unable to withstand the ordinary working pressure.

Explosion from a Tube in a Steam-heated Baker's Oven.

Report of Preliminary Inquiry No. 1,928.—The explosion occurred at about 7-50 a.m. on Saturday, the 19th February, 1910, at Church View House, Shepherdswell, near Dover, Mr. W. E. Masters being the tenant. The bakehouse in which the oven is situated is a part of the dwelling house known as Church View House, which is the property of Mr. Harry Steeds, Ratling Court, Adisham, Kent. The oven is of the double-decked type, each of the compartments being 6 ft. in length and 4 ft. in breadth. It was heated by means of 52 wrought-iron sealed tubes arranged in three rows, there being 16, 14, and 22 in the upper, middle, and lower rows respectively. They were 7 ft. 5 in. in length, and $1^{5}/_{16}$ in. in external diameter, some being $^{23}/_{32}$ in. in internal diameter, while others, including the one which exploded, were $\frac{5}{8}$ in. in internal diameter. Each tube contained a small quantity of water, but was not provided with any fittings. The tubes rested on bearers at the front end, and projected through the back wall of the oven into the furnace for a length of 6 in., being depressed from the horizontal at the furnace end. The outer ends of the lower row formed the firegrate; a suitable door was fitted to the furnace, and a damper was provided in the flue to control the draught. A mercurial thermometer, marked up to 620 deg. Fah., was fitted to each compartment to indicate the temperature, each being clearly marked "Baking Heat," at 460 deg. A water cistern was placed on the top of the furnace flue to provide hot water for household purposes, and for the prover which was built under the oven. The latter supply had not, however, been used for some months, owing to the pipe from the cistern to the prover being out of order. Coke was the fuel used in the furnace, and the waste gases passed away into a brick chimney attached to the side of the house. The eighteenth tube, in the lower row counting from the fire door, ruptured at the furnace end. The rupture commenced in the butt weld and in opening out the solid metal at the opposite side of the tube was torn through. The total length of the fracture at the side of the weld was $11\frac{5}{8}$ in. and that on the opposite side $9\frac{1}{2}$ in., the two portions of the tube opening out 2¾ in. There was no material reduction in the thickness of the metal. The explosion was probably due to over-pressure and overheating of the material, brought about by the wastage of the brickwork forming the furnace, whereby the length of the latter was increased in the vicinity of the exploded tube nearly 100 per cent more than that originally intended by the makers of the apparatus.

Explosion from the Auxiliary Condenser on the steamship Avondale Castle.

Report of Preliminary Inquiry No. 1,929.—The explosion occurred on board the "Avondale Castle," at about 3-50 p.m. on the 14th February last, when the vessel was being taken from the East India Dock into the dry dock at Blackwall, London, E. The auxiliary condenser is the property of the Union Castle Mail Steamship Company Ltd., 3 and 4, Fenchurch Street, London, E.C. The condenser and covers were made of cast iron. The former was of the ordinary cylindrical type; it was 5 ft. 11¾ in. long, 27 in. diameter, and ⅝ in. thick. The end covers were 35¼ in. diameter, and were secured by 20 studs ⅞ in. diameter; the covers were ⅝ in. thick in the centre and ⅞ in. thick at the flange forming the joint, and were strengthened with two outside webs, each web being ⅝ in. thick and 1⅝ in. deep at the centre. The condenser was fitted with 389 brass tubes ¾ in. diameter, the circulating inlet and outlet valves were each 5½ in. diameter, and on the exhaust side there was a 2¾ in. drain valve fitted with a pipe leading to the feed tank. There was also a supplementary feed cock and pipe about ½ in. bore, so that extra feed could be supplied to the auxiliary boiler when required. On the cover at the forward end of the condenser, a relief valve 3⅜ in. in diameter was fitted and loaded to a pressure of 30 lbs. per square inch. A brass patch ⅛ in. thick and about 14 in. wide was fitted to the bottom part of the shell in November, 1906, and this patch extended the full length of the steam space between the tube plates. In January last the condenser doors were taken off and a new diaphragm plate fitted at the after end, and some of the tubes were renewed. The whole of the front cover, inside of the securing bolts, on the circulating side of the condenser was completely blown out. The explosion was due to the exhaust steam pressure from the steering engine having been admitted to the condenser, owing to an oversight, when it was not in use, and passing through the supplementary feed-cock to the water side, the pressure was greater than the condenser door was able to withstand.

Explosion from a Boiler Feed Pump.

Report of Preliminary Inquiry No. 1,930.—The explosion occurred about 11-50 a.m. on the 5th March last, at the factory of Trufood Ltd., Wrenbury, Cheshire. The pump was of the horizontal duplex type, the bore of the steam and water cylinders being 6 in. and 4 in. respectively, and the stroke 6 in. It was used to supply feed water to the boilers, the water flowing into the pump, at a temperature of about 230 deg. Fah., from a feed water heater. The delivery pipe was fitted with a relief valve, 2 in. in diameter, loaded to about 20 lbs. above the boiler pressure. The dimensions of the fractured cover were 12 in. × 12 in. and ½ in. to ⅝ in. in thickness at the fractured part. With the exception of renewing one suction and one delivery valve, and the re-making of the cover joint, no repairs have been required. The pump has not been inspected beyond the examination which was made by the factory mechanic when the valves were renewed and the water end cover re-jointed. The cover of the water end of the pump fractured at the top, leaving an opening about equal to one-half the total area of the cover, through which the fluid contents of the pump escaped into the engine room. From the statement of the manager, the primary cause of the explosion appears to have been a flaw in the cover and also the irregular working of the pump.

TRADE NOTES.

Messrs. Geo. Brown and Co., Greenock, have contracted to build two small twin-screw passenger steamers for shipment to India.

The "Hatfield" treble-barrel high-speed reciprocating pump, of which **Messrs. Merryweather and Sons** are the sole patentees and makers, has found great favour among railways, and has been adopted by the Great Eastern, Midland, Great Central, Caledonian, and other companies. It is suitable for driving by various powers, such as electricity, gas, oil, petrol, steam, etc., and is made in sizes ranging from six to 1,000 gallons capacity per minute. A pump of this design, driven by electric motor, has recently been supplied to the Lancashire and Yorkshire Railway for a fire protective installation at the company's premises at Castleton. The pump, which is capable of delivering 600 gallons per minute at 100 lbs. pressure when running at 185 revolutions per minute, is driven by a 60 H.P. motor through silent chain gearing. The motor is fitted on sliding rails, enabling the chain tension to be adjusted as may be necessary in order to take up wear. The pump delivers through a system of fire-main piping with hydrants at various points. A relief valve is fitted, so that no damage will occur to the fittings between the time the hydrants are closed and the pump ceases to run. It is claimed that the "Hatfield" pump will deliver more water, at a greater pressure, for a given expenditure of power, than any other pump employed for fire purposes.

A contract for a large steamer is understood to have been received by **Messrs. Ropner and Son,** Stockton, from Messrs. R. Chapman and Sons, Newcastle. The vessel, which will be of 10,000 tons capacity, is intended for the Eastern trade.

An order for a trading steamer of 7,300 tons has been placed by Messrs. W. Holzapfel and Co., Newcastle, with the **Northumberland Shipbuilding Co.,** Howdon-on-Tyne.

H.M. Trade Commissioner reports that a firm at Ottawa wish to get into communication with British manufacturers of chains of all sizes, and of rubber, leather, and cotton belting. The name and address of the firm in question may be obtained by British firms on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C., but any further communications with regard to the inquiry should be addressed to H.M. Trade Commissioner for Canada, 120, Board of Trade Building, Montreal.—*Board of Trade Journal.*

We understand that **Messrs. Sir W. G. Armstrong, Whitworth and Co.** have received an order for the construction of a cruiser for the Chinese Government. The cruiser will be a small one similar to the one being built for China by Messrs. Vickers, Sons, and Maxim.

The **British Westinghouse Co.,** Manchester, have secured the contract for a turbo-generator, which is to be installed at a cost of £4,775, for the Leith Corporation Electricity Station.

Messrs. E. Bennis and Co. Ltd. have received an order from Messrs. Greenwood and Batley Ltd. for two Bennis stokers and self-cleaning compressed air furnaces for an 8 ft. 6 in. Lancashire boiler. The same firm are also supplying the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board with four Bennis stokers at the generating station, Tame Valley, Stalybridge.

A new company named the **Dowson and Mason Gas Plant Co. Ltd.** has been formed to combine the old-established business of the Dowson Co. with that of the Mason Co., of Manchester, who have had special experience with gas furnace work. The well-known Dowson gas plants will still be used for engine work, and the Mason furnaces and producers will be used for furnace work. The works of the combined company will be at Levenshulme, Manchester, and the London office will be continued at 39, Victoria Street, Westminster. Mr. Dowson will act as engineer and managing director of the combined business.

The Admiralty has placed with **Messrs. Scott and Co.,** Greenock, an order to build a depot ship for a fleet of submarines. The vessel will be in certain important respects an improvement on the vessels of her class. She will have twin screws, and will be fitted with a full range of repairing machinery, having her engines so arranged that they can be employed in supplying power to the workshops on board as well as propelling the vessel. She will be 320 ft. in length and will be supplied with a double set of reciprocating engines. This new contract is welcomed by employés of Scott's Co., for whom it means a good deal of employment. Messrs. Scott were the builders of the Dreadnought Colossus.

BORING PNEUMATIC HAMMER HANDLES ON THE TURRET LATHE.

[CONTRIBUTED.]

THESE handles (fig. 1), of which a numerous quantity have to be dealt with, require to be machined within close limits of accuracy, both as regards surface and relative angles of the different holes.

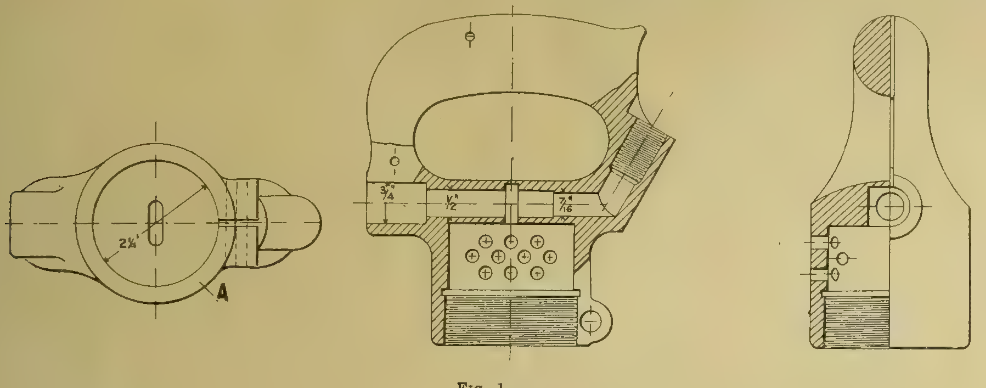


FIG. 1.

Material is drop forged mild steel of 30 tons tensile strength. Boring is performed on a No. 3 Herbert turret lathe, provided for the first operation with a two-jaw chuck, fitted with hardened extended vice jaws of sufficient length to grip diameter A (fig. 1), so that the handle clears the chuck body.

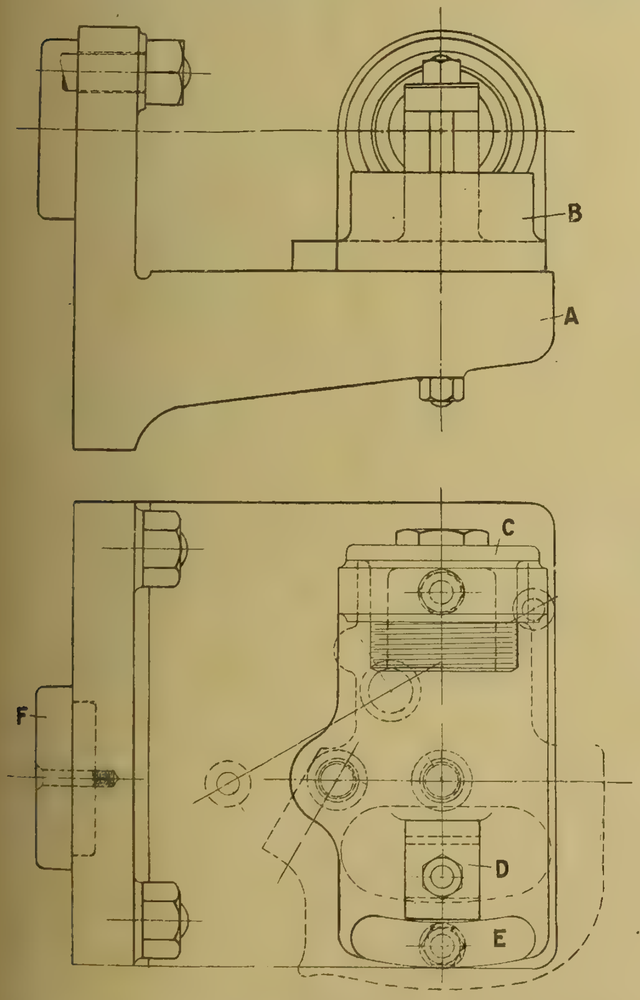
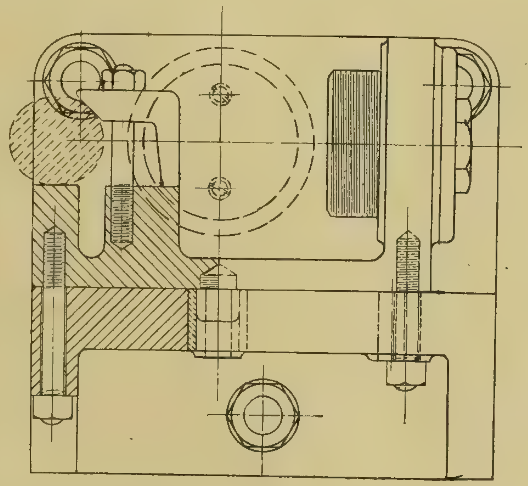


FIG. 2.

Forging is chucked true in this, faced on the end, and a 2 in. drill taken as deep as possible; this is then opened out with single-point tool to within ·010 in. of the 2¼ in. bore. Threaded part is bored to required size, and back recess formed; 2¼ in. diameter is then finished by a Herbert standard counterboring tool, these proving particularly adapted to the particular job.

Threads are cut by single-point tool and chased to gauge, this completing first operation. The parts are now taken up by a similar machine, equipped with fixture shown at fig. 2. This consists of a body A of grey iron, carrying a loose top piece B, one end of which is fitted with screwed plug C, bearing on its outer facing.

At opposite end are facings D and E, D carrying clamp and stud as shown, while E forms the supporting base.



The top plate is fitted with two hardened steel locating dowels, and body carries corresponding bushes for the required positions. Back spigot F is turned a snug fit for face-plate recess, to which fixture is secured by three bolts.

With fixture in position shown, the clamp is removed and screwed plug (a good sliding fit in its bush) drawn back; the handle is correctly located by insertion of the plug into the bore, and driving work hard against end facing. The top plate holding-down bolts are then secured.

Operating turret to a stop in each case, the $^7/_{16}$ in., ½ in., and ¾ in. bores are drilled and opened out to their respective depths, reamed to gauge, and top boss faced. The top plate is then re-located in second position and clamped, this without alteration to position of work. The second ½ in. bore is drilled to meet the $^7/_{16}$ in. hole of previous operation, and reamed to gauge. This method proved productive of both economical and accurate work, while relative angles were positive.

The fixtures used in drilling the barrel air holes and milling throughout are of somewhat novel design, and may be described in a subsequent article.

ORGANISING AN INSPECTION DEPARTMENT IN AN ENGINEERING WORKS.

By H. Graham.

One of the most important sections in any modern engineering works is undoubtedly an efficient and properly organised inspection department, which should be in charge of a competent foreman inspector, who, in turn, is responsible to the works manager for the quality of all the work passing through the department under his charge, which, broadly speaking, comprises the entire product of the factory. Where work of an interchangeable nature is produced, requiring a very high degree of accuracy, such as machine guns, motor cars, gas and steam engines, electrical machinery, and small arms, etc., a very rigorous and thorough system of inspection must be enforced, otherwise serious trouble will arise, and, in fact, the reputation of the firm involved will suffer. In these highly competitive days, when so many piece, premium, and bonus systems are in operation in the machine, fitting, and assembling departments, whereby the operators are encouraged to make a special effort to increase their day's output, it is to their benefit, of course, to spend as little time as possible on any given operation or piece of work; consequently, unless every operation, no matter how small it may be, is subjected to a critical inspection, the output would certainly not possess that standard of accuracy which present-day conditions demand, and also under the old day work method, where the workman is apt to spend more time on the job, there being no inducement offered in the shape of bonus if a job is completed in a certain time. Therefore, in every works where a piece work or similar system is in operation, it behoves the management to provide a means of checking the workman's errors. This is generally recognised now, and ample provision is made in the majority of works, whilst in others it is left to the foreman over his department to see that all work turned out under his supervision is of the requisite standard of accuracy. This method is to be condemned, and is open to criticism, as the foreman is very often a busy man and has many calls upon his time. This leaves very little time for inspection purposes, which therefore gets neglected, and work gets into the stores without being examined, which is a very serious item indeed, and sure to cause endless trouble in fitting and assembling; moreover it is not advisable to let the foreman inspect the work of the men under his charge, as naturally he wants the men to turn out as much work as possible. Under these circumstances he may be inclined to pass work as good enough which an independent authority, free to act on his own initiative, would reject.

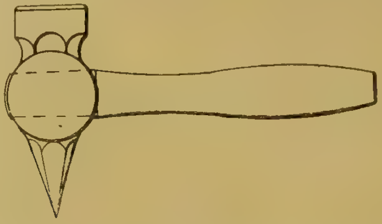


Fig. 1.

A foreman inspector should be a man of ability and force of character, and not be easily led by the departmental foreman, as his position carries great responsibility, and, as a rule, he is not a man to be envied, as his position is not a very pleasant one. "Finding all the fault he can with everybody's work," as his job is often called, he often comes in contact with foremen, charge hands, and workmen, when they think he is severely harsh on them, by rejecting their work, or sending it back for correction, when as a matter of fact he is only carrying out his duties.

When a premium or bonus system of payment is in operation for the workmen, they do not get paid for scrap work, as a rule, but only on the work which the inspector passes as correct, and any sent back for alterations, of course, takes time; hence they lose slightly in that case also, and it is often the cause of friction between the parties concerned, which is to be deplored.

In any works employed on accurate work, everything in the production departments should be inspected, including rough castings, stampings, forgings, and also all outside purchased material, such as nuts, setscrews, studs, bolts, and in fact any special work which it is considered necessary or more economical to purchase outside, as it will often be found that outside contractors are the worst offenders, and, unless a strict inspection is enforced, it will often be found that inferior work is supplied at a price which would allow a good article to be produced.

The location of the inspection department depends somewhat upon circumstances, and also the lay-out of the works in question, but it should be arranged to be in close proximity to the finished stores, if possible, to save a lot of time in delivering the finished components from the inspectors to the storekeeper, who has charge of their distribution. The rough castings, forgings, etc., are not often taken into the inspection department to examine for soundness and size, but are generally inspected in the rough stores, where they are delivered previous to being given out to the various works departments. For inspecting castings a hammer, similar to fig. 1, is recommended, the point at the bottom being used to tap suspected parts, to break through the skin and expose blow holes, and thus save valuable time in the machine departments by condemning them straight away, where possible, if the blow holes are any depth in; of course, they cannot be revealed until partly machined. The home-made calipers shown at fig. 2 are also very useful when inspecting rough castings, etc., for gauging the size of such work as piston castings, gear blanks, etc., and are almost indispensable. A and B are the two sheet steel measuring legs, whilst E is a rectangular steel bar of suitable size to suit requirements. The leg B swings on the short bolt D, and the opposite leg A swings on a similar bolt C. For large variations in work the leg A can be adjusted to any of the holes marked F by taking out the bolt C and inserting it in the required hole. Thus a very wide range of work is within its scope. Moreover, as the legs A and B are so short, in comparison to the diameter of work they will gauge, they are very rigid and free from sag, which is a very great advantage, not found in large calipers of this size if made without the bar E.

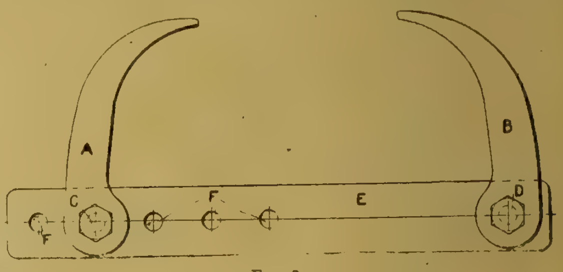


Fig. 2.

In addition to a pair of calipers of the type shown, a full set of internal and external micrometers should be provided, the former provided with extension bars; also a 6-in. vernier for testing plug gauges, which should be tested for accuracy at least once a month. Case-hardened and ground steel ring and plug gauges are much superior to cast-iron ones, and retain their accuracy much longer. Limit gauges should be provided for all work requiring them, with the plus and minus limits properly stamped on. A set of caliper snap gauges of standard sizes should be furnished, graded to suit requirements; also one or two pairs of vee blocks for resting turned work in during inspection. In addition to the measuring tackle and appliances mentioned, which are of a standard nature applicable to the general run of work, a large amount of special gauges and templets made to suit individual requirements will be needed. These are, of course, made in the works tool-room, and are used by the shop operators, as well as the inspection staff.

The inspection department of any works where gearing is manufactured, such as a motor car works for instance, should possess a means for testing the accuracy of cut gears, as modern demands in this respect are very exacting; therefore all gears should be examined after being cut. For this purpose a simple machine, such as illustrated at fig. 3, is recommended. This has provision made for testing both spur and bevel gears. J is a short planed-up bed resting on the two legs K; H is an upright column clamped on J; I is a hand-wheel keyed on a vertical screw for adjusting B; A is a collar, with graduations to permit of fine adjustment to B; C and D are two similar studs to B; E, F, and G are three locking handles. The collars on the bottom of B, C, and D are ground to an inside diameter (3 in. in the present case). An inside micrometer can then be used to gauge the exact distance the centres are apart, as indicated by X, 3 in. being deducted, of course, or an external micrometer can be used over the outside of these collars if they are not far apart, say, under 9-in. centres. E and F are clamped down, and spur gears are tested on C and D, interchangeable bushes being slipped on the studs to fit the bore of the wheels. B and C are used for testing bevel gears on, D being drawn out of the way. Graduated steel rules should be let in the top of the planed bed J, and also in front of the vertical column H, so as to guide the inspector when setting the gear centres. This device does not cost much to make, and is indispensable where accurate gearing is produced.

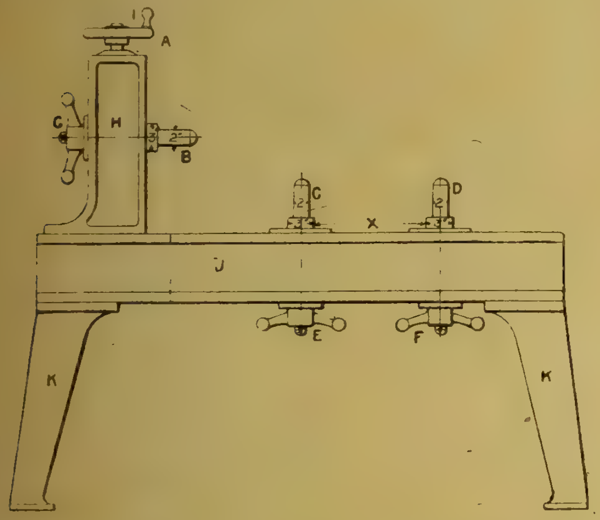
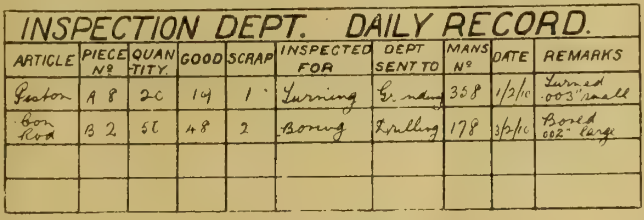


Fig. 3.

Every inspection department should keep a record of the daily work, and every item inspected should be stamped with the private stamp of the inspector, and then entered in the book, so that should any item get lost in being transferred from one department to another the inspector, by looking at his record book, can tell which department it was last sent to, and at what date, which will enable the management to locate the particular item with the minimum of lost time. This is a very important item and often the means of saving much time, and goes far towards the harmonious working of the various departments, as in a large works where a quantity of small items are continually passing through it is a very difficult job to keep in touch with every item and locate it at any time instantly.

Fig. 4 shows a page of a suitable book for an inspector's daily record. It contains most of the necessary entries to facilitate the smooth working of the department, and is quite indispensable in any large, well-organised factory where an inspection department exists. It was originally introduced by the managing director of one of the largest and foremost engineering works in the provinces, and is now used in a large number of works, some of them being in a slightly modified form, with wording to suit special requirements. A daily record of all scrap work should be sent to the works manager or superintendent, as the case may be, with a short explanation in the remarks column prepared for that purpose, briefly stating on what grounds the work is rejected; and where there is a question of doubt as to whether an item should be passed or rejected as scrap, the superintendent should be appealed to for his decision, and the item in question should then be stamped with a special mark only in possession of the foreman inspector, so that in the event of any trouble in assembling or otherwise afterwards it will readily be seen upon what authority it has been passed into the stores.

As regards fixing the limits of accuracy for the products of a factory, great care and judgment has to be exercised. They are sometimes fixed by the designers, and at other times by the works manager, or by a trained expert, such as a jig and tool draughtsman, who has had considerable practical experience and accustomed to working to fine measurements. Of course, no fixed limit of accuracy can be laid down as a standard, as each component part has a duty to perform; hence a limit must be fixed according to circumstances. For a lot of work + ·001 in. and − ·001 in., or a total variation of ·002 in., is the limit allowed, and for medium-sized work that limit is reasonable, and work which passes that should not cause much trouble afterwards in assembling, but for light work, such as small arms and machine guns, a much finer limit has to be fixed. For gear blanks and cylindrical shafts to work in a bearing, petrol engine pistons, etc., the limits are fixed below the whole sizes; thus 3 in. − ·001 in. and − ·003, or 2·999 and 2·997, which gives a total variation of ·002 also. Any errors made in turning spur gear blanks over the top should always be stamped on the side of the rim in figures, as allowance has to be made for that when gear cutting, otherwise the teeth may be cut too deep, and backlash, and consequently noisy gears would be the result; or else the teeth would not be cut deep enough, and the wheels could not then be geared to run at their proper fixed centres, this, notwithstanding the teeth being cut full depth stated on the cutter, or standard depth.



INSPECTION DEPT. DAILY RECORD.

ARTICLE	PIECE Nº	QUANTITY.	GOOD	SCRAP	INSPECTED FOR	DEPT SENT TO	MANS Nº	DATE	REMARKS
Piston	A 8	20	19	1	Turning	Grinding	358	1/2/10	Turned ·003" small
Con Rod	B 2	50	48	2	Boring	Drilling	178	3/2/10	Bored ·002" large

Fig. 4.—Part of Page for Inspector's Daily Record.

Now that grinding has become universal, much finer limits of accuracy can be obtained than would be possible otherwise, and all work possessing any fine degree of accuracy has now a ground finish, which makes case-hardening possible, as the grinding is done afterwards, thus rectifying the errors caused by shrinkage, etc.

Although inspectors may be termed non-producers, and consequently an inspection department increases the dead charges of a works, yet a great deal more would be thrown away by correcting bad work afterwards, besides the cost of fitting and assembling going up to an alarming extent, than compensates for the wages paid in the inspection department; but not only that, what is more important still, the inspector is a check on bad work, and wherever an inspection department is installed the accuracy of the product turned out improves accordingly, and thus enhances the reputation of the firm involved.

ELECTRO-MAGNETS FOR LIFTING PURPOSES.

[CONTRIBUTED.]

At all plants wherever pig iron, metal plates, tubes, rails, beams, scrap or heavy castings of iron or steel are handled, lifting magnets can be advantageously employed. The time saved due to the fact that hoisting tackle need not be adjusted to the object to be raised is of itself sufficient to justify the use of a lifting magnet. For handling pig iron, scrap, and similar material, a further advantage is found in the fact that the objects to be moved need not be piled beforehand. All that is necessary in work of this sort is to lower the magnet on to the pigs or scrap, switch on the current, and lift.

The accompanying illustration, Fig. 1, shows a 43-in. Cutler-Hammer magnet handling a 3,500-lb. steel girder in the manner above mentioned, while drawings figs. 2 and 3 show the terminal connections, the arrangement of the coil in the magnet body, as well as the inner and outer pole-shoes. The illustration fig. 4 shows one form of Browning lifting magnet, while drawing fig. 5 indicates two arrangements for taking up slack cable in carrying current to lifting magnets, the diameter of the pulleys being at least 30 times the diameter of the cable.

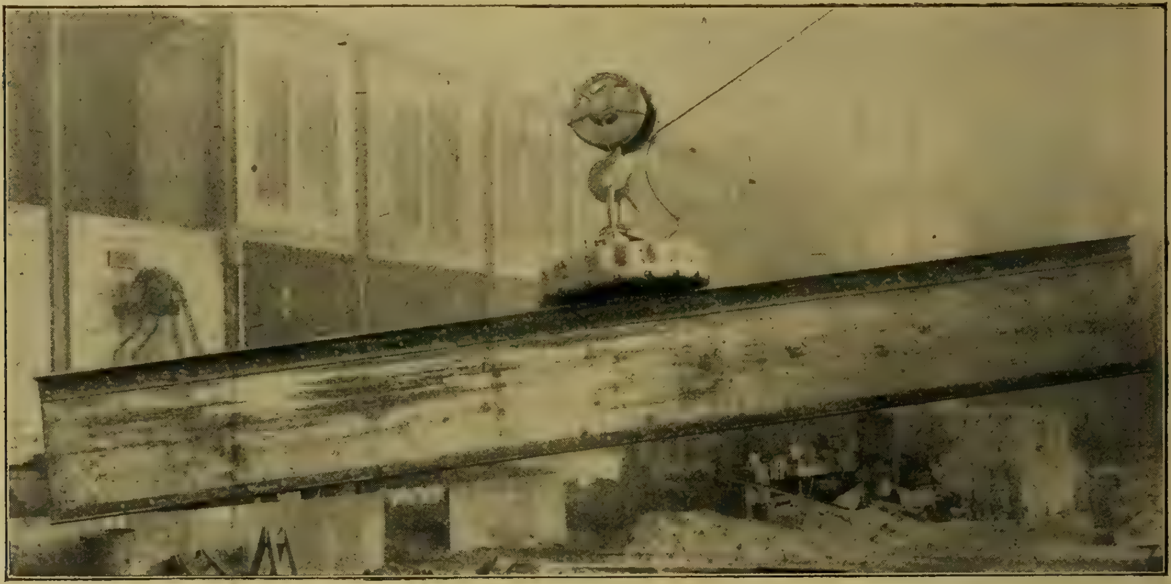


Fig. 1.—43-in. Cutler-Hammer Magnet.

The Browning magnets range from 12 in. to 48 in. in diameter, and sizes up to 60 in. have been made. When used on a locomotive crane the current for operating the magnet may be brought from an outside source, using flexible cable or other convenient means to connect to the magnet controller, so as to allow the crane to perform all its functions freely, or it may be generated on the crane itself by a steam or gasoline-driven generator set.

It is claimed that this latter method has the advantage that it is not subject to the variation of voltage which often occurs where the current is taken from the general power circuit of a factory. Such variable voltage will tend to irregularity in the amount lifted by the magnet, and is sometimes great enough to cause dropping of part of the load which the magnet may have suspended.

It may be stated that the principle upon which the operation of a magnet is based is that when a current of electricity passes through a wire, magnetic lines of force are induced to circulate around the wire.

When the wire is straight the magnetism will be thinly distributed along its entire length, but if the wire be wound in a coil the lines of force will be concentrated within a space slightly larger than the coil, and they may be supposed to pass up through the centre, outward on top, down along the outer side and back to the centre beneath.

As iron or steel is a good conductor of these magnetic lines of force, and air is a very poor one, the centre of the magnet coil is filled with steel, which is spread outward over the top and down the outside, so as to make an easy path for the lines of force for three-quarters of their circuit.

It will be noted that the material to be lifted forms the keeper bridging across from the outside shell to the centre, and completes the circuit for the easy passage of the magnetic lines, and the keeper is attracted and held to the magnet poles more or less strongly, just in proportion as it furnishes a path of less resistance than air. The lines of force in use are proportional to the current sent through the wire and to the number of coils.

If the power is turned on or off it induces a current of electricity in a wire circuit near by, so it results that the magnet sends back a reverse current, or tries to do so, by setting up a counter voltage. When the generating current is turned off suddenly the voltage of the reverse current will rise very high, several times the normal generating voltage, so that frequently it punctures the insulation of the coil itself in the effort to make a circuit for the counter current. As the current must be turned on and off each time a new load is picked up, devices must be supplied to prevent the "kick" from damaging the coil.

The Browning lift magnet controller was designed with several pairs of carbon blocks in series inserted in the circuit, and gradually separated as the handle is turned, so as to draw arcs between the carbon tips. The resistance of the arcs is very great and gradually increased with the length, and the current diminishes just as gradually to zero as the arcs go out.

Now the counter voltage which results when this occurs but little exceeds the normal operating voltage, if the handle is turned as rapidly as possible, while if one second is allowed for moving the handle from on to off, the counter voltage will not rise above half the normal.

The frame of the Browning magnet is of open-hearth steel, and the top of the frame is deeply corrugated to provide radiating surface. The outer ring and inner pole are made of the same special steel as the frame, and are so designed as to be easily and cheaply replaced when worn. The inner faces of the magnet frame and ring are machined to exact dimensions, so that the coils fit closely, and the heat generated in the coil is quickly transmitted to the metal on every side.

It may be stated that the bottom plate is of hard non-magnetic material, and, like the poles, can be easily renewed when necessary. It is ribbed on the bottom, so as to increase its radiating surface while increasing its stiffness to withstand the shocks of contact with the material to be lifted. The coils are wound with copper wire, which is covered with special fireproof non-absorbent insulating material. As they are wound, all spaces between the wires of adjacent layers are filled with the same insulating material, which does not become brittle or friable when subjected to shocks together with repeated heating and cooling.

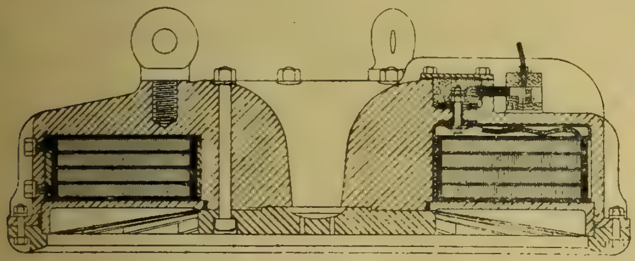


Fig. 2.

It is claimed that a coil made in this way is therefore a homogeneous cushion having the requisite number of turns of wire embedded in it at uniform spaces from each other. It is further insulated with mica and taped. The coils are made of such size as to completely fill the space in the frame, and, when the several parts of the magnet are bolted together, are tightly clamped in place.

It may be mentioned that two coils are used in magnets of this type, which are connected in series for 220 volt circuit, but which may be connected in parallel and used on circuits of 110 volts. For 500 or 550 volts special coils are provided. The terminal box, to the bottom of which the terminals of the coils are connected by insulated studs, is bolted over the opening in the magnet frame, making a water-tight joint. This box forms a socket in its outer part for the reception of a terminal plug, to which the end of the cable is fastened.

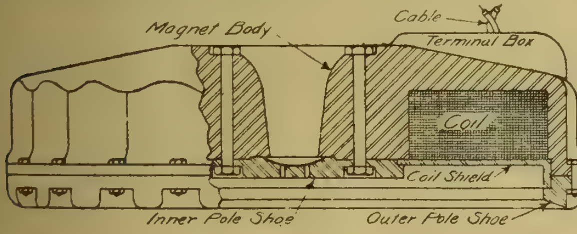


Fig. 3.

A 24-in. Browning magnet, weighing 1,100 lbs. and using 9 amperes at 220 volts direct current, will have an average lift of pig iron of 450 lbs., and heavy plate scrap 300 lbs.

In considering the lifting magnet, it may be noted that the greater the product of turns multiplied by the current the greater will be the lifting capacity, and the greater the actual current taken by the magnet the higher will be its efficiency, since the proportion of live load to dead weight will be increased.

It is necessary to locate the greatest number of ampere turns in the least space and of carrying the greatest amount of current in the conductor. Copper, the metal always used for magnet coils, possesses a positive temperature coefficient, its ohmic resistance increasing with increase in temperature.

A lifting magnet will easily dissipate from its outside surface double the wattage that can be used in the coil, even assuming absolutely perfect conditions for heat radiation to be present. The limiting feature in magnet design, therefore, is the temperature rise of the coil. If too great (aside from the heat effects on the insulation), the result will be a reduction in efficiency due to the increase in coil resistance and consequent reduction of current and ampere turns. Hence it follows that to secure maximum efficiency the best possible conditions for conducting heat from the coil to the outside surface of the magnet must be present.

It may be mentioned that, structurally considered, a lifting magnet consists of the body, or frame, the coil, the coil shield, the renewable pole shoes, and the terminal box. The frame, or body, of the Cutler-Hammer magnet is made of a special grade of dynamo steel, which combines great strength and ductility with excellent magnetic qualities. No combustible material is used in the construction of these magnets, hence there is no danger of them being injured if by accident they should be left in circuit overnight, as has actually happened. Under test the coils of these magnets have been heated to 470 deg. Fah. without injury.

It will be noted that various forms of material require various forms of magnets. It is important that we should know in advance the character of the material to be handled. Magnets for handling plates, rails, tubes, and material of a similar nature, are usually made rectangular in form, and are preferably operated in pairs, the two magnets being placed on a balancing bar to which the crane hook is attached. Magnets for handling pig iron or scrap are almost invariably circular in form, and are constructed with much greater lifting capacity than plate magnets.

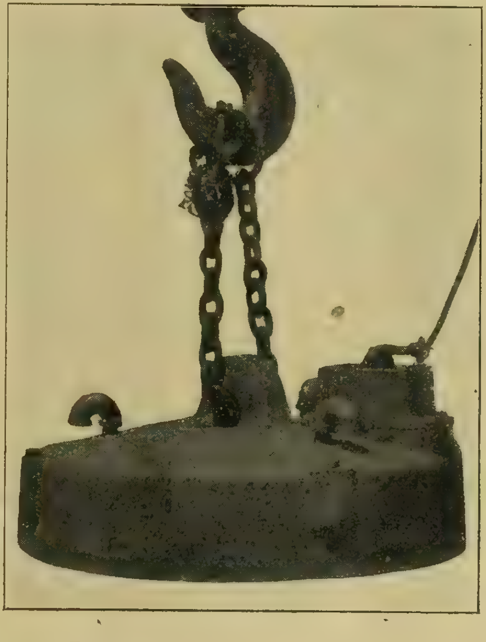


Fig. 4.—Browning Electro Lifting Magnet.

It is held that no single feature of a lifting magnet is so important as the coil, on the design and construction of which the lifting capacity of the magnet largely depends. In very small lifting magnets wire coils may be used to advantage, but in large magnets designed for handling pig iron and scrap it is necessary to secure the highest space efficiency in order to obtain maximum lifting capacity. The highest space efficiency is obtained by constructing the coil of thin copper strip and using asbestos ribbon for insulating between the successive turns of the winding. For insulating between the various layers or sections of the coil, and for insulating the upper and lower faces of the coil from the frame, thick sheets of mica are used in Cutler-Hammer magnets.

The coil and casing of a lifting magnet must be so assembled as to form a compact unit structure, the winding being securely anchored to the frame in every direction, top, bottom, and radially. This is accomplished in Cutler-Hammer magnets by so proportioning the coil, coil shield, and frame that when assembled the coil is gripped firmly between the upper and lower surfaces of the magnet body, this intimate contact again aiding in heat radiation.

The lateral movement of the coil is prevented, first, by the inner pole of the magnet, which extends through the centre of the coil, and, second, by the heavy bolts which extend through the body of the magnet and bear on the periphery of the coil. These bolts are provided with lock washers and are sealed with a waterproof compound.

In order to prevent "creeping" of the coil, the winding is securely clamped with metal bands before being inserted in the magnet frame. The construction described positively prevents any slipping of the coil, no matter how violent may be the shocks to which the magnet is subjected, while at the same time it provides for the inevitable expansion and contraction of the winding due to variations in the working temperature of the magnet.

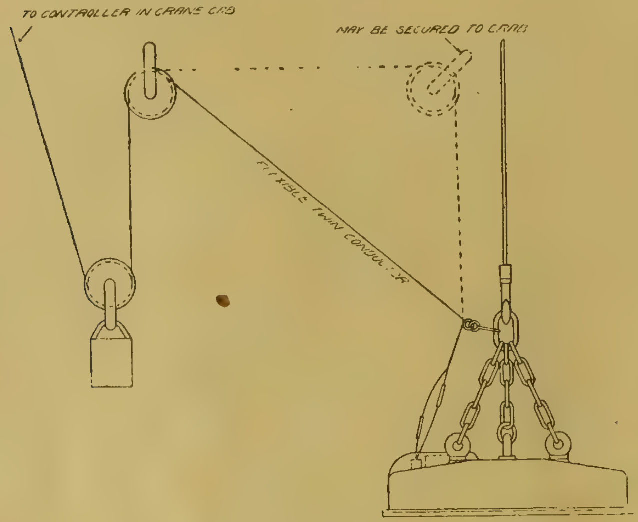


FIG. 5.

Magnets are used at foundries, blast furnaces, and rolling mills for lifting and transporting metal too hot to be touched with the hand. Castings which, because of their shape or because of unequal distribution of weight, require careful adjustment of hoisting tackle, and finished parts which are liable to be chafed with chains, are examples of objects which can be more conveniently handled with lifting magnets than in any other way.

It is true that the single limitation to the magnet's field of usefulness is, in fact, that the objects to be handled shall possess magnetic properties. Iron or steel containing only a small percentage of manganese can be handled with magnets, but the magnetic permeability of such metals will decrease as the percentage of manganese increases, until a point is reached where the magnet will attract them but slightly, if at all.

The lifting capacity of magnets is of great interest, given a solid mass of iron, such, for instance, as a casting affording surface for good magnetic contact, and a 50-in. Cutler-Hammer magnet will lift as much as 60,000 lbs. The magnetic permeability of the metal constituting the load, inequalities of surface, nature of piling; these, and many other considerations, tend to influence the lifting capacity of magnets.

It is stated that the pole shoe of a lifting magnet may be likened to the sole of a shoe; it is the part subjected to the greatest wear and tear. The advantage of casting the pole shoes of a magnet separate from the magnet frame, and hence readily renewable at slight expense, is obvious.

It should be noted in this connection that through bolts, not cap and screws or studs, are used for securing the pole shoes to the magnet frame. Those who have ever endeavoured to remove a cap screw or stud that has rusted in will appreciate the reason for using through bolts. With both ends of a refractory bolt accessible, it is an easy matter to chisel off the nut, knock out the shank of the old bolt, and insert a new one.

It is said that the 43-in. magnet was designed primarily for use with locomotive cranes, a class of service in which it is often necessary to work with restricted head room; a different form of suspension is therefore employed. This consists of a yoke bolted to the top of the magnet and carrying a single link for attaching the magnet to the crane hook. This form of suspension requires only about 27 in. head room.

The cable take-up designed for use with Cutler-Hammer magnets is of special interest. This apparatus is self-contained, and may be attached to any part of the crane trolley. The motor driving the drum on which the cable is coiled is a 2-H.P. series-wound motor, taking 2 amperes at 220 volts from the same feed wires that energise the magnet.

The torque exerted by a motor of constant field strength will vary with the strength of the current admitted to the armature winding, and this principle is utilised in the case of the cable take-up by inserting in the armature circuit of the motor a fixed resistance which limits the amount of current passing through the armature, and consequently limits the pull which the motor can exert on the cable to a predetermined maximum, which is just sufficient to keep the cable taut at all times.

It may be stated that the current for energising the magnet is transmitted to the cable by the collector rings. One of the wooden lags forming the drum is pierced with a small hole, through which the end of the cable connected to the collector rings is passed. The cable is then wound up on the drum and the other end connected to the cables issuing from the terminal box of the magnet.

The control switch for these magnets consists of two parts, the master controller and a solenoid-operated clapper-type contactor, the latter being mounted on the face of the box containing the resistance. The master controller should be installed in the crane cab within convenient reach of the operator, while the contactor and resistance may be secured to any portion of the cab, either inside or out.

As before mentioned, when the circuit is suddenly opened on a magnet coil there is a strong inductive reaction or kick, the effect of which is to induce a high voltage at the terminals of the coil. Constant repetitions of this kick will sooner or later break down the strongest insulation, unless provision is made for guarding against this induced voltage and dissipating its energy outside of the coil. In the Cutler-Hammer system of control the force of this inductive reaction is rendered harmless by automatically shunting the discharge resistance across the magnet terminals just prior to the opening of the magnet circuit and automatically disconnecting it just prior to the re-establishment of the circuit.

For ordinary service the master controller is used, but when conditions are such that it is desirable to release the load instantly a reversing controller is utilised. This not only opens the circuit, but reverses the current in the coil, overcoming the residual magnetism that causes the load to cling to the magnet for a second or two after the circuit is opened.

THE ELECTRIFICATION OF RAILWAYS.*

An Imperative Need for the Selection of a System for Universal Use.

By George Westinghouse.

(Continued from page 181.)

Railway Motors.

Essential requisites in a railway motor are that it shall start its load and quickly accelerate it to the required speed, and that it shall operate continuously at any desired speed or speeds. Railway conditions make desirable speeds varying from the slowest to the highest schedule speeds for regular operation, both for the movement of freight and passengers, and for making up time.

The steam locomotive, which is limited in power by its boiler capacity, is capable of continuous operation at any speed up to the maximum, but the maximum speed in a given case depends both upon the length of the train and the grade of the track. It automatically slows down when ascending a grade, so that the actual horse power developed does not vary greatly at different speeds. The limitation of the capacity of the electric locomotive is not the power available, as is the case with the steam locomotive, but in the capacity of the motors, and is usually fixed by the heating of their coils. An electric locomotive may safely develop for a short time an output which far exceeds its normal continuous capacity. The power and speed characteristics of electric locomotives therefore differ from those of steam locomotives.

The three types of electric motors have certain fundamental differences in speed performance which are important factors in determining the advantages, disadvantages, and limitations of the several systems.

The Direct-current Motor.

The characteristics of the direct-current series railway motor are well known. It automatically adjusts its speed in accordance with the load, running more slowly if the weight of the train be greater, or the grade steeper. The speed with a given load, however, is definite; it is dependent upon the voltage applied to the motor and cannot readily be varied. It is true that the speed can be decreased by inserting a resistance in the motor circuit, but this is wasteful and is inadmissible except as a temporary expedient. It is true also that the motors may be connected in series, thus dividing the pressure between two motors, and thereby reducing the speed one-half; or if among four motors, to one-quarter speed. As the system of current supply involves a fixed voltage, it is obvious that for emergencies no speeds much above the maximum speed determined in the construction of the motor can be obtained. Furthermore, on account of the high cost involved in maintaining a practically constant voltage throughout the system, the voltage supplied to the motors often decreases considerably at the end of long lines at the time of heavy load, thereby further reducing the speed attainable. It often happens in railway service that a locomotive should be operated somewhat above the normal speed, and sometimes a locomotive designed for freight service has to be pressed into passenger service. In such cases the speed with the direct-current locomotive would be considerably less than that necessary to maintain the schedule speed. A special form of field control can be used in certain cases for varying the speed, although this has so far been utilised to a very limited extent.

The Three-phase Motor.

On the three-phase system the motor is inherently a constant-speed motor; it runs at approximately the same speed at light load and at full load; it runs at nearly the same speed up a grade as on level track, although the horse power required on the grade may be several times that on the level. Conversely, it can run no faster on a level than it can climb a grade. In order to give a lower speed, however, the motors may be arranged upon the locomotive in pairs in a manner equivalent to the arrangement of two continuous-current motors in series just described. Motors may also be arranged for two or more speeds, but this involves some complication in windings and connections. In all cases lower speeds can be secured by the introduction of resistances which increase the losses and lower the efficiency. In no case can the speed in any of the arrangements of motors be appreciably higher at very light load than it is at full load.

The motors are of the induction type without commutators and their inherent limitations, and are of relative simplicity in construction. The current is usually supplied at 3,000 volts from two overhead lines through two sets of current collectors.

With three-phase motors as now constructed and arranged upon locomotives, it is possible with no additional complication so to utilise the motors, when locomotives are moving trains upon a descending grade, that they become generators and return current to the line, a feature of value in certain mountainous districts, but not of controlling importance in the selection of a universal system.

The Single-phase Motor.

The single-phase railway motor is a series motor with speed characteristics very similar to those of the direct-current motor, as the speed at a given voltage is greater or less, depending upon the load. The speed with a given load is also greater or less, depending upon the pressure applied to the motor, and this is not limited, as with direct-current motors, to that supplied by the circuit, and to one-half and one-fourth of that pressure, but is capable of adjustment to any desired degree of refinement by means of auxiliary connections from the secondary winding of the transformer on the locomotive, which is necessary for reducing the line voltage of 11,000 volts to the lower voltage required by the motors. Not only may numerous voltages less than the normal be arranged for lower speeds, but higher voltages can be provided to make possible speeds considerably above the normal. In this simple manner a wide range of efficient speed adjustment is secured which is impossible with other systems.

Like the throttle lever of the steam locomotive, the control lever of the single-phase locomotive may be placed in any one of its numerous notches to maintain the required speed. This facility of efficient operation over a wide range of speed and power requirements is one of the especially valuable features of the single-phase system. This difference, however, may be noted: the ability of the steam locomotive to maintain its speed continuously with heavy loads depends upon the capacity of the boiler; on the other hand, the electric locomotive has an ample supply of energy available, drawn from a large power house, and the limit of its endurance is determined by the safe temperature of the motor.

The question of determination of the frequency for use on single-phase railways is one of very great importance. Twenty-five cycles is in general use for power transmission purposes and has been adopted by nearly all the single-phase railroads now operating. The Midi Railway of France has adopted 15 cycles. The lower frequency permits of a marked reduction in the size of a motor for a given output, or conversely of a considerable increase in output from a motor of given dimensions and weight. Three-phase installations in nearly all cases employ approximately 15 cycles. The choice of frequency is one of the most involved, difficult, and important problems now presented for solution.

Summary.

Locomotives equipped with each of the three types of motors have been in successful operation and have demonstrated their usefulness, capacity, and reliability in practical railway service. The three-phase motor, having a definite constant-speed characteristic, is particularly adapted to certain conditions; but, on the other hand, it has a less general adaptability to the ordinary varying conditions of railway operation. The single-phase motor has a facility of voltage control which gives an efficient means of speed adjustment, and is in this particular superior to other systems. The relative weights and costs of the several types of motors and of the locomotives designed to accommodate them depend upon so many conditions that comparisons must necessarily be general. It will be found, however, that these differences in locomotive cost are in many cases more than offset by the cost of the other elements in the electrical system.

The control apparatus for all types of locomotives has been developed so that it is reliable and convenient in operation. For each system a small master controller serves to operate by auxiliary means the necessary electric switches for the control of the motors of one locomotive, or to operate simultaneously as a single unit the motors on two or more locomotives or cars in a train.

Transmission of Power from Power House to Locomotive.

The controlling factor in the cost of electrification in nearly all cases is the system for transmitting power from the power house to the locomotive, and not the locomotive itself. The choice between the several systems must, therefore, be based upon a comparison of the complete systems. The differences between the methods of transmitting power are of far greater importance than the differences between power houses or between locomotives. The current for all systems is generated in usual practice as high-tension alternating current, for the reason that electric energy can be most economically transmitted by high-tension alternating current even though it is in some cases converted into direct current.

The Direct-current System.

For the direct-current locomotive the apparatus which intervenes between the alternating current generator and the locomotive consists of a number of links or elements through which the electric energy must pass one after the other. These consist of—

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* Abstract of a paper read before the Institution of Mechanical Engineers and the American Society of Mechanical Engineers, July, 1910.

(*a*) Raising transformers in groups of three.
(*b*) A transmission line of three wires, sub-stations, which require attendance, containing
(*c*) Transformers in groups of three, and
(*d*) Rotary converters for receiving the alternating current and delivering direct current.
(*e*) A third-rail contact conductor, which for heavy work must often be supplemented by copper feeders.
(*f*) The track return circuit, which must be provided with heavy bonds, and in certain cases supplemented by feeders and so-called negative boosters.

It is necessary to maintain the alignment of the third rail within close limits both in its distance from the track rails and in its elevation above them, as the contact shoe can have only a small range of automatic adjustment.

The Three-phase System.

For the three-phase locomotives the respective links between the generator and the locomotives are:—

(*a*) Raising transformers in groups of three.
(*b*) Transmission line of three wires.
(*c*) Sub-station transformers in groups of three.
(*d*) Two overhead wires as the contact system.
(*e*) A track return which usually requires nothing but inexpensive bonding.

The two overhead trolley wires require a double system of overhead construction, as the wires must be kept separate and well insulated from one another; the two must be maintained at equal height above the track, and at switches and cross-overs the construction is complicated.

The Single-phase System.

For single-phase locomotives there is:—

(*a*) A raising transformer.
(*b*) A transmission line of two wires and sub-stations widely spaced, each containing
(*c*) A lowering transformer, which supplies
(*d*) A single trolley wire.
(*e*) A track return, usually requiring nothing but inexpensive bonding.

In certain cases where the distance from the power station is not more than 15 or 20 miles, the single-phase trolley can be supplied directly from the power house, so that only one single element—*i.e.*, the trolley wire, intervenes between the generators and the locomotives.

The single trolley wire permits a relatively wide range in height, as the pantagraph trolley automatically adjusts itself to the position of the trolley wire. In some cases the wire has a normal height of 22 ft., but is carried under bridges where the limit is 15½ ft.

The three types of railway motors and the three respective systems for conveying power from the generating station to the locomotives have all successfully demonstrated their ability to operate railway trains. It is not my purpose to urge the adoption of a particular system, but rather to point out some of the well-known characteristics of these systems which have a bearing upon their limitations and their general adaptability to railway conditions, and to urge the great gain which will result from a single universal system.

(*To be continued.*)

METAL MARKETS.

July.

Pig Iron.—During the month of July it is usual to expect a quiet time in the iron and steel markets, and the month that has passed has been no exception to this expectation. The speculation in warrants has been restricted, and the general tone of the market has been disappointing. The falling off in shipments compared with June has been rather serious and amounts to about 35,000 tons. The principal movement of the month has been in semi-steel. The highest and lowest daily settlement prices quoted for pig iron during the month are as follows: At Glasgow, Scotch, 55s. and 54s. 7½d.; Cleveland, 49s. 1d. and 48s. 7d.; hematite, 65s. 7½d. and 63s. 10½d. In London, Cleveland, 49s. and 48s. 7½d. Rubio ore has been quoted at 20s. 6d. ex-ship Tees. Average blast-furnace coke has been as low as 15s. delivered at Middlesbrough. At the end of the month Messrs. Connal and Co., the warrant store keepers, had in stock at Middlesbrough 443,334 tons of Cleveland pig iron composed of 405,201 tons of No. 3 Cleveland, 34,385 tons of other kinds of iron deliverable as standard, and 3,748 tons of other kinds of iron not deliverable as standard. Since the beginning of July the stock has been increased by 7,285 tons. Shipments of pig iron for July amount to 75,961 tons, 64,946 tons of which have gone from Middlesbrough and 11,015 tons from Skinningrove.

Manufactured Iron and Steel.—The prices for steel plates and bars are a little steadier than they were at the beginning of the month. The demand is best for sheets, plates, and angles. At the end of the month common iron bars were £7; best bars, £7 7s. 6d.; best best bars, £7 15s.; packing iron, £5 15s.; iron ship angles, £7; iron girder plates, £6 15s.; iron boiler plates, £7; steel bars, £6 5s.; steel ship plates, £6 10s.; steel ship angles, £6 2s. 6d.; steel strips, £6 10s.; steel hoops, £6 12s. 6d.; steel joists, £6 2s. 6d.—all less 2½ per cent discount. Cast-iron railway chairs are £3 10s.; cast-iron columns, £6 10s.; light iron rails, £6 10s.; heavy steel rails, £5 10s.; steel railway sleepers, £6 2s. 6d.—net cash at works. Iron and steel galvanised corrugated sheets, 24 gauge, in bundles, stand at £11 10s., f.o.b.—less 4 per cent discount. Manufactured iron shipped during July amounted to 8,292 tons and steel 22,178 tons.

Copper.—The price of this metal further declined towards the middle of the month, but has finished the month rather better. The highest and lowest daily settlement prices were £53 and £55 10s. The prices at the beginning and end of the month were £54 17s. 6d. and £55 10s.

Tin.—There has been a decline in prices of this metal, the lowest price touched being £147 15s.; the prices at the beginning and the end of the month were £150 5s. and £149 5s.

Lead.—In both soft foreign and English varieties there has been a decline in the price of lead. The daily settlement prices for the beginning and end of the month were soft foreign £12 13s. 9d. and £12 11s. 3d. and English £13 and £12 18s. 9d.

Spelter.—There has been a rise in g.o.b.'s from £22 2s. 6d. at the beginning to £22 13s. 9d. at the end of the month. The price of specials has been constant and at £23.

LAUNCHES AND TRIAL TRIPS.

Messrs. Hall, Russell, and Co., Aberdeen, launched on July 30th a steam drifter for Messrs. J. Falconer and Co., Banff. She is of the following dimensions: Length, 86 ft.; breadth, 18 ft. 6 in.; and depth, 9 ft. 10 in. Boilers and compound engines will be supplied by the builders.

Thistleban.—On the 30th July the steel screw steamer Thistleban, built by Messrs. Craig, Taylor, and Co. Ltd., Stockton-on-Tees, to the order of Messrs. the Albyn Line Ltd. (Messrs. Allan, Black, and Co., managers), was taken to sea for her trial trip, which proved highly satisfactory. The vessel is of the following dimensions, viz: 382 ft. by 51 ft. 4½ in. by 26 ft. 6 in. moulded. She is built of steel to the highest class in Lloyd's Registry under special survey. She is fitted with patent direct steam windlass with quick-warping ends, steam steering gear, eight steam winches, and multitubular donkey boiler, shifting boards in holds for carrying grain cargoes, telescopic masts to Manchester Ship Canal requirements, double derricks, and all the latest improvements for rapid loading and discharging. The engines have been constructed by Messrs. Blair and Co. Ltd., Stockton-on-Tees, the cylinders being 26 in., 42½ in., 69½ in., by 45 in., with two large steel boilers working at 180 lbs. pressure. During the whole of the trip everything worked with the greatest smoothness, and over a series of runs a mean speed of slightly over 12 knots was maintained.

Owenaminane.—The grab hopper dredger Owenaminane, built by Messrs. George Brown and Co., Greenock, for the Cork Harbour Commissioners, ran a loaded trial on the Gareloch on July 30th. A mean speed of 7·82 knots was attained. The machinery was supplied by Messrs. Gauldie, Gillespie, and Co., Glasgow.

Bogstad.—On July 30th Messrs. Osbourne, Graham, and Co. sent to sea for her official trial trip the steel screw steamer Bogstad, which is the third vessel they have specially constructed to the order of Messrs. Fearnley and Eger, of Christiania. The steamer carries 2,800 tons on a shallow draught, and is equipped with the most modern appliances for quick and economical working of cargo. The engines and boilers have been supplied by Geo. Clark Ltd., Southwick Engine Works, Sunderland, and during the loaded trial, which was very satisfactory in every way, a speed considerably over the contract requirements was easily attained.

Daventry.—Messrs. Joseph L. Thompson and Sons Ltd., of Sunderland, launched on the 21st ult. the steamship Daventry, which they have built to the order of Messrs. Sivewright, Bacon, and Co., of Manchester. The principal dimensions of the vessel are: Length, 367 ft. 3 in.; breadth, 50 ft. 11 in.; depth moulded, 27 ft. 4 in. She has been constructed to Lloyd's highest class under special survey, the upper deck being fully laid and the main deck for about half length. The vessel is designed to have a large cubical and dead-weight capacity with a very moderate draught of water. The engines have cylinders 25 in., 41 in., and 68 in. diameter, by 48 in. stroke, supplied with steam from three large boilers working at 180 lbs. pressure.

Kamma.—A new steel screw steamer, which has been built by Messrs. Wood, Skinner, and Co. Ltd., of Bill Quay, Newcastle-on-Tyne, to the order of Mr. Martin Carl, of Copenhagen, was launched on Tuesday, 26th July. She has been built under Lloyd's special survey for their highest classification. The machinery has been constructed and will be fitted by Messrs. The North-Eastern Marine Engineering Co. Ltd., of Wallsend-on-Tyne, and will comprise a set of triple-expansion engines of the most improved type, supplied with steam by a large steel multitubular boiler. The engines and boiler have also been built to Lloyd's requirements.

Rio Curuca.—Messrs. Murdoch and Murray, Port Glasgow, launched on the 26th July the steamer Rio Curuca, which, like the Republicano, recently put into the water by the same firm, will be used for service on the Amazon. After the launch the vessel was towed up to Glasgow, where she will be engined.

Nessie.—Messrs. Fleming and Ferguson, Paisley, launched on the 26th July a steel screw coasting steamer, built to the order of the Ailsa Craig Granite Quarries, Glasgow.

Inventor.—On Thursday, August 4th, there was launched from the shipbuilding yard of Messrs. David and William Henderson and Co. Ltd. at Partick, Glasgow, a large steel screw steamer of about 8,000 tons gross, which they have built to the order of Messrs. Thomas and Jas. Harrison, Liverpool. This addition to the already large fleet of vessels owned by Messrs. Harrison is 470 ft. long between perpendiculars by 58 ft. broad by 34 ft. 10in. depth moulded, is classed in Lloyd's 100 A1, and fulfils the requirements of the Board of Trade for their passenger certificate. She is rigged as a four-masted schooner, and has an exceptionally large number of powerful derricks, which, with 10 steam winches, provide ample means for the rapid handling of large cargoes. The machinery, which has been constructed by the builders, consists of quadruple-expansion engines, having cylinders 25½in., 36½ in., 52 in., and 74 in. diameter, by 54 in. stroke, with steam from three boilers at 215 lbs. pressure.

Carthage.—On August 5th the twin-screw steamer Carthage, built for the Compagnie Generale Transatlantique by Messrs. Swan, Hunter, and Wigham Richardson Ltd., Neptune Works, Walker-on-Tyne, was taken on her consumption trials off the Tyne. The Carthage left the river about 10 o'clock, and did an official eight hours' run at an average speed of 18 knots an hour. The vessel, which is built for service between Marseilles and Tunis and Malta, is 403 ft. long, 51½ ft. broad, and 30 ft. moulded depth, and her gross tonnage is 5,036 tons. The Carthage has been engined by the builders with two sets of four-crank triple-expansion engines, balanced on the Yarrow, Schlick, and Tweedy system, to give a horse power of 9,500, and a speed of 19 knots an hour. She has been fitted to accommodate 300 first-class, 100 second-class, and a large number of third-class passengers.

Highland Brae.—There was launched on August 6th from the Mersey shipbuilding yard of Messrs. Cammell, Laird, and Co. the steamer Highland Brae for the fleet of the Nelson Steam Navigation Co. She is an 8,000-ton vessel, and a similar vessel is to be launched in a few weeks' time from the same yard, to be followed by two more for Messrs. Nelson's new fleet of River Plate liners.

Ingleside.—On July 6th there was launched from the yard of the Tyne Iron Shipbuilding Co., Willington Quay, a steel screw steamer, built to the order of Rowland and Marwood's Steamship Co. Ltd., of Whitby. It is interesting to note that the vessel has been constructed on the Isherwood patent system of longitudinal framing, and is the second ship of the type to be built on the Tyne, being the second of three which the Tyne Iron Co. contracted to build for the Rowland and Marwood Co. The vessel has been built to the highest class at Lloyd's, and is 360 ft. in length, 50 ft. in breadth, and 25 ft. in depth moulded. She is of the single-deck rule, with poop, bridge, and forecastle. Water ballast is fitted fore and aft on the cellular system, and all modern improvements for the rapid loading and discharging of cargo are provided, including eight cylindered steam winches. There will be double derricks to all main cargo holds, and there will be derrick posts on the bridge for use at the cross bunker hatch. The Ingleside will carry about 6,400 tons dead weight on the very light draught of 21½ ft. The engines are to be supplied by Messrs. John Dickinson and Sons Ltd., of Sunderland, and will be of the triple-expansion kind, having cylinders 24 in., 40 in., and 66 in., by 45 in. stroke, with two boilers 16 ft. by 10 ft. 6 in. working at a pressure of 180 lbs.

Ariosto.—On August 6th the steel screw steamer Ariosto, built by the Northumberland Shipbuilding Co. Ltd., Howdon-on-Tyne, to the order of Messrs. Thos. Wilson, Sons, and Co. Ltd., Hull, for their Eastern trade, left the Tyne for her trial trip. The steamer is 390 ft. long by 49 ft. beam by 29 ft. deep, and has been built under special survey to the highest class at Lloyd's, with two complete steel decks. Very special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes arranged for, consisting of eight steam winches by Messrs. Clarke, Chapman, and Co. Ltd., Gateshead-on-Tyne, a large number of cargo derricks, steam windlass by Messrs. Clarke, Chapman, and Co. Ltd., and powerful steam steering gear by Messrs. Donkin. The machinery has been supplied by Messrs. Richardson, Westgarth, and Co. Ltd., Sunderland, consisting of engines with cylinders 25 in., 41 in., and 69 in., by 48 in. stroke, and three large steel boilers 180 lbs. pressure. The vessel is designed to carry about 7,500 tons dead weight on the light draught of 23 ft. 8 in. The trial trip proved in every way satisfactory.

Berwindmoor.—On Saturday, 6th August, Messrs. Sir Raylton Dixon and Co. Ltd. launched from their Cleveland Dockyard, Middlesbrough, a fine steel screw steamer which is believed to be one of the largest merchant colliers yet built. The vessel is being constructed for American owners, and is of the builders' latest improved patent cantilever framed type with top-side water ballast tanks, shelter deck type, with engines aft. The principal dimensions of the steamer are: 425 ft. long by 54 ft. beam by 29 ft. moulded, and she will have a dead-weight carrying capacity of over 8,500 tons on a light draught of water. Triple-expansion engines having cylinders 28 in., 46 in., and 77 in., by 48 in. stroke, supplied with steam by three large single-ended boilers fitted with Howden's system of forced draught, which are estimated to drive the vessel a speed of 11½ knots, loaded, will be fitted by Messrs. Richardson, Westgarth, and Co. Ltd., of Hartlepool.

NAVAL NOTES.

Sao Paulo.—Messrs. Vickers, Sons, and Maxim have completed at their naval construction yard at Barrow-in-Furness the Brazilian battleship Sao Paulo, and she has been towed to Liverpool, where she will be docked. Afterwards she will proceed to the Clyde under her own steam. The Sao Paulo is one of the most formidable battleships now afloat. She was launched on April 19 of last year. The vessel, which is 500 ft. long, with an 83 ft. beam, recently underwent her speed and gun trials on the Clyde, which were most satisfactory. Her contract speed of 21 knots was exceeded, developing 24,000 I.H.P.

Gloucester.—The final trials of the second-class cruiser Gloucester, built at Dalmuir, were carried out on July 5th in the Clyde. The vessel ran for eight hours at full speed satisfactorily, the required speed being more than attained.

THE Admiralty have decided to extend the torpedo factory which is being built at Greenock. The present buildings cost £50,000, and the new addition will probably cost £25,000. When the factory is completed there will be about 1,500 men employed, and this consequently will mean work for a large number of Clyde men.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 4th August, 1910.

CARDIFF.—*First class:* C. G. Priestley, R. Carey, L. C. Bate, G. H. Pritchard. *Second class:* C. M. Harrington, G. Moraits, J. H. Jones, W. H. Crossman, S. A. Alchin.

GLASGOW.—*First class:* A. Cowan, J. H. Parson, J. Carnie, R. Gold, D. M. Blair. *Second class:* A. S. McLean, J. Nelson, J. McLennan, J. D. MacKay.

HULL.—*Extra first class:* E. G. Vickerman.

LEITH.—*Second class:* A. F. Gray.

LIVERPOOL.—*First class:* F. E. MacSwiney, C. H. Riddock, G. H. Butterworth. *Second class:* M. J. Myles, S. R. Harvey, D. Horsburgh, V. H. Green, J. Atkinson, H. Edwards, J. Neild, J. L. Prichard, S. Hermans, E. T. Weatherill.

LONDON.—*Extra first class:* E. R. Stephens, H. Skelton, H. MacKenzie. *First class:* L. Le Sueur, W. H. Higgitt. *Second class:* F. Colley, D. Brown, W. T. Roberts, E. J. Clarke.

NORTH SHIELDS.—*Extra first class:* W. Earnshaw, E. E. Briggs. *First class:* E. P. Williams, E. Bain. *Second class:* E. Martin, T. Knowles, J. W. Scott, J. J. Walker, J. W. Cook.

SOUTHAMPTON.—*Second class:* E. T. V. Smith.

WEST HARTLEPOOL.—*Extra first class:* J. P. Hurworth, H. W. Hemy.

TRADE CATALOGUES.

Messrs. Veritys Ltd., have sent us their monthly budget of new catalogues dealing with all classes of switch gear and fuses; also a booklet which deals with electric geysers which give an instantaneous supply of hot water, and are fitted with automatic and pole-reversing switch. Attention is drawn by pamphlet to their retarding batteries.

Messrs. W. P. Butterfield Ltd. have sent us their monthly list for August 1st giving sizes of riveted cisterns in stock and also odd sizes of cisterns in stock.

A pamphlet is to hand from the **Automatic Tap Syndicate Ltd.** illustrating their "Acme" tap for use with hot or cold water. The use of these taps reduces and avoids concussion.

Messrs. A. Reyrolle and Co. Ltd., Hebburn-on-Tyne, send us a pamphlet, No. 17, showing their switch type fuse boxes. These are of the firm's standard construction, the principal advantage of the type being that in order to replace a fuse the fuse holders must be withdrawn from all contact with the circuit.

Messrs. James McMillan and Co., Clun House, Surrey Street, Strand, W.C., have issued an illustrated leaflet descriptive of their autogenous welding apparatus for use with acetylene oxygen or lighting gas oxygen. The process is adopted for repairing fractured or damaged castings and welding wrought iron, steel, copper, and brass, etc.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2261. **Manganese and Chrome Steel.**—I shall be very much indebted to any reader for a reliable method for distinguishing manganese and chrome steel from ordinary cast steel, and from each other?—M. K. H.

2268. **Dimensions of Engine.**—Should esteem it a great favour if any reader could give me suitable dimensions for inlet, transfer, and exhaust ports for two-stroke engine $2\frac{3}{4}$ in. bore by 3 in. stroke, also compression ratios in cylinder and cylinder case. Do you know of any simple method of ascertaining these dimensions?—A. P. S.

2269. **Brazing Sheet Brass.**—Can a reader of *The Practical Engineer* inform me of a firm where I can buy metal suitable for brazing sheet brass up to $\frac{1}{32}$ in.? Also metal for repairing aluminium utensils, or books relating thereto?—F. T.

2270. **Hand Portable Boring Bar Rig.**—Will any reader give rough sketch of an up-to-date light and handy hand portable boring bar rig for boring out the stern posts of small vessels, small steam boats, tugs, etc.; largest bore 8 in. diameter? Any information on this subject as regards the making of same would greatly oblige.—Stern Post.

MISCELLANEA.

Personal.—Mr. Walter H. Derriman, B.Sc., A.C.G.I., A.I.E.E., Fellow of the Chartered Institute of Patent Agents, has entered into partnership with Messrs. Dicker and Pollak, chartered patent agents, of 37, Furnival Street, Holborn, E.C., and in consequence the name of the firm has been changed to Dicker, Pollak, and Derriman.

Canadian Fleet.—Three Canadian and two British firms have sent applications to the Dominion Naval Department to be allowed to tender for the construction of the new Canadian fleet. The final specifications are expected to be ready in November on receipt of the Admiralty plans for the improved Bristols, which are now being drafted. The active work of construction will be begun next year.

Wireless Telegraphy.—The City of Dublin Steam Packet Co. some time ago made arrangements with the Marconi International Marine Communication Co. for fitting the mail packets with wireless telegraphy. The R.M.S. Connaught has now been furnished with the apparatus. The trials so far have been most satisfactory, and after experiments have been made with it for a few days it is expected that the travelling public will be able to avail themselves of this facility.

New Cable to America.—The cable ship Telconia arrived at St. John's, Newfoundland recently to lay the shore end of the Western Union Telegraph Co.'s new cable at Bay Roberts. This is in pursuance of the policy recently adopted by the company of having a mid-Atlantic terminal on the Newfoundland coast. Another ship will follow shortly with the deep-sea sections of a cable of the Direct Cable Co., which it will land at Harbour Grace during the next month.

Clyde Shipbuilding.—With a total output of 26 vessels, aggregating 43,097 tons, the Clyde shipbuilding industry has had one of the best Julys on record. In the corresponding month of last year the launches aggregated only 20,172 tons, the record being 67,300 tons in 1907. There has recently been a lull in the placing of new work, but prospects are again improving, and full time working up to the end of the year is now assured.

Zinc and Boiler Corrosion.—Zinc is often used to prevent the corrosion of boilers. Its efficiency is due to the fact that any metal with a greater tendency than iron to dissolve, on which hydrogen is liberated with more difficulty than on iron, will protect the latter at the expense of the more soluble metal. The protection, however, becomes ineffective in pure water at a distance greater than about an inch. Salt or some other electrolyte will extend the zone to 20 in. or more.

Fire Protection.—A Hatfield treble-barrel high-speed reciprocating pump, driven by an electric motor, has recently been supplied to the Lancashire and Yorkshire Railway by Messrs. Merryweather and Sons Ltd. for a fire protective installation at the company's premises at Castleton. The pump is capable of delivering 600 gallons a minute at 100 lbs. pressure when running at 185 revolutions per minute, and is driven by a 60 H.P. motor through silent chain gearing.

Rosyth Naval Base.—The sand pits opened some time ago by Mr. Fred. Graham Youll, Leith, on the Grange Hill estate, to the west of Kinghorn, have recently been taken over by Messrs. Easton, Gibb, and Co., the material to be used in the construction of the naval base at Rosyth. A quantity of 500,000 tons is likely to be removed, with a daily output of 200 tons. It is understood that Messrs. Easton, Gibb, and Co. are negotiating for a supply of water to manufacture brick on the spot.

Dundee Naval Base.—We understand that the naval base established at Dundee about a year ago is to be abandoned by the Admiralty. The base has been used principally in connection with submarines, and it is stated that its utility has been greatly interfered with owing to the unsatisfactory state of the estuary. Much work would require to be done at considerable cost to make the port entirely suitable for naval purposes, ingress and egress at all times being of prime importance. The lease taken by the Admiralty was only for a few years.

Compulsory Wireless Equipment for Ships.—From the point of view of the uniformity of maritime law there is something to be said for Sir Edward Sassoon's bill rendering the wireless equipment of passenger steamers compulsory. If the hon. member's bill is passed, the law of this country and of the United States would be practically the same upon this subject. The American Act, approved last month, provides that ocean-going passenger steamers shall not, under a penalty of $5,000, leave an American port without a wireless equipment if 50 or more persons, including crew, are on board. The English bill goes upon the same lines, and would impose the equivalent penalty of £1,000. The American Act exempts steamers plying between ports less than 200 miles apart. The English bill would restrict the exemption to vessels plying "between British and Irish ports" not more than 200 miles apart. Cross-Channel steamers, therefore, would not be exempt.

Rosyth Naval Base.—Now that the contractors have been put in a position to restart all their electric cranes and other machinery, which were stopped by the recent fire, it is anticipated that operations will soon resume the steady swing which existed before the destruction of the power house. Three of the four suction gas engines have now been replaced, and it is expected that the starting of the fourth will be a matter of a few days only. With the three engines the whole of the machinery can be driven, but the fourth provides a safe working margin. At present the number of men employed is about 1,200, and that number is likely to be greatly augmented before the end of the summer. The wet weather of the past week hampered to some extent the work in the submarine basin, inasmuch as the trenches for the sea walls became partially filled with water. While all sections of the undertaking were affected by the stoppage of the electric current, the operations in this basin have probably been least retarded, and the work of constructing the foundations has proceeded steadily.

PATENTEES' CHRONICLE

OF

Applications for British Patents.

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*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

JULY 29th, 1910.

18017 Pulley. Hancock.
18018 Tyre inflator. Allsup.
18019 Tobacco pipe. Frith.
18020 Aerial propellers. Tilburg.
18021 Photography. Woodiwiss.
18022 Match box. Alderson.
18023 Monoplane. Navarre.
18024 Perambulator brake. Green.
18025 Bottle seals. Maccormack.
18026 Dress fastenings. Hamilton.
18027 Screw heads. Chappell.
18028 *Shaft governar. Stumpf.
18029 *Steam engine. Stumpf.
18030 Boot laces. Bancroft.
18031 Apparatus for subjecting gases, etc. Fowler.
18032 Mine shafts. Thompson.
18033 Fnger pad truss. Reynolds.
18034 Winding wire on bobbins. Wood.
18035 Domestic fire place. Bell.
18036 Handbag. Farley.
18037 Puzzle. Hateley.
18038 Collar stud. Gibson.
18039 Motor car, etc., wheels. Hawksley.
18040 Seats. Lobel.
18041 Flour milling. Claridge.
18042 Weaving devices. Smith.
18043 Gates. Nixon.
18044 Hinge. Pailthorpe.
18045 Window fastenings. Tonge.
18046 *Flycatcher. Dean.
18047 *Relating to motor car radiators. Foy.
18048 Fibrous material stretcher. Corrigan.
18049 Advertising device. Love.
18050 Flour milling. Heys.
18051 Liquid meter. Watson.
18052 Driving belt fastening. Matthews.
18053 Buckets, etc. Lester.
18054 Wireless telephone system. Krammer.
18055 Aerial machine. Tweedale.
18056 *Balloon. Mach.
18057 Air gas apparatus. Williams.
18058 Air pump. Weir.
18059 *Horse shoe. Pockett.
18060 Bridle bit. Atkins.
18061 Finger print reproduction. Grundy.
18062 Tea, etc., measuring canister. Medcalfe.
18063 Water heater. Futcher.
18064 Aerial machines. Jorgensen.
18065 *Bottle filling. Milne.
18066 Internal-combustion engine. Kemp.
18067 Paper feeding mechanism. Warren.
18068 Metal plate joint. Koopman.
18069 Toothed implements. Koopman.
18070 Metal tube protection. Koopman.
18071 *Removing teeth from card clothing fillets. Molls.
18072 *Steam boiler regulator. Schoenicke.
18073 Electrical device. Rogers.
18074 Internal-combustion engine. Simon.
18075 *Motor car control. Royce.
18076 *Casting device. Eichengrüm.
18077 Wearing apparel fastening. Kingston.
18078 Ventilating device. Daffon.
18079 *Taximeters. Ohmer.
18080 Ventilating sewers. Bailey.
18081 Treatment of stone. Hines.
18082 Ball bearings. Marles.
18083 Railway wheels, etc. Zwicky.
18084 *Gas lighter. Bagrchow.
18085 Mending device for articles. Skaife.
18086 Pneumatic tyres. Kreuzer.
18087 Lubricating electric apparatus. Kermode.
18088 *Cinematograph apparatus. James.
18089 Lamp lenses. Stevens.
18090 *Containers. for transport. Koopman.
18091 *Inserting fasteners. Goddn.
18092 Fastening device. Baker.
18093 Clothes fasteners. Friedlander.
18094 *Key rings. Emrich.
18095 *Magneto-electric machine. Bosch.
18096 *Artillery ammunition.
18097 Carburetters. Coudsley.
18098 Telephone connections. Lewell.
18099 *Colouring matter. Geigy.
18100 *Valves. Stumpf.
18101 Cigar piercers.. Egg.
18102 *Weeding implements. Meyer.
18103 *Bell ringing device. Hartmann.
18104 *Aeroplanes. Gammisch.
18105 Superheaters. Gordon.
18106 Gum cleansing device. Brown.
18107 Submarine mines. Vickers, Sons, and Maxim.
18108 *Clock striking device. Lake.
18109 Lense manf. Bentzon.
18110 Curtain rods. Johnson.
18111 Cots. Adams.
18112 *Breast support. Bruckner.
18113 Destruction of rabbits. Bart.
18114 Ovens. Dressler.
18115 Electric heating apparatus. Berry.

JULY 30th, 1910.

18116 Safety razor blades. Wragg.
18117 Aeroplanes. Walker.
18118 Collapsible crates. Smith.
18119 *Spirit level. Zeiss.
18120 Pneumatic tyres. Hine.
18121 Rotary shaft covers. Dawson.
18122 Spinning frames. Battersby.
18123 Wrenches. Birt.
18124 Indicating device for trains, etc. Clarke.
18125 Diving stage. James.
18126 Heating, etc., device. Kay.
18127 Window casements. Worrall.
18128 *Lowering device for boats. Smallwood.
18129 Hair net manf. Israel.
18130 Air and gas mixture supply. Docking.
18131 Advertising device. Wertheimer.
18132 Lappets. Cook.
18133 Spring fasteners. Hodge.
18134 Locking device. Liebert.
18135 *Coal mining machines. Kovatch.
18136 Electrical heaters. Pipkin.
18137 Freewheel clutches. Cooper.
18138 *Auto-motor cars. Crossley.
18139 Breaking up fibrous materials. Standeven.
18140 Boot lace attachment. Alderson.
18141 Steam lurries. Talbot.
18142 Chimney pots. Larmer.
18143 Gas producer. Whitfield.
18144 Boot heel pads. Taylor.
18145 Window blinds. Thompson.
18146 *Strap fasteners. Griffiths.
18147 *Lavatory basins. Dauber.
18148 *Treating carbonaceous substances. Burstall.
18149 *Projectiles. Bacon.
18150 Woven fabrics. Riley.
18151 *Coil winding. Hacfely.
18152 Coat coller. Phillips.
18153 Inkstands. Kultan.
18154 *Steam generator, etc. Midgley.
18155 *Stud buttoning device. Laumann.
18156 *Cyclists overall. Bergmann.
18157 Railway coupling. Giese.
18158 Propellers. Schwéers.
18159 Amusement device. Savage.
18160 *Envelope. Burrell.
18161 Blackboard compasses. Heath.
18162 Gate latches. Jones.
18163 Valves. Hargreaves.
18164 Stirrups. Nobes.
18165 Rock drills. Rayner.
18166 Coop. Assheton.
18167 Poultry nest, etc. Assheton.
18168 *Tobacco pipe. Pragnell.
18169 Chair, etc., legs. Maclean.
18170 Washer manf. Bailey.
18171 Surveying instruments. Ebbs.
18172 Bobbin supports, etc. Edwards.
18173 Lubricating device. Thomsen.
18174 Moulding rubber goods. Gare.
18175 Pressure gauge. Short.
18176 Treatment of coal gas. Wilton.
18177 *Timing pigeon races, etc. McMillan.
18178 Pneumatic tyres. Perks.
18179 Pulleys. Smith.
18180 Telephone systems. Burney.
18181 Burners. Pearson.
18182 *Couplings. Breda.
18183 Cycle spring forks. Sharp.
18184 *Pointing lengths of materials. Mertens.
18185 Exercising device. Caddy.
18186 Pneumatic tyre cover. Caddy.
18187 Cycle brakes. Wire.
18188 *Speed gear. Tour.
18189 *Moulding, etc., masses. Eichengrüm.
18190 *Electric motors. Adams.
18191 *Motor controllers. Adams.
18192 Motor car indicator. Meguelle.
18193 Lavatories. Bullock.
18194 Ovens. Ihlee.
18195 *Dynamo. Brown, Boveri and Co.
18196 *Bottle sealing. Adnance.
18197 *Dynamo. Leitner.
18198 Tobacco pipe. Price.
18199 Gas testing. Carr.
18200 Amusement apparatus. Hartley.
18201 *Gas production. Emanuel.
18202 *Valves, etc. Friedrichs.
18203 *Bell ringing device. Hartmann.
18204 Gripping device. Smith.
18205 Ploughs. Mederer.
18206 Compound of materials. Fitz-Gerald.
18207 Rudder. Fitz-Gerald.
18208 Grain, etc., drying. Rolfe.
18209 Colour photopraphy. Dawson.
18210 Weight motor. Russell.

AUGUST 2nd, 1910.

18211 Superheaters and water heaters. McPhail.
18212 Steam engine valve gear. Eastwood.
18213 Expanding spring bracelet. Dreyfus.
18214 Covered latex cup. Bailey.
18215 Pipe filler and match box. Wright.
18216 Fire escapes and alarms. Hamilton.
18217 Automatic suspension. Stevenson.
18218 Carburetter. Kelly.
18219 Tobacco pipe cases, etc. Kelly.
18220 Heating ovens. Kirkby.
18221 Boots and shoes. Pearson.
18222 Air gas atomiser. Bruce.
18223 Motor vans and wagons. Buck.
18224 Safety traffic alarm. Badger.
18225 Cooking ovens. Parker.
18226 Kitchen ranges. Parker.
18227 Cotton cop apparatus. Moir.
18228 Propeller shaft dies, etc. Smith.
18229 Detonator holders. Ludlow.
18230 Feed water regulators. Gee.
18231 Water closets. Midgley.
18232 Shirt supports. De Mille.
18233 Vehicle wheels. Buck.
18234 Gas burners. Allday.
18235 Fire-clay cutter. Waites.
18236 Telephone instruments. Sugden.
18237 Motor alarms. Standing.
18238 *Angle measuring instrument. Zeiss.
18239 Metallic plant clip. Ward.
18240 Ventilators. Ashworth.
18241 Lamps or lanterns. Wardle.
18242 Book page indicator. Gibson.
18243 Invalid bedsteads. Dwyer.
18244 Motor weather screen. Oram.
18245 Safety razor. Brunacci.
18246 Reversible barrow axle. Foy.
18247 Rain-water gutter stays. Eynon.
18248 *Bottle safety cap. Henri.
18249 *Resilient wheels. Gaynor.
18250 Mechanical transporters and shovels. Marks.
18251 Bottle safety device. Hays.
18252 *Motor car speed indicators. Onken.
18253 *Magnetic separators. Kisoler.
18254 Bicycle saddle supports. Seile.
18255 Spectacle tester. Faber.
18256 Reaping machines. Schlenfer.
18257 Adjustable caps. Satsch.
18258 Cake support. Stein.
18259 Grindstone. treadles. Buckenberg.
18260 Surgical appliances. Block.
18261 Resilient wheels. Buddicom.
18262 *Heating compressed air. Schaeffer.
18263 Wire toe clips. Leadbeater.
18264 Lamps. Schwarz.

18265 Motor vehicles. Teschke.
18266 Motion transmitter. Otto.
18267 Gas delivering apparatus. Ionides.
18268 Furniture. Scott.
18269 *Multiple copying machines. Flanigan.
18270 *Bedpans. Hogan.
18271 Photo enlargment device. Newling.
18272 *Blast furnace. Hicks.
18273 *Smyrna needlework device. Diehl.
18274 *Improved hair fastener. Hofsäss.
18275 *Laundering machine. Benjamin.
18276 *Combustion engines. Vasöntö.
18277 *Paper winding apparatus. Woodhead.
18278 Propelling apparatus. Woodhead.
18279 Brewer's vent. Rigmaiden.
18280 Marine engine governors. Harold.
18281 Cycle driving mechanism. Austin.
18282 Motor starting device. Price.
18283 Aeroplanes. Hamilton.
18284 Airships or balloons. Epstein.
18285 *Car seats. Edgar.
18286 *Advertisement signalling device. Naylor.
18287 Liquor serving device. Buxton.
18288 Hatpin and protector. Harris.
18289 Churns. Llewellin.
18290 Gearing. B. T.-H. Co.
18291 Tap waste preventer. Firth.
18292 Car running gear. Angus.
18293 *Churns. Austin.
18294 Suspending billiard chalk. Franklin.
18295 *Sparking plugs. Anderson.
18296 Tip wagons. Spencer.
18297 Straw bleaching device. Wickham.
18298 Wheel supports. Davis.
18299 Saw sharpening machines. Kubiak.
18300 Electrolysis of fused chlorides.
18301 *Glass pot heating furnaces. Smythe.
18302 Tube squirter. Bloxam.
18303 *Rail traffic controller. Tyer.
18304 Pump valves. Scarborough.
18305 *Punching ball supports. Croucher.
18306 *Electric machine controller. Adams.
18307 *Combined reciprocating and turbo generator. Warburton.
18308 *Automatic stokers. Lake.
18309 Brush making device. Ellis.
18310 Azo-dyestuffs. Newton.
18311 *Salt refining process. Glaser.
18312 *Loose leaf books. Hamacher.
18313 *Switch throwing mechanisms. Schaeffer.
18314 Hearth rugs. Clay.
18315 *Dissolution of proteids. Chavassieu.
18316 *Loom shuttles. Isherwood.
18317 *Grinders. Ward.
18318 *Gear grinding machines. Ward.
18319 *Tension bolts and nuts. Kennedy.

AUGUST 3rd, 1910.

18320 Photo dark slide. Hartley.
18321 *Turbines. Saver.
18322 Cleaning carding engines. Barlow.
18323 Internal-combustion engine. Wood.
18324 Power belt fasteners. Sendall.
18325 Relating to carding engines. Chadwick.
18326 Window blinds. Vigne.
18327 Production of electricity. Fry.
18328 Internal-combustion engine. Fielding.
18329 Spanner, etc. Adams.
18330 Advertising device. Playfair.
18331 *Riveting tool. Halstead.
18332 Card shuffling device. Ormiston.
18333 Wireless telephone installations. Kramer.
18334 Paper box manf. Griscom.
18335 Coin freed mechanism. McDougall.
18336 Cameras. Arnold.
18337 Hair drying device. Ansell.
18338 Cement manf. Rhodin.
18339 Straining wire netting, etc. Freeman.
18340 *Clocks. Phinney.
18341 *Pipe jacks. Thebodean.
18342 Disinfectant. Bozzelli.
18343 *Surveying devices. Tebyrica.
18344 *Switches. Fairweather.
18345 Frame saws. Zancolo.
18346 Sewing machines. Plunger.
18347 Block and sheave pin. Pople.
18348 Sawing, etc., boards. Colley.
18349 Centrifugal fans. Kieffer.
18350 *Cloth washing, etc. Henrici.
18351 Caps, etc. Pethybridge.
18352 Tyres. Whiteman.
18353 Tyre armour. Gamble.
18354 *Envelopes. Toomer.
18355 *Cooking utensils. Carter.
18356 *Finishing textile fabrics. Gessner.
18357 *Forming railroad spikes. Fairweather.
18358 Pneumatic tyres. Cadett.
18359 Electric switches, etc. Dickson.
18360 Expanding reamer. Coleman.
18361 Mustard pots. Cody.
18362 Pneumatic tyres. Ramsden.
18363 *Pistol. Mauser.
18364 Dye manf. Johnson.
18365 Syringes. Rowse.
18366 *Respiratory helmets. Bentz.
18367 Road paving. Boyd.
18368 Anti-skidding wheels. Johnson.
18369 Sound reproducer. Gaydon.
18370 Gas stoves. Creasey.
18371 *Transport vessel. Küpper.
18372 *Treatment of super-phosphate. Wenk.
18373 *Lubricating device. Weinland.
18374 *Boiler tube cleaner. Weinland.
18375 Extracting rubber, etc. Haddan.
18376 Bracelet, etc., adjustments. Collins.
18377 Sluice gates. Ashford.
18378 *Recovery of tin from waste. Linde.
18379 *Suspenders for socks, etc. Büchler.
18380 *Music sheet, etc., supports. Phillips.
18381 Cigar, etc., holders. Perks.
18382 Internal-combustion engine. Cleaver.
18383 Tobacco cartridge, etc., case. Richmond.
18384 Fuel economisers. Leetham.
18385 Egg cutting, etc. Parkes.
18386 *Advertising device. Pudney.
18387 Drying barrels. Canning.
18388 *Press. Bousfield.
18389 *Spring controller for vehicles. Hartford.
18390 *Rifles. Brown.
18391 *Framing device. Park.
18392 *Lathes. Royston.
18393 Delivery pipe for beers, etc. Schroder.
18394 *Yarn winding. Boult.
18395 *Beaming machines. Boult.
18396 Power transmission system. Boyd.
18397 Lubricating system. Boyd.
18398 *Packing accumlators, etc.
18399 *Clasps. Boult.
18400 Hydrogen purification. Bedford.
18401 Catalytic synthesis of methane. Bedford.
18402 *Pencil case. Stockel.

AUGUST 4th, 1910.

18403 *Fence post staples, etc. Darling.
18404 Closets. Adams.
18405 Raising flash point of oils, etc. Snowdon.
18406 *Improving quality of coke. Phillips.
18407 Doors, etc. Saunders.
18408 Marine engine safety device. Davies.
18409 Beer, etc., vessels. Cormell.
18410 Printers' type. Mackenzie.
18411 Match striking surface. Buckley.
18412 Securing ladies' hats. Munro.
18413 Japanning, etc., stoves. Brooks.
18414 Tobacco pipe. Maxwell.
18415 Miners' safety lamp. Hailwood.
18416 Means for treating viscose. Fielding.
18417 Gas generating fuel generators. Duncan.
18418 Pneumatic tyres. Kitchen.
18419 Wringing device for mops. Isherwood.
18420 Steam engine condensers. Morison.
18421 Beer vessel cocks, etc. Cormell.
18422 Light reflector. Williams.
18423 Device for holding ladies' hats. Midgley.
18424 Closets. Adams.
18425 *Boot, etc., ventilator. Farr.
18426 Embroidery machine. Thornhill.
18427 *Electrifying process. Paillet.
18428 Pipe scrapers. Schmidt.
18429 *Fluid pressure motor. Hodgkinson.
18430 *Brush manf. Jones.
18431 *Bosom press. Guggenheim.
18432 Automatic fire ignition. Watson.
18433 *Shoe dryer. Rhönisch.
18434 Injecting fuel in oil engines. Petter.
18435 Milling, etc., machine. Leggett.
18436 *Milk churns. Hegedus.
18437 Hook and eye. Hone.
18438 *Mixing machines for hair, etc. Verbruggen.
18439 *Cutting machine for round rods. Kluge.
18440 Poultry slaughtering device. Hart.
18441 Isolation cabinets. Holt.
18442 Amplifying devices. Fischer.
18443 *Switches. Adams.
18444 Releasing vehicle trace from splinter bar. Rutty.
18445 Window guard. Seifist.
18446 Rail joints. Heydenblut.
18447 *Relating to perforations. Tetctleni.
18448 *Live stock food manf. Dymond.
18449 Telephone system. Hodgson.
18450 Gramophones. Gaydon.
18451 Looms. Higgins.
18452 Treatment of ores. Baker.
18453 *Gas burners. Yapp.
18454 Advertising device. Concepcion.
18455 Drilling tool. Marsh.
18456 Bottle stopper. Lowry.
14857 *Corsets. Teufel.
18458 Treatment of liquids. André.
18459 *Rotary motors.s Hodgkinson.
18460 *Process to cause emanation of radio-active substances to act on living bodies. Boch.
18461 *Churns. Schröder.
18462 Ladies' hair combs. Levin.
18463 Road cleaning. Levin.
18464 Milk delivery. Levin.
18465 *Projectiles. Quisling.
18466 Buoy for fishing net. Maclean.
18467 Internal-combustion engine. Martin.
18468 Horticultural implements. Wall.
18469 Determining quantities of liquids. Spencer.
18470 Electricity meters. Johnson.
18471 *Apparatus for manifold carrying. Ewen.
18472 Reflecting device. Jones.
18473 Motor lamps. Kerrill.
18474 Water bottles. Hamilton.
18475 *Fixation of nitrogen, etc.
18476 *Musical instrument. Lake.
18477 *Folding beds. Lyons.
18478 Aerial navigation. Mayes.
18479 Treatment of jute, etc. Schmid.

AUGUST 5th, 1910.

18480 Window sash fastener. Mayston.
18481 Aeroplanes. Booth.
18482 *Lever stabiliser. Hambling.
18483 Golf scoring cards. Chapman.
18484 Talking machines. Ezekiel.
18485 *Compression machine. Baade.
18486 *Music teaching. England.
18487 Apparatus used in mines, etc. Hailwood.
18488 Railway line joints. Shortridge.
18489 Railway carriage door lock. Prichard.
18490 Telphers. Brooks.
18491 Rubber manf. Silberrad.
18492 Melting furnaces. Brookes.
18493 Heel pads. Denholm.
18494 Internal-combustion engine. Goldie.
18495 Gas retorts. Brown.
18496 Motor lorries. Harris.
18497 Vulcanising latex. Clarkson.
18498 Cutting machines. Lambert.
18499 Screw. Isherwood.
18500 Window dressing. Ralls.
18501 Insole for boots, etc. Beale.
18502 Securing device. George.
18503 Drains, etc. Stephens.
18504 Tyres. Wilford.
18505 Coal conveyors. Winsleigh.
18506 Road vehicle bodies. Hewer
18507 *Spinning frames. Boyd.
18508 Glass furnace. Bateson.
18509 Carriage doors. Unsworth.
18510 Lubricators. Heenan.
18511 Mixing device for liquids, etc. Morton.
18512 Can opener. Woodward.
18513 *Friction clutch. Collins.
18514 Conveyors. Woodall.
18515 Door stays, etc. Shaw.
18516 *Windmills. Hervé.
18517 Ball castors. Peebles.
18518 *Shoe attachment for ladders. Cross.
18519 Cinematographs. Bates.
18520 Ankle support. Wilson.
18521 Beam case. Mauley.
18522 Heel plate. Barker.
18523 *Superphosphate manf. Cusatelli.
18524 Lasting machines. Boult.
18525 Kettles. Beel.
18526 Cigar guards, etc. Wright.
18527 Motor cycle saddles. Goldsmith.
18528 *Electrical furnace. Siemens.
18529 *Concrete structures. Boult.
18530 Lowering, etc., ships' boats. Williams.
18531 *Press button. Meisses.
18532 Cigar, etc., holder. Coughtrie.
18433 Gun firing mechanism. Durand.
18534 *Screw locks. Burrows.
18535 *Floating docks. Klitzing.
18536 Sleeved garments. Joseph.
18537 Steam superheater. Tourtel.
18538 Clip for securing devices. Young.
18539 *Sashes. Fordu.
18540 *Perforated music sheets. Lake.
18541 *Cutting machines. Beissel.
18542 *Embroidery. Friedberger.
18543 Door fasteners. Bishop.
18544 *Type setting machine. Jones.
18545 *Electrical oscillations. Dymond.
18546 Regulating furnace draught. Homesham.
18547 *Cash registering. Henning.
18548 *Pneumatic controlling device. Goodsteed.
18549 Wheels. Ransom.
18550 Wheels. Ransom.
18551 Blowpipes. Murray.
18552 Dust extractors. Godsal.
18553 Tyres. Godsal.
18554 Fuse lighting for blasting, etc. Chat.
18555 *Cinematograph apparatus. Seischab.
18556 Detecting coins. Haddan.
18557 *Bell ringing. Hartmann.
18558 Bottle stoppers. Hurst.
18559 Game. Donald.
18560 Carriage door locks. Clements.
18561 *Heddlers. Felten.

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18562 Steam generator. Bone.
18563 Eyeglasses, etc. Pearce.
18564 Knife cleaner. Smith.
18565 Wheels. Sharples.
18566 Locating sunken vessels. Dellbridge.
18567 Carriage door lock. Lewis.
18568 Clothes hangers. Alderson.

18569 Tyres. Lippert.
18570 Fire extinguisher. Stansfield.
18571 Propulsion of ships. Kennedy.
18572 Heating apparatus. Earl.
18573 Rolling mills, etc. Gibbins.
18574 Coupling. Turner.
18575 Ladies' skirt clip. Adams.
18576 Tobacco cartridge case, etc. Salomon.
18577 Telephone switchboards. Aitken.
18578 Safety device for mines. Bailey.
18579 Elastic couplings. Hall.
18580 Honey sections. Tilley.
18581 Vehicle rear signals. Parfitt.
18582 Casting moulds. Putnam.
18583 Globe, etc., holder. Challis.
18584 *Internal-combustion engine. Crossley.
18585 Treatment of heat. Crossley.
18586 Pumps, etc. Hele-Shaw.
18587 Pumps, etc. Hele-Shaw.
18588 Sportsmen's bags. Atkins.
18589 Internal-combustion engine. Lemmens.
18590 *Ore washers. Draper.
18591 *Electric switches. Lundberg.
18592 Wheels. Spencer.
18593 Fuel economisers, etc. Bonwick.
18594 Gas, etc., taps. Bishop.
18595 Steam valves. Abeijer.
18596 *Locking clips. Ver-Mehr.
18597 Regulating valves. L. J. De Clair.
18598 *Revolving shutters. Pulscher.
18599 Motor lamps. Vandervell.
18600 Semaphore signalling apparatus. Coombs.
18601 *Advertising. Nachf.
18602 *Pincenez. Walter.
18603 Internal-combustion engines. Fielding.
18604 Flying machines. Pelterie.
18505 Lantern. Bright.
18606 Manufacture of nitro-cellulose. Hart.
18607 Waterproofing fabrics. Hart.
18608 Electric controlling apparatus. Darwin.
18609 Drying clothes. Owen.
18610 *Loom for cocoanut matting. Hallansleben.
18611 Tryes. Evans and Doubleday.
18612 Internal-combustion engines. Mercer.
18613 Transforming reciprocations into revolutions. Greger.
18614 *Fastening device for blinds. Jäckle.
18615 *Expression indicators for piano players. Lake.
18616 Controlling valves. Polikarpow.
18617 ·Carburetter. The Belle Vue Motor Car Co.
18618 *Suspenders. Temple.
18619 Swaging device. R. Lamb.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to September 12th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

6777 Parkinson: Device for heating ovens, radiators, cooking utensils, hot plates, irons, and the like by means of electricity. [Post-dated July 1st, 1909.] 7954 North and North: Rings for curtains and the like. [Post-dated September 1st, 1909.] 7962 Sabater y Aranda, Fanjul y Goni, and De Blanco y Perez de Vera: Topographical surveying instruments. [Date applied for under International Convention, April 2nd, 1908.] 8190 Whitley-Lavarack and Greenwood: Recreative apparatus of the switchback or like type. 8336 Kittle: Vaporisation of oil and other volatile substances. 10538 Higginson: Syringes. 10763 Robb, Welch, and Banner Motors Ltd.: Internal-combustion engines. 10874 Robb, Welch, and Banner Motors Ltd.: Valve mechanism for multi-cylinder internal-combustion motors. 12379 Gray: Means for facilitating reading from pointers, scales, moving liquid, or other indicating means in measuring instruments and the like. [Post-dated November 26th, 1909.] 12916 Ludwig Hupfeld Akt.-Ges.: Mechanically-actuated musical instruments. [Application for Patent of Addition to 12573, 1909.] 12939 Schwarz: Manf. of mats and the like. 13102 Drummond: Steam generators. 13123 Wm. Simons and Co., Brown and Brown: Dredging vessels. 13203 Browne and Stephens: Inexpensive form of bottle and the like to prevent contents from being tampered with. [Post-dated August 5th, 1909.] 13529 Black: Appliances for temporarily securing drapers' check or sales books and the like. [Post-dated December 9th, 1909.] 13773 Hingelberg and Middleton: Furnace grates. [Post-dated December 13th, 1909.] 15263 Wm. Simons and Co., Brown and Brown: Dredging cutters. 15306 Lilienfeld: Process for coating or printing with viscose. 15327 Lesieur and Delom: Spring wheels. [Date applied for under International Convention, June 30th, 1908.] 15344 William Newman and Sons Ltd., and Newman: Door closers and checks. 15370 Hodgson: Radiators for motor vehicles. 15384 Mackintosh: Alloys. 15397 Yoxall, Thorneycroft, and Richmond: Roller skates. 15405 Chambon and Massot: Machine for cutting paper or the like. [Date applied for under International Convention, July 1st, 1908.] 15447 White: Injectors. 15455 Ionides: Heating apparatus burning gaseous fuel. 15472 Asten, and Francis Barker and Son Ltd.: Instrument for surveying and like purposes. 15487 Evershed and Vignoles Ltd., and Kilroy: Means for automatically indicating certain relative positions of guns or the like to each other. 15493 Grant, and Grant Automatic Machine Co.: Automatic lathes. [Application for Patent of Addition to 9570, 1907.] 15520 Whitfield: Liquid fuel burners. 15527 Alcock and Macmillan: Advertising devices. 15565 Holzwarth and Junghans: Gas turbines. [Request under Section 19 of the Act not granted.] 15566 Holzwarth and Junghans: Method and arrangement for regulating gas turbines. 15569 Cone: Generation of gas in gas producers. [Date applied for under International Convention, July 3rd, 1908.] 15575 Lake (Stromberg Motor Devices Co.): Carburetters for internal-combustion engines. 15593 Todd: Fastenings for smoke box doors of tubular boilers or the like. 15644 Stirling: Automatic force-feed lubricators. 15646 Jorgensen: Method of producing products such an imitation embossed leather having a metallic surface. [Date applied for under International Convention, July 4th, 1908.] 15649 Backus: Manf. of artificial stone. 15651 Fairweather (Underwood Typewriter Co.): Sheet-feeding device. 15663 Gendron: Reed-actuating mechanism for looms. 15746 Wheat: Rotary printing presses. 15751 Lake (Marshall): Pulp-beating engines. 15768 North: Automatic apparatus for controlling the supply of gas to burners. 15801 Blackburn: Aeroplanes. 15805 Wolseley Tool and Motor Car Co., and Rowledge: Internal-combustion engines. 15813 Mason: Furnaces of steam generators or the like. 15835 Jackson and Weber: Propeller. 15850 Keall, Gouldbourn, and British United Shoe Machinery Co.: Supporting and the relative positioning of the work and the tool or tools in machines used in the manf. of boots and shoes. 15851 Bates, Gouldbourn, and British United Shoe Machinery Co.: Sole-levelling and like machines. 15882 Kurze: Manf. of hollow castings. 15889 Leitner: Automatic electric regulators, output adjusters, and the like. 15890 Benkert: Files or binders for letters and other sheets. 15896 Kuttner: Insulation of electric conductor windings or coils made of aluminium or aluminium alloys. 15898 Mathot: Governing mechanism for internal-combustion engines. [Date appiled for under International Convention, July 7th, 1908.] 15906 Millet: Trouser pressers. [Application for Patent of Addition to 15785, 1909.] 15907 Hewitt: Motor road vehicles. 15912 Zeiller: Process for the production of a substance intended to produce masonry castings. 15913 Wasserfuhr: Process for the protection of iron and similar substances against atmospheric influences. 15914 Thompson (Irving): Tobacco pipes. 15918 Baker, and Pictorial Newspaper Co.: Phototelegraphy. 15931 Mechan: Discharge aperture fittings of cyanide and other tanks. 15934 Clark: Adjustable scoring board for horse shows and sports. 15940 Greenall, Rathmill, and Thorley: Aerial propellers. 15961 Lyon: Means or apparatus for introducing air into buildings, apartments, or chambers, and distributing the same therein. 15977 Thornycroft and Thornycroft: Power-driven boats. [Cognate Application. 542, 1910.] 15979 Walton and Rogers: Thread spool or reels. 16061 Schmidt: Air compressors. [Request under Section 19 of the Act not granted.] 16076 Pope's Electric Lamp Co. (Trenzen): Process for the production of a metallic connection between incandescent filaments and their leading-in wires. 16107 Urquhart: Masked shelters or berths for military flying machines or airships. 16114 Electromotor Equipment Co., and Barlow: Controlling mechanism of automatic electric lifts. 16117 Parsons and Ball: Electric impulse or step-by-step clockwork mechanism. 16121 Stephens, Milner, and Milner: Machine for disintegrating vegetables, shelling beans, and the like, and churning cream, or for performing analogous operations. 16122 Willis (Leith and Sims): Means for operating railway points and switches. 16156 Adam: Aeration of dough. 16165 Elliott: Transmission gear for self-propelled vehicles. 16166 Gabanou: Valves and valve packing for internal-combustion engines. 16212 Plant: Machines for inserting fasteners in leather. 16230 James: Resilient wheels for road vehicles. 16262 Slatter: Machine or appliance for absorbing water or moisture from cricket pitches, tennis lawns, and the like. 16273 Ferguson: Automatic electric switches. 16311 Schulz: Eyeglass frames. 16323 Dinsdale: Meat-carving appliances. 16349 Plant: Lasting machines. 16371 Hamilton: Firebars of furnaces. 16373 Schauffelberger: Means for balancing the end thrust on the rotor in rotary pumps, blowers, compressors, and the like. 16393 Kenworthy: Lawn and parlour golf. 16418 Boultbee and Page: Circulation of liquid in boilers or liquid-heating apparatus for the generation of steam or other purposes. 16456 Macomber: Rotary internal-combustion engines. 16481 Maddocks: Apparatus for heating water for baths. 16576

Guthrie: Gear for raising and lowering boats. 16619 Stevens: Tubular locks. 16622 Arnold, Holford, and Jennings: Variable-speed and reversing gearing. [Post-dated January 17th, 1910.] 16647 Beasley, Beasley, and Bradbury: Form of recording gas calorimeter specially adapted for the analytical examination of the products of combustion. 16669 McIntire and Sommerville: Machine for making up cigarettes in packets. 16909 Powell: Twine-cutting rings and blanks therefor. 16998 Block Light Co., and Webber: Incandescent gas burners.

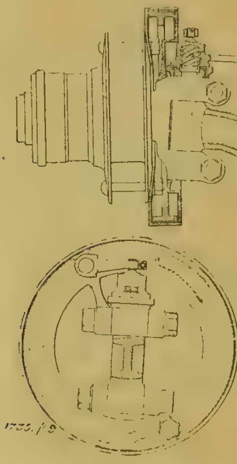
17254 Arthur George Hopper and Joanna Elisabeth Hopper Greenwood, Executors of the late Arthur Greenwood and Chapman: Windings for the armatures of dynamo electric machines and the like.

This invention consists of an improved method of constructing that class of armature winding known as the short-circuited or squirrel cage type, in which the conductors composing the windings are all electrically connected together at each end by a short-circuiting member consisting of a ring, disc, or the like. When the ordinary method of construction is employed mechanical difficulties arise in securing the conductors to the short-circuiting member in those cases where the tangential width of the conductors is too small to permit of screws or rivets being passed radially through it. These difficulties are overcome in the following manner, in cases where the radial depth of the conductors is greater than their tangential width: The ends of the conductors projecting from the slots are turned about an axis parallel to the length of the conductor through an angle of 90 deg. or thereabouts, and are then fixed to the short-circuiting member with their broad side towards it by screws, rivets, or other suitable means. In order to facilitate the twisting when necessary or desirable, the conductors may be laminated.

17311 Michaelson: Machine for fixing stamps on to letters, circulars, and the like. 17321 Beavis and Pearse: Reversible propellers controlled by tiller. 17324 Hollingsworth: Sensitised albumenized paper for photographic purposes.

17352 Allen and Allen Liversidge Front Wheel Brakes Ltd.: Brakes for the steering wheels of motor road vehicles.

This invention relates to brakes for steering wheels of motor road vehicles where the steering wheels are mounted on stud axles, and has for its object to provide improved means for transmitting the braking movement without the same affecting or being affected by the steering movement of the wheels which carry the brakes. The invention relates particularly to that type of such mechanism described and claimed in prior Patents No. 19044 of 1904 granted to P. L. Renouf and J. Renouf and No. 15912 of 1906 granted to T. G. Allen. In the Renouf invention the braking movement is transmitted by a movement along the axis of the pivot on which the steering wheels of the vehicle are turned for steering. In the Allen invention of 1906 the braking movement is transmitted by pulleys, levers, or equivalent devices having rotary motion around the axis on which the wheels turn for steering. According to the present invention the motion necessary for actuating the brake on the steering wheels is transmitted by mechanism embodying the two motions referred to, namely, a movement around and along the axis of the steering pivot, the mechanism comprising, for example, a member capable of rotating on the axis of the steering pivot and adapted to have or produce a longitudinal movement along the axis of the steering pivot by the aid of a helical device, such as opposing oblique surfaces or quick threaded screw suitably disposed, preferably co-axial with the axis of the steering pivot.



17465 Mitchell: Means for working railway points or switches. 17476 McKechnie: Mechanical lifting jacks.

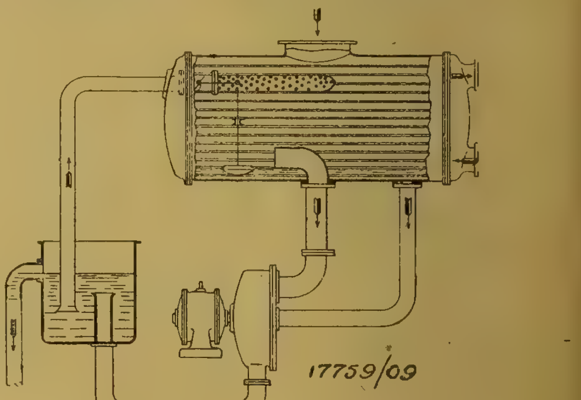
17516 Wardale and Storey: Means for preventing overwinding and underwinding electrically-driven cranes, capstans, lifts, and the like.

This invention relates to means for automatically preventing overwinding and underwinding in working electrically-driven cranes, capstans, lifts, and the like of the kind in which a rotating part, such, for example, as the motor shaft, or the winding drum, operates a screw along which runs a nut-operating means by winch, when the nut arrives at the end of its travel in either direction, a device, which retains the electric switch on, will be released so that the switch breaks the circuit and the motor is stopped, and this invention has for its object to provide a simplified and efficient construction and arrangement in which the operation of the motor can by means of one switch be discontinued at any required period in both raising and lowering. According to this invention the nut which is operated from any suitable rotating part, such, for example, as the screwed spindle of the winding drum, carries a guided striker plate provided with means for causing a lever to be acted upon to operate a bell crank lever, one member of which engages with an arm fixed to the shaft of the switch to normally retain the switch on, so that when the striker plate arrives at any predetermined position in either direction it will act on the first-mentioned lever, so as to operate the bell crank lever and cause it to release the aforesaid arm and allow a spring to bring the switch to its "off" position and stop the motor.

17521 Bishop: Box-making machines. 17525 Dinesen: Ships. 17641 Jones (McWilliams): Means for handling or transferring goods. 17738 Hodgson: Military sketching boards.

17759 Wolf: Condensing systems. [Date applied for under International Convention, August 1st, 1908.]

This invention relates to condensing plants comprising a centrifugal air pump which is essentially of the type in which the impeller wheel, instead of acting directly upon the air or other elastic fluid to be pumped is adapted to discharge a suitable liquid which is directed through passages in the stationary part of the pump so as to entrain the air or other elastic fluid to be exhausted or compressed. The operation of condensing plants with centrifugal air pumps is simple so long as the pump is supplied with pure conveying water or entraining fluid containing little air, and that the same can freely flow away. Difficulties are encountered, however, when pure water cannot be obtained at all or only in small quantities for the conveying, as is the case, for instance, on board ship. In cases of this kind special tanks have been adopted from which the pump sucks water and into which the conveyed water flows back again. Here care has to be taken that the water supplied to the pump is kept as cool as possible, which has led to the arrangement of a special cooling device. This whole arrangement has, however, several objections. First of all care must be taken for fresh and pure water containing little air, and the same must be kept in a large tank when a constant supply is not present, as in the case of ships, for example. This arrangement takes up much space and together with the conveying water has great weight. Further, the quantity of steam carried by the pump air exhaust pipe, which condenses in the pump itself, cannot be used like the rest of the condensation water for feeding the boiler, because it has been made impure by the conveying water. In the working of steam turbines especially, this is of the greatest importance, because the water of condensation is nearly chemically pure water which cannot be replaced by other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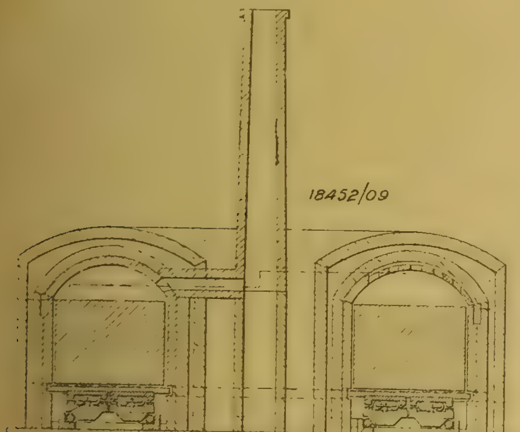
water. A further defect of the former arrangement consists in this, that with the above-mentioned cases a special re-cooling for the conveying water must be provided, which increases the weight of the plant and again requires special cooling water. The present invention has for its object to overcome these disadvantages, and consists in a condensing system comprising a centrifugal throwing-air pump adapted for simultaneously removing air and condensation water from the condenser, the condensation water from the discharge side of the pump being conveyed back into the condenser.

17818 Wyler and Levinstein Ltd.: New dyestuffs derived from indigo and the production thereof. 18018 Lake (Healy): Machinery for making cleat-reinforced and wire-bound box blanks. 18054 Hill and Hill: Means or apparatus for grading, cleaning, and polishing peas, beans, maize, seeds, and the like. 18252 Smith: Portable cigarette cases or boxes.

18452 Bary: Furnaces.

This invention relates to furnaces, and has for its object to provide a furnace of improved construction. A furnace constructed in accordance with this invention is provided with a rotary moving platform adapted to be revolved in a closed annular space on anti-friction devices, the devices comprising conoidal rollers adapted to revolve on circular rails and to support the platform through the medium of ball bearings. In one form of furnace constructed in accordance with this invention, an annular moving platform is arranged between a pair of concentric circular walls and covered over by an arch constituting the working chamber and the whole is enclosed by a masonry casing. The masonry casing is separated from the concentric walls and the arch by a space which serves as an insulator and decreases the loss of heat. Within the circle so formed a chimney shaft is arranged, the shaft being connected with the upper part of the working chamber by a flue. The moving platform is arranged on an annular frame on the periphery of which a rack is provided and adapted to mesh with a pinion connected with a source of power. On the upper part of the platform are arranged a series of pairs of members of U section parallel to the radii of the platform and equidistantly spaced, and engaging in the pairs of members are second pairs of members of T section secured to brick segments carried thereby, the brick segments occupying practically the whole of the working chamber and being provided with concavities on their upper surfaces as receptacles for the material to be treated. Beneath the annular frame on which the moving platform is mounted are a series of pairs of anti-friction devices. Each of these devices comprises a lower member having a tapering projection adapted to rotate on circular rails, an upper member rigidly secured to the frame, a central boss, and a triangular plate adapted to space apart the balls disposed between the members, and the members are provided with a tongue and slot connection for the exclusion of dust. When the frame and platform are revolved the upper members of the anti-friction devices drag round the lower members which revolve on the rails, each on its own axis, and below the ball bearings and prevent side shift of the platform.



18492 Koenig: Pipe connections to allow for expansion. 18503 Galagher and Rendle: Method of combining leather and rubber. 18608 Zanni and Bridger: Toys, applicable also as an advertising device. 18617 Alexander and Applebys Ltd.: Devices for bagging coal and the like. 18853 Gold: Ventilators. 18864 Kraus: Electric lamp for miners and for the house. 18897 Luckwill: Lock for sliding windows and doors, and cycle and other wheels. 18926 Caudrey: Reaping or harvesting machines. 18962 Wolff: Treatment of steel for desulphurising and deoxidising purposes. 18965 British Thomson-Houston Co. (General Electric Co.): Electrodes for arc lamps. 18978 James Challis Ltd., and Challis: Folding seats, forms, tables, and the like. 18991 Dennison, Dennison, and Dennison: Butter churns. 19045 Connare: Wall sockets for electric couplings. 19087 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new ketone alcohols. 19136 Whalley, Edmondson, and Whalley: Wringing and mangling machines. 19213 Tate: Art of waterproofing fibrous materials. 19297 Hohmann: Automatic gas-analysing apparatus. 19367 Mills: Clutches for motor road vehicles. 19489 Peebles: Means for operating coin-prepayment mechanism of fluid meters from a distance. 19626 Talansier: Apparatus for emulsifying, pulverising, and homogenising liquids. 19704 Blake: Means for lubricating engines, exhausters, and the like. 19871 British Thomson-Houston Co. (General Electric Co.): Propulsion of ships. 19897 Linton and Francis: Ratchet braces and other portable drilling machines. 20025 Beckmann: Process for the manf. of an adhesive composition in powdered form. 20077 Gaskell: Tobacco pipe. 20116 Hills (Dunn): Dry closet. 20216 Josse and Gensecke: Process and apparatus for removing gases and vapours from surface condensers. 20275 Dewar: Stand for ink bottles and similar articles. 20286 Dmitriew: Elastic electromagnetic power-transmitting device, particularly for use with automobiles, locomotives, and the like. 20301 Daemen-Schmid: Mechanism for setting and restoring the axially slidable pinions in calculating machines with only one slidable pinion for each denominational element. 20352 Wardzinski: Means for preventing the development of smoke in furnaces, more especially those of steam boilers. 20370 Mills: Roller and other skates. 20380 Farago: Process for concentrating solutions without heating them. 20432 British Northrop Loom Co. (Northrop Loom Co.): Self-threading devices for shuttles employed in weft-replenishing looms. 20482 Amborn: Chain pipe wrenches. 20653 West: Discharging and charging machine for gas retorts. 20680 Garner, Huggins, and Parker: Exhaust or like operated whistle or hooter for a motor car or the like. 20713 Priddin: Tube bender. 20820 Hess and Fernau: Counting device for beer glasses. 20906 Sheppard: Manf. of fuel blocks. 20967 Walter: Valve gear for steam and like engines. 21068 Roberts: Cleaners, polishers, sharpeners, and the like. 21102 Cotta: Change-speed gearing. 21180 Barbour: Flexible electrical brushes or collectors. 21230 Hollingworth (Crompton and Knowles Loom Works): Drop devices or detectors of warp stop motions for looms or warping machines. 21361 Stevens: Twist lace curtain machines. 21452 Willis (Walter): Means for detecting unauthorised opening of envelopes. 21525 Bullock and Burley: Door or casement bolt or fastener. 21545 Elliott: Stencils and method of producing same. [Date applied for under International Convention, January 27th, 1909.] 21581 Johnson (Kalle and Co. Akt.-Ges.): Manf. and production of brominated colouring matters of the thio-indigo group. 21592 Smith's Dock Co., and Figgin: Sliding windows for ships. 21877 Roberts: Extensible ladders. 21897 Brawn: Shield or screen for protecting the drivers of motor vehicles. 21945 Consolidated Brake and Engineering Co., and Luard: Release valves for vacuum brake apparatus. 22140 Robertson (Robertson): Extraction of tin and like metals capable of oxidisation from ores and slags and furnaces therefor. 22150 Darrah and Sinclair: Valves for closet-flushing cisterns. 22241 Rowell: Valves and valve gear for use with internal-combustion engines. 22257 Crossley and Webb: Governing of internal-combustion engines. 22288 Simmons and Wilkie: Railways for recreation. 22305 Jardine and Holland: Looms for weaving narrow fabrics, such as tapes, ribbons, and the like. 22449 Clements: Tool or appliance for the removal of scale or soot from the interior of boiler tubes, economiser tubes, and the like. 22513 J. W. Spridgeon Ltd., and Spridgeon: Presses for lace machine bobbins. 22519 Davis: Combined hand bag and mirror. 22523 Carl Zeiss: Indicating devices for optical measuring instruments. [Date applied for under International Convention, October 8th, 1908.] 22594 Haddan (Bergmann Electricitats Werke Akt.-Ges.): Method of suctionally removing air and condensing steam by an intermittent jet of water, and apparatus therefor. 22604 Gilmore: Apparatus for drying fabrics. [Date applied for under International Convention, October 5th, 1908.]

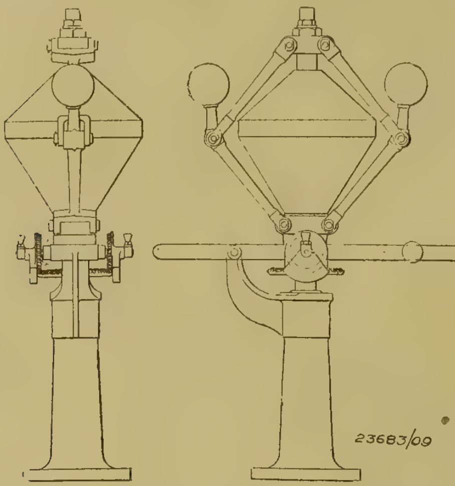
22653 Witzenmann: End connection for metallic hose pipes.

This invention relates to an end connection for spirally-wound metallic hose made from metal bands of suitable profile. According to the present arrangement an end connection is provided which is specially suitable for welded metallic hose in which the edges of the profile metal band are autogenously welded together, and it consists in autogenously welding a ring-shaped metal plate to the end of the metal hose, so that it forms a seat or bearing for the packing which is in a known manner pressed between the end connecting pieces.

22864 Adams: Sewage purification plant. 22984 Spence: Tapping of rubber trees and the like. 23220 Mitchell: Automatic closing and locking of lift gates and the like. 23325 Soc. Anon. Du Temple: Apparatus for dredging and subsequently sorting sands. [Date applied for under International Convention, October 13th, 1908.] 23434 Visseaux: Process for the manf. of incandescent mantles. 23538 Hardingham (Barclay): Means applicable for use in exposing, developing, and fixing photographic plates.

23683 Hargreaves and Hudson: Centrifugal governors for motive power engines.

This invention relates to centrifugal ball governors for motive power engines, and of the type in which the balls rotate in a plane embracing the axis of rotation, and has for its object to apply improved and simple means for giving such a saltatory motion to the parts of the governor as will keep them in a constant state of slight vibration, so that only the friction of motion, and not the friction of rest which is considerably greater, will require to be overcome when the parts of the governor—relatively to one another at rest but as a whole rotating—commence to move relatively to each other. Thus a certain lag in the action of the governor and what is known as hunting, which may ensue, more particularly if the valve gear in connection with which the governor is applied operates without shock reacting on the governor, are to all intents eliminated. The improved means for giving this saltatory motion to the parts of the governor are such as to cause only distinct vibration and not appreciable motion of them, and comprise unbalanced masses rotating, oscillating, or reciprocating upon the governor or connected thereto, driving means for the governor of slightly and rapidly fluctuating speed, or a diaphragm or piston operated by rapidly fluctuating pressure (such as cylinder pressure in a steam engine) and operatively connected to the governor or a mass vibrated or oscillated electrically.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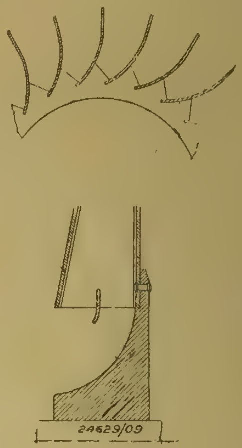
24000 Chappelow: Method of producing concrete structures. 24373 Collins: Electrical switches. 24439 Clarkson and Morison: Speed indicators for motor road vehicles. [Cognate Application. 4761, 1910.] 24487 Newton (Farbenfabriken vorm. Friedrich Bayer and Co.): Manf. and production of new acid wool dyestuffs.

24629 Warwick Machinery Co. (1908), and Alquist: Centrifugal compressors.

This invention relates to centrifugal air compressors of the type having a radial air inlet, and has for its object the improved construction of such compressors. In such compressors great difficulty has been experienced owing to the inlet passages closing up under the centrifugal strains to which they are subject, as the vanes on the inlet side are usually secured so that the receiving edges are substantially tangential to a cylinder concentric with the shaft and consequently there is a great tendency for these edges to bend under the centrifugal force and close up the entrance passages. Even when the vanes are well supported on each edge by side plates, there is still a tendency for them to bend over in the middle unless they are made of considerable thickness. Strengthening the vanes by thickening, however, increases the weight to such an extent that very high stresses are set up on the side plates which have to carry the vanes, and these side plates are also subject to stresses due to their own weight. It is therefore essential that the vanes should be made as light as possible, and it becomes practically necessary to provide some sort of support between the side plates. This invention therefore consists in providing such a support between the side plates which may take the form of a ring provided with serrations on its outer edge into which the inner ends of the vanes extend. A support so constructed will cause a minimum amount of disturbance to the flow of the incoming air, as there need be no flanges or rivet heads for securing it to the vanes. The inner and solid edge of the ring may be bent so that it is substantially concentric with the curve of the hub, thereby still further decreasing its resistance. It will be obvious that where wide vanes are employed two or more such rings may be used. Similar rings may also be secured to the inner edges of the side plates to form a guide for the air instead of curving the edge of the vanes themselves and riveting the side plates to them at several points.


24629/09

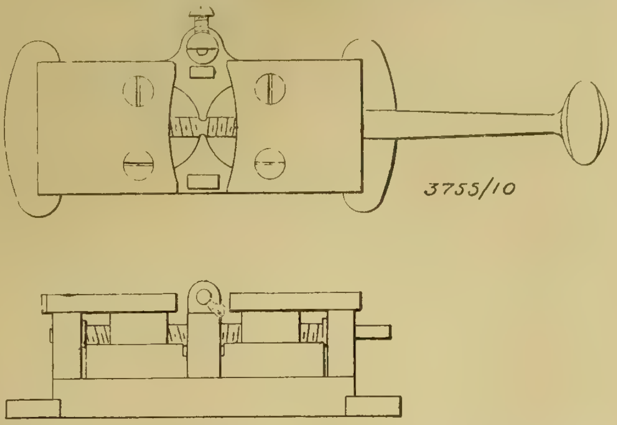
24652 Scopes: Dished countersunk washer for bolts used in making steam, water, and like joints. 24703 Bloxam (Act.-Ges. fur Anilin Fabrikation): Manf. of new sulphurised dyestuffs. 24735 Harris: Electro-deposition apparatus. 24852 Elias: Vehicle wheels. [Cognate Application. 1931, 1910, and 7970, 1910.] 24868 Gibb and Mavor: Elevators and conveyer systems for use in mines. 25056 Reynolds: Cheese cutter. 25093 Mellowes: Glazing. 25242 Burroughes: Cushions for billiard tables and the like. 25528 Schoenfeld: Embroidery machines. 25529 Schoenfeld: Shuttle embroidery machines 25558 Lewis and Pateman: Combined easy chair and table. 25577 Woodhouse: Conduits or casings suitable *inter alia* for electric wiring systems. 25644 Peiseler: Files. [Date applied for under International Convention, August 7th, 1909.] 25858 Pearson and Seward: Chucks and work-holding spindles. 25940 Mackintosh: Casks and like receptacles for containing liquids. 25999 Becke and Beil: Process of dyeing half-woollen goods. [Date applied for under International Convention, April 8th, 1909.] 26004 Chippindale: Dust bins. 26196 Sidaway and Sidaway: Manf. of miners' and like crowbars. 26703 Hoffmann: Tank for the driving liquid of aerial machines, airships, and the like. 26707 Huserich: Process for manufacturing imitation stained glass out of paper. 26776 Falvey: Mounting of railway and road vehicles on their axles. 26782 Crawford: Pulverising machines. 26842 Wetter (J. D. Riedel Akt.-Ges.): Process for purifying water. 26881 Primrose: Regulation of the temperature of superheated steam. 26891 Moore: Builders' cradles. 26913 Lake (Goss Printing Press Co.): Inking mechanism for printing presses. 27011 Haddan (Lamb Knitting Machine Co.): Variable-speed gearing. 27019 Dufour: Hydraulic turbine regulating devices. [Date applied for under International Convention, November 21st, 1908.] 27091 Melvin: Pumps for automatically inflating pneumatic tyres. 27095 Solly: Stoppers for bottles, jars, and the like. 27120 Mannesmannrohren-Werke: Turbines. [Date applied for under International Convention, November 23rd, 1908.] 27178 Krichbaum: Pressure regulators. 27197 Voit: Valve gear. [Date applied for under International Convention, November 25th, 1908.] 27277 Krummel: Apparatus for seaming the heads on cans. 27361 Leske: Method of and apparatus for making lids of cardboard and the like. 27510. *See* 8241, 1910. 27589 Wangelin: Ball and float valves. 27888 J. and J. Cash Ltd., Cash and Averns: Coat hanging tabs and the like. 27933 Hughes (Long): Wrenches. 27964 Novotny: Pneumatic tyres. 28041 Chrimes and Woolhouse: Liquid meters. 28054 Moores: Composition for purifying air gas. 28196 Besson and Co., and Lyster: Percussion musical instruments of the type known as Glockenspiel. 28355 Offenbau-Ges.: Mechanism for pressing doors or covers on to their seatings. [Date applied for under International Convention, June 28th, 1909.] 28360 Abresch: Apparatus for filtering and purifying liquids. 28451 Saracco: Bobbins or apparatus for utilising or treating thread. 28467 Dicker (Underfeeder Stoker Co., of America): Analysis of gas. 28604 Santnanieff: Apparatus for indicating the presence of water in ships' compartments. 28734 Pottin: Automatic distributing device for use in the sale and hire of books. 28749 Coe and Werden: Strips for carrying and discharging goods, more particularly stamps, tickets, and the like from automatic delivery machines. 28774 Davie and Bissell: Non-slipping ruler. 28847 Schmidt: Method of vaporising liquid fuel introduced into an internal-combustion engine. [Date applied for under International Convention, December 14th, 1908.] 28941 British Thomson-Houston Co. (General Electric Co.): Systems of electric motor control. 29189 Foster: Superheaters. 29229 Kletti: Rolling board adapted for use in applying the covering leaf of cigars. 29286 McKechnie and Beasley: Methods or processes of separating metallic compounds from complex ores, mattes, residues, and metalliferous substances. 29358 Churchward: Method of and means for connecting steam, water, and like pipes. 29363 Moya: Back-spacing mechanism for the carriages of typewriters. 29445 Drucker: Continuous slimes vacuum filter. 29781 Wewerka: Process and apparatus for the production of hollow bodies of reinforced concrete, articial stone, or clay, or similar plastic material. 29836 Schmid: Tyre valves. 29858 Cooke: Motor-cooling system. 29880 Gustafson: Pile elevators for sheet-feeding machines. 29881 Whitehall: Joints for box and like cleats. [Date applied for under International Convention, December 30th, 1908.] 29886 Marks (Southern Manufacturing Co.): Processes of extracting turpentine, oils, and other products from wood. 29904 Janssens: Means for tightening ropes and other flexible connections. [Date applied for under International Convention, March 3rd, 1909.] 29979 Holmested: Loading machines. 29997 Pneumatic Rubber Stamp Co. (Buck's Patent), and Garland: Pneumatic or other cushion rubber stamps. 30142 British Thomson-Houston Co., Gray, Rogers, and Holden: Electric meters. [Application for Patent of Addition to 12689, 1909.] 30214 Piercy: Nut and screw gear. 30310 Monk: Casement windows. 30463 Schulte: Apparatus for electrolytically removing the grease from objects to be galvanised. 30546 Grocock: Handles or grips for scrubbing or the like brushes. [Post-dated January 27th, 1910.]

1910.

278 Hodge: Indoor games. 448 Hofer: Combined music folio and music rest. 498 Mann: Hot-air motor. 528 McCormack and McCormack: Fuel economisers for domestic firegrates. 542. *See* 15977, 1909. 545 Gebruder Sulzer: Steel bottles, the contents of which are under high pressure. [Date applied for under International Convention, September 9th, 1909.] 738 Hawkins: Tools for trueing carborundum wheels. 939 Brown and Brown: Hose supporters. 1219 Beart: Spliced fishing rods. 1244 Monsma: Water cock or valve. 1667 James: Ball bearings for the axles of perambulators, mail carts, and the like. 1714 Boult (Nellis): Metallic building structures. 1750 Wiese: Steering gear of potato diggers. 1786 Rouzet: Apparatus for rocking cradles of all kinds. 1931. *See* 24852, 1909. 2003 Tucker: Chemises and other articles of underwear. 2073 Schilling: Apparatus for removing fat from effluents. 2099 Hillmer: Device for determining the weight of liquids in storage tanks. [Application for Patent of Addition to 2812, 1909.] 2122 Sehr: Manf. of filters. 2289 Wells and Ballard: Wheels for vehicles, self-propelling and otherwise. 2313 Langer: Apparatus in connection with locomotive fireboxes. [Date applied for under International Convention, January 31st, 1909.] 2406 Bouffler: Handle bars of cycles and the like. 2407 Kletti: Rolling board adapted for use in applying the covering leaf of cigars. [Application for Patent of Addition to 29229, 1909.] 2429 Domnick: Protective casing for glass receptacles and the like. 2470 Durey: Propeller screws for airships. 2517 Farmer: Grip for rope haulage in mines and other places. 2584 Larkin: Riding breeches. 2660 De Paepe: Life-saving apparatus. 2725 Dandoy: Construction of roofs. 3159 Arthur: Domestic coal firegrates. 3244 Firth: Fastener for coffin lids or the like. 3282 Hilditch: Bottle closure. [Date applied for under International Convention, February 12th, 1909.] 3302 Soher and Storey: Internal-combustion engines. 3333 Haddan (Sells): Roller bearings. 3580 Williams: Stain or grease-removing devices. 3591 Patent Borax Co., and Bradford: Soaps and other saponaceous compounds, detergents, bleaching compounds, and the like.

3755 Thomesen and Kent: Vice or holder.

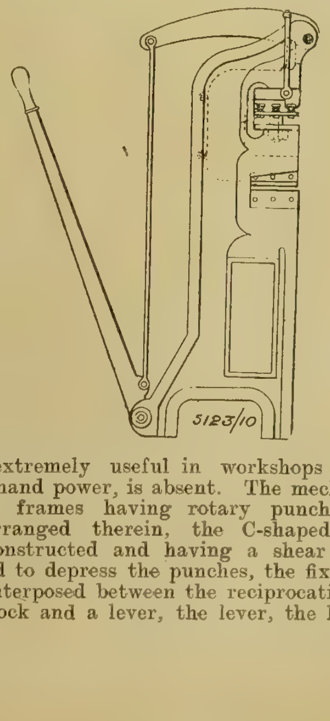
This invention relates to an improved vice or holder for metal or other bodies during the operation of drilling or otherwise treating same, and it has for its object to produce a vice particularly designed for holding tapering or other bodies having sides which are not parallel and in which vice the jaws shall automatically assume the desired angular position, the angular movement of one jaw being transmitted to the other so that each jaw is moved through the same angle. In carrying the invention into effect, two jaws are provided, each having a gripping surface of any desired outline and each secured to a body carrying a nut through which passes a second spindle provided on its opposite ends with right and left-hand threads, similar threads being provided in the nuts aforesaid. The bodies carrying the nuts are each mounted in guides, which guides themselves are formed upon or secured in any convenient manner to a plate connected to a pinion having a bearing in the base plate of the vice and in which is formed a recess for containing the pinion. The pinions of each jaw are in engagement so that the angular movement of one jaw is transmitted to the other and the extent of the movement of each jaw is equal. By this means a body having a tapering outline may be securely held and at the same time is accurately centred beneath the drill or other tool. Obviously by suitably shaping the gripping portion of the jaws, work having curved sides which are either cancave or convex may be held.



3777 Haenke and Haenke: Chutes for frangible granular material. [Date applied for under International Convention, February 15th, 1909.] 3816 Schwarz: Self-acting clockwork device for tearing the leaves off block calendars. 3897 Gamwell and Taylor: Metal receptacles for holding liquids, powders, and the like. 3913 Kumpf: Ink pots. 3969 Richardson: Process or method of purifying or clarifying water. 4000 Metcalfe: Twine holder. 4102 Chevalier: Covers for tyres. 4158 Ince: Apparatus for separating and collecting rain water discharged from roofs. 4318 Thomson: Electric circuit closers. 4495 Manifold Printing Co., and Bailey: Account forms and the like. 4654 Greist and Beckert: Sewing machines. 4689 Davidson: Machines for making artificial stone slabs and the like. 4690 Stahn: Opening devices for prismatic packages with paper wrappers. [Date applied for under International Convention, March 6th, 1909.] 4761. *See* 24439, 1909. 4815 Southby: Combined cotton reel holder and thread cutter. 4913 Kummer: Travelling rugs. 4952 Thomsen: Skirt holders.

5123 Miller: Punching and shearing machines. [Date applied for under International Convention, March 1st, 1909.]

This invention relates to punching and shearing machines, and it has for its object to provide a new combination of parts and mechanism which are mostly of known construction to constitute a machine which is new as a whole, and will compactly comprise all the main features essential in a cheap, though powerful and efficient, tool which will be found extremely useful in workshops where power, other than hand power, is absent. The mechanism consists of the side frames having rotary punch carriers and punches arranged therein, the C-shaped reciprocating block as constructed and having a shear blade thereon and adapted to depress the punches, the fixed shear blade, the block interposed between the reciprocating shear blade carrying block and a lever, the lever, the hand lever, the

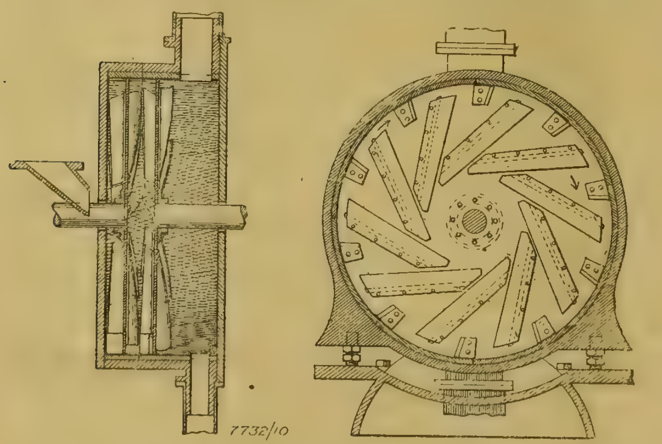


connecting rod between the two levers, and the links connecting the first-mentioned lever with the C-shaped reciprocating block whereby the latter and the particular punch depressed is raised.

5261 Adams Manufacturing Co. (Cutler Hammer Manufacturing Co.): Multiple switch devices for electric motors. 5572 Stevens: Tubular locks and the manf. of the same. 5642 Moy and Bastie: Form of scene-raising gear. 5686 Burgers: Ring for marking pigeons and the like and process for manufacturing the same. 5761 Cope: Pneumatic hubs for wheels for bicycles and all other kinds of vehicles. 5791 Adler: Means for binding loose sheets of paper in book form. 6068 Rechnitz: Means for affixing plaster work or the like to ceilings, walls, and so forth. 6179 Goldman: Carrier for holding bottles during washing, pasteurising, and like operations. 6206 Birkbeck (American Looking Glass Co.): Apparatus for silvering glass plates. 6239 Bean: Devices for carrying parcels, bags, cases, and other hand baggage. 6378 Blumberg: Golf-ball markers. 6386 Hohnbaum: Securing devices for the cutters in chaff-cutting machines. 6462 Richardson: Tyre protectors. [Date applied for under International Convention, May 28th, 1909.] 6538 Berg and Imhoff: Process of preserving tin-weighted silk. 6596 Schott and Gen: Electrolytic apparatus having a liquid annular anode. [Date applied for under International Convention, March 30th, 1909. Application for Patent of Addition to 14288, 1909.] 6607 Collins: Free-wheel and back-pedalling brake combinations as applied to bicycles and the like. 6930 Harvey, and Mathew Harvey antd. Co.: Hame clips and hames for harness. 6947 Van Ristell: Automatic signal wire compensator. 6988 Electric and Ordnance Accessories Co., Hinton and Lawrence: Roller bearings. 7005 Firm Krawinkel and Schnabel: Polishing and cleaning cloth. [Date applied for under International Convention, April 8th, 1909.] 7094 Ges. fur Chemische Industrie in Basle: Method of producing discharge effects on coloured grounds. [Date applied for under International Convention, February 14th, 1910.] 7641 Bloxam (Firm E. Hoorickx and A. Hindel): Current terminals for use in the manf. of mirrors by electro-deposition. [Application for Patent of Addition to 2490, 1909.]

7732 Heinz: Machines for abrading or disintegrating metallic lead and the like.

In the manufacture of white lead three processes are usually employed—first, the "Old Dutch" process in which the lead is cast in buckles and suspended in jars containing acetic acid, which jars are packed in spent tan bark; second, the "Carter" or quick process, in which the lead is atomised in the presence of air and afterwards reduced to the carbonate by means of acids and carbonic acid gas; and third, the "Mild" process, in which the lead is atomised and acted upon by oxygen and by carbonic acid gas in the presence of water. The machine illustrated in the accompanying drawings is adapted to reduce the size of small particles of matter in the presence or absence of liquids, at the same time facilitating the chemical action of any of the elements of the air or liquid while in the machine. While other machines have been employed for acting upon various materials when dry, this machine is especially adapted to operate upon substances in the presence of liquids, especially such as have a tendency to cake. This present invention as embodied in this application consists in a drum having an interior abrading surface, oppositely revolving discs within the drum, each of the discs provided with vanes or buckets for engaging a stream of liquid, such as water, which carries particles of solid matter, such as lead, with it in such a manner as to throw the liquid and the particles of solid matter against the abrading surface, causing the reduction of the solid matter in the presence of the liquid. When water is used and lead acted upon, the presence of the water prevents the lead, which is being reduced, from turning into desirable high oxides of lead which are difficult to convert into white lead.


7732/10

7860 British Thomson-Houston Co. (General Electric Co.): Electric heating apparatus. 7970. *See* 24852, 1909. 8025 Mackay: Locking devices for railway carriage doors and the like. 8100 Farbenfabriken vorm. F. Bayer and Co.: Process for the production of aliphatic hydrocarbons with more than one double bond. [Date applied for under International Convention, April 8th, 1909.] 8183 Fried. Krupp Akt.-Ges.: Mechanical time fuses for projectiles. [Date applied for under International Convention, July 13th, 1909.] 8241 Bates and Southan: Targets. [Date applied for under Rule 13, November 12th, 1909. Cognate Application. 27510, 1909.]

8413 Fried. Krupp Akt.-Ges.: Fluid-pressure brakes for ordnance. [Date applied for under International Convention, June 5th, 1909.]

The subject matter of this invention is a fluid-pressure brake for barrel recoil ordnance, which is provided with means for regulating the length of the recoil. For the passage of the brake liquid from one side of the piston to the other the brake cylinder has on the one hand grooves, the length of which corresponds to the shortest recoil, and, on the other hand, has perforations, the cross section of which is adjustable from outside, so that when the piston perforations are completely shut off the brake liquid flows through the brake cylinder grooves only, and the shortest possible recoil of the brake is produced, while, when the piston perforations are more or less opened, the brake liquid passes over through these also, and recoils are produced which are longer than the shortest one.

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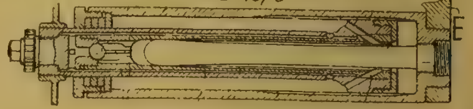
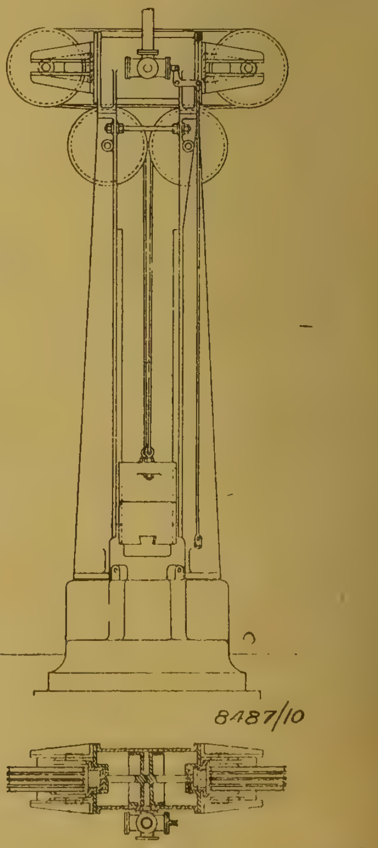


8438 Imray (Soc. of Chemical Industry in Basle): Manf. of concentrated formic acid.

8487 Ross: Drop hammers.

This invention which relates to drop hammers consists in an improved arrangement of devices for controlling the movement of the tup of the hammer. The claims consist of (1) a drop hammer wherein the tup is adapted to be operated through the intermediary of a rope or the like passed around guide pulleys and around pulleys connected to pistons within a cylinder supplied with actuating fluid which enters between the pistons to move them in opposite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directions; (2) a drop hammer, according to Claim 1, provided with means for cushioning the pistons when the tup has descended.

8540 Weber: Means for securing railway rails to sleepers. 8728 Nissen: Collar attachment for harness. 8742 Thomas: Safes. 8944 Marks (Firm Franz Muller): Drum napping mills. 8945 Marks (Firm Franz Muller): Diagonal brushing machines. 9211 Sharp: Means for whitening or colouring the edges of platforms and the like. 10035 Bajley and Valvero: Arm rest and corrector for violin players, especially adapted for students. 10113 Wm. Simons and Co., Brown and Brown: Dredging cutters. [Date applied for under Rule 13, June 4th, 1909.]

10465 Weinland: Tube cleaners.

This invention relates to tube cleaners, and more particularly to the class of cleaners employed in the removal of scale from the interior of the tubes of water-tube boilers. Cleaners of this class must be operated at a high speed, and when driven by a motor that travels through the tube with the cleaner, the power being limited, it is essential that the cleaner be as light as is consistent with strength and durability. The object of this invention is to meet these conditions and provide a cleaner of few parts, light, simple, strong, and efficient, that can be easily assembled and readily taken apart for repairs. The invention consists in the combination of a body having spindles with arms pivoted thereon to swing in planes transverse to the axis of the body, bolts with cutters thereon mounted in the arms, and means adapted to swing on the spindles to secure the bolts in place.

10466 Hauer: Tube cleaners. 10607 Allgemeine Elektricitats Ges.: Control of electric motors. [Date applied for under International Convention, April 30th, 1909.] 10669 Moreaux: Masticating implements. 10815 Collett and Eckardt: Process of converting calcium cyanamide into nitrate of lime. [Date applied for under International Convention, May 3rd, 1909.] 10996 Fairweather (Singer Manufacturing Co.): Presser foot for sewing machines. 11132 Rajala: Cross-cut saw set. 11729 Fabrique de Soie Artificielle de Tubize, Soc. Anon.: Means for collecting the vapours of the volatile solvents used in the manf. of artificial silk. [Date applied for under International Convention, May 12th, 1909.] 11906 Leopold Cassella and Co. Ges.: Manf. of anhydrous sodium hydro-sulphite. [Date applied for under International Convention, May 15th, 1909.] 11943 Firm Robert Erlemann: Apparatus for projecting flying discs and the like. [Date applied for under International Convention, June 12th, 1909.] 12522 Schultz: Electric switches. [Date applied for under Rule 13, July 24th, 1909.] 12604 McKean: Tension device for winding machines for yarns. [Date applied for under Rule 13, December 28th, 1909.] 14760 Societe Antoinette: Control of aeroplanes. [Date applied for under International Convention, July 1st, 1909.].

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1909.

23230 Geb. Heyl and Co.: New disinfectant and the method of producing the same.

1910.

4950 Maschinenfabrik Oerlikon: Arrangement of the governing mechanism of electrically or mechanically-driven machines with variable numbers of revolutions. 6165 Buckminster: Presses. 8019 Egner and Holmstrom: Cooling devices for telephone transmitters. 8069 Mauderer: Steam engine cylinders. 9544 Paul: Rotation flying machine. 11464 French and Frederic: Apparatus for solving spherical triangles. 13087 Kindhauser: Corsets. 13104 Tschorner: Method of and apparatus for telegraphically transmitting and reproducing pictures and the like. 13482 Baroness Brenner: Sanitary petticoat. 13692 Lindsay: Pyroxyline compounds or compositions and the method of manufacturing the same. 13779 Radcliffe: Internal-combustion engines. 14116 Wolfram Lampen Akt.-Ges.: Process of decarbonising filaments for use in metallic filament glow lamps. 14371 Pokorny and Wittekind Maschinenbau Akt.-Ges.: Turbo-compressors. 14378 Elia: Ships or vessels. 14501 Armstrong: Exercising devices. 14585 Chiquet: Jointing ring for the joints of tubes, machine parts, and the like. 14935 Sellier: Combination machine tools. 15063 Aeschlimann: Arc lamps. 15292 Monard: Apparatus for controlling railway points and signals. 15293 Allgemeine Elektricitats Ges.: Construction of a shaft mounted in an axially-divided casing, and the machine parts mounted at the end of the shaft in a casing which is not axially divided for the purpose of removing the shaft without moving the same in an axial direction. 15369 Loughney: Abdominal

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THE
PRACTICAL ENGINEER
AND ENGINEERS' GAZETTE.

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CREATING AN INDUSTRY.

It is unfortunately true that in the United Kingdom, at all events, little if any commercial success has attended the endeavours to utilise the peat deposits of which there are a number situated in various districts. In Great Britain the area of bogland is estimated at 3,500,000 acres, and in Ireland the acreage approximates 3,000,000. These deposits are in thickness from 1 ft. to 20 ft., and the calorific value varies considerably even in different portions of the same beds.

In this country the low price of coal and the relatively low heat value of peat together tend to retard the introduction of the latter, either as fuel for industrial or domestic purposes. In countries like Russia, where coal is dear, the production of peat fuel has become an important industry, but only the older methods are in vogue. As pointed out by Mr. Haanel, the President of the American Peat Society, there are no plants in existence in any country furnishing regularly and at reasonable prices artificially-dried and briquetted peat.

Neither of the two processes for manufacturing peat briquettes that have been experimented with in the British Isles have up to now realised expectations. The Electro-peat Company's system has been tried on a large scale, and although it was anticipated that the prepared peat could be sold commercially at 6s. per ton, we understand that the machinery failed to fulfil its purpose, and the company has ceased to manufacture. The only other system for removing the water from peat, working in this country, viz., the Ekenberg process, is still in the experimental stage, although much capital has been sunk abroad in an endeavour to bring it to perfection.

Canada has vast deposits of peat in districts which are rapidly becoming centres of industry, and where the coal fields are far removed. Many attempts have been made to utilise these deposits, but they, like the British attempts, have all ended in failure. The Canadian Government, having recognised the importance of the subject and investigated the causes of failure in the past, has issued a Departmental report on the manufacture of peat as carried out in Europe. The Government can foresee that to allow or encourage speculators and inventors to experiment in the production of peat would only lead to the ruination of any industries that might be started in the peat districts, and thus create a distrust which it would take the Canadians many years to efface.

The Canadian Government has thus taken a most reasonable step in acquiring a peat bog where only approved European methods will be put into practice, with the sole object of encouraging interested parties to ascertain for themselves the working of a plant on a commercial scale. This is a very sane and straightforward manner in which peat production may become a sound industry without incurring a large national expenditure or requiring a subsidy.

The growth should be a gradual one, built on business lines, after which the development of special machinery could be conducted in such a way that it would only be put into use when it had proved itself advantageous.

The exploitation of undeveloped and improved machinery by the flotation of companies at fancy prices has done so much to retard legitimate progress, and made investors hesitate, that we look forward to the Canadian peat development with more than hopeful anticipations.

THE ELECTRIFICATION OF RAILWAYS.

THE success of electrical methods of propulsion, so far as suburban traffic is concerned, has now been amply demonstrated, and the system is now advocated by the majority of railway engineers. The abundance of coal supply, and the scarcity of water power, are reasons, so far as this country is concerned, for not applying electrical methods generally to other classes of railway traffic; as in countries where the fuel supply is scarce, and the available water power abundant, such, for instance, as in Switzerland, Sweden, and Italy, where the general electrification of railways would probably be a thoroughly sound commercial proposition.

Although it is only about 25 years since the development of apparatus to generate, distribute, and utilise electricity has created a new economic and industrial situation, large sums of money have already been invested in the electrification of portions of the lines of the standard steam railways in England. The London, Brighton and South Coast Railway Company have been enabled, by the electrification of a portion of their suburban line, to recover a considerable amount of the traffic which the tramways had wrested from them, and a further electrification of this line is now proposed. Amongst other new schemes of electrification, we now hear of the possibility of the Manchester, South Junction, and Altrincham Railway being electrified. At the half-yearly meeting of the Great Central Railway Company, held at Manchester on the 5th inst., attention was directed by one of the proprietors to what was designated by him the exceedingly unsatisfactory condition of the trains on the Manchester, South Junction, and Altrincham Railway, which is a joint line belonging in equal proportions to the London and North-Western Company and the Great Central Company. Sir Alexander Henderson, the Chairman of the Company, acknowledged the justice of much of what had been said, and observed that the desirability of electrifying the line had been under consideration for some time, although no definite decision had as yet been arrived at. In view of the possible change in the mode of traction, however, it would not, he thought, be advisable to spend money upon new carriages.

A correspondent in our contemporary, *The Electrical Review*, writing regarding a scheme for the electrification of the Manchester suburban railways, says that the London and North-Western has already decided to give a trial to motor trains on the line between Manchester and Wilmslow. A great deal will probably depend on the success of this venture. The necessity of a much more frequent and effective train service is acknowledged to be necessary if the suburban traffic is to be retained and not to be monopolised by the tramways. The areas of Heaton Park, Prestwich, Whitefield and Bury, the extensive district between Stockport and Wilmslow, and the whole of the southern side of Manchester, is said to be included in the scheme, and if it goes through there will probably be a 10-minutes' service of electric trains in the mornings and evenings between the city and Manchester suburbs, which should do much to attract back to the railways at least some of the traffic which has lately gone to the tramways.

AN International Hygienic Exhibition is to be held in Dresden in May-October, 1911, under the patronage of the King of Saxony. The office of the British Executive Committee, which is a particularly strong one, under the patronage of H.R.H. Princess Christian, is at 47, Victoria Street, Westminster, where all information can be obtained by those interested. The Exhibition will be of an essentially scientific nature, and the number of congresses which are to be held should ensure a large attendance of hygienists from every country. The industrial exhibits are divided into 15 classes, viz., chemical industry; scientific instruments and apparatus; settlements, dwellings, housing, etc.; foodstuffs and food accessories, beverages; clothing and the care and protection of the body; profession and labour; provision and care for infants and the young; traffic conditions on land and sea; technics and machinery; watering places, health resorts, mineral waters; cosmetics and other toilet preparations and requisites; hygiene in connection with the army, navy, colonists, etc.; care of the sick, ambulance work, hospitals, life-saving service; physical exercise, games and sports; hygiene in literature and arts.

NEW DOCK AT METHIL.—During the past four months uninterrupted progress has been made by Messrs. M'Alpine and Sons with the construction of a new dock at Methil. An outstanding feature of the undertaking is the running of a sea wall beyond low-water mark from Methil Pier to the mouth of the river Leven, a distance of a mile. In this great stretch of ground the dock proper is to be constructed and railway siding accommodation provided. At the Methil end the wall has a base of 50 ft., tapering to 25 ft. at the quay level, which is 3 ft. above high-water mark. The wall was surmounted by a parapet of 10 ft. in height, the base being 7 ft., tapering to 4 ft. at the top. In a storm in January 450 ft. of the parapet was thrown down or damaged. Some of the blocks torn out of the solid concrete parapet weighed from 100 tons to 200 tons, the pressure from the waves being as much as 1,000 tons. The wall up to quay line stood the storm without the slightest damage. The Leven end of the wall does not suffer from easterly storms to the same extent as the more exposed Methil division, and it was therefore originally proposed that the wall and parapet at the east end should be considerably lighter than that at the west end. After the storm, however, it was agreed to strengthen the parapet at the Methil end and to thicken both wall and parapet at the east section. Work has proceeded since the beginning of April at the three points—at the Methil end, at the site of the dock gates, 2,000 ft. from Methil Pier; and at the Leven end. The work has proceeded so satisfactorily that the wall between Methil and the dock gates has been founded, and within a few days the whole of the stretch of 2,000 ft. will be at quay level. In the stretch between the gates and the river Leven there is only a gap of 350 ft. It is fully anticipated that this gap will be filled up by the end of September. The contractors are handling from 3,000 to 3,500 yards of concrete a week, a result which means a weight of about 3,000 tons.

Scottish Aeroplane.—A new Blériot type of aeroplane which is claimed to be the largest of this type yet built has been constructed by Messrs. W. and S. Pollock, engineers, of Glasgow. The wings measure from tip to tip 40 ft., and the breadth is 7 ft. 6 in. The chassis is 24 ft. long and the rudder 4 ft. 6 in. by 4 ft. 6 in., the elevator which is situated in front of this consisting of three small planes, having an overall length of 9 ft. 6 in., and a width of 4 ft. 6 in. The framework is made of long grain ash, and is covered with fabric weighing $4\frac{3}{4}$ oz. to the square yard, and having a strength 2,880 lbs. warp and 2,340 weft. The power will be obtained from a Pollock aeroplane petrol motor of the diagonal type, having four single air-cooled cylinders and a single crank, developing 60 H.P. Magneto ignition and coil accumulator are fitted. A special feature of the machine is the propeller, which is a new design by Messrs. Pollock, and is 6 ft. 9 in. in diameter. Trials are to take place shortly.

PRACTICAL METALLURGY.

By Horace Allen.

(Continued from page 101.)

Malleable Iron Castings.

In constructional iron and steel work there are innumerable instances where much cost in smith work could be avoided by the employment of cast shapes. In shipbuilding and other similar work, steel or iron angle sections require to be *joggled* where they join, or pass over other angles, or to fit over joists, etc., while the variety of forms are such that the provision of shaping tools would run to a very considerable expense, which might be avoided if the desired shape could be obtained by moulding in sand with liquid metal which would not be brittle and liable to fracture by bending within small limits, or in *setting*, riveting, etc. In a great number of cases, such as for certain parts of agricultural machines, fittings for electric tram standards for carrying trolley wires, the employment of iron castings is not practicable on account of their brittleness.

In this direction it is probable that in the near future the electric furnace may be adapted to produce castings in mild steel and wrought iron which will take the place of much smith work, and compete with *drop forgings* and malleable iron castings, the high temperature available being sufficient to render the mildest steel or purest iron sufficiently fluid for pouring into moulds.

However, there is at present a very large field where castings made in cast iron, and subsequently rendered higher in tensile strength and ductile enough to stand considerable mechanical treatment without fracture, by heat application and the employment of certain agents, oxidising or otherwise, can be economically employed. The United States produce and consume very large quantities of malleable iron castings, and are far ahead of any other country in this product. In Great Britain the use of malleable castings is on the increase, and a more general knowledge of the properties of this metal will no doubt cause its application to extend to many other objects not yet attempted in this very useful metal. Cast iron is characterised by its having from 2·3 to 4·3 per cent of carbon, and a melting temperature ranging from 2,400 deg. Fah. to 2,080 deg. Fah.; while steel or wrought iron require a temperature about 2,700 deg. and upwards, so that the first stage of producing malleable castings can be carried out at ordinary foundry cost. The physical properties of cast iron are not only controlled by the content of carbon, but by the condition in which this carbon exists in the cooled product. The form of combination of the carbon and iron depends upon the proportions of other ingredients, along with the rate of cooling and the thermal conditions which have been applied. For the manufacture of malleable castings the contents of silicon must be kept low, as otherwie the carbon would separate as flake graphite on solidification. For this reason the range of pig iron suitable for conversion into malleable is confined to those in which the carbon exists chiefly in the combined form, commonly called white iron, or mottled iron, when the carbon is not to be removed in the course of annealing, as for *black heart* castings, while greyer qualities can be employed for casting to be annealed by the Réamur system. Not only must the content of silicon be low in pig iron intended to be employed in the production of malleable castings—Mr. A. Caddick gives the limits as 1·3 per cent for castings under $\frac{1}{2}$ in. in thickness, and 0·5 per cent for thickness above $\frac{1}{2}$ in.—but the contents of manganese and sulphur have considerable effect in regard to satisfactory results; for black heart castings the sulphur limit being 0·06 per cent, and for Réamur castings as high as 0·40 per cent is permissible, while in either system the manganese should not exceed 0·40 per cent, or the phosphorus 0·2 per cent.*

Suitable iron having been selected, it may be melted either in a crucible or an air furnace, precautions being necessary to avoid absorption of sulphur from fuel or gases during melting, and the castings may be made in dry or green sand moulds.

The design of malleable castings to give the best results should avoid as far as possible changes of section and variations in the thickness and bulk; light, thin, uniform sections being superior to heavy, rectangular, or bulky forms.

When the castings are removed from the moulds, they consist of brittle white iron, in whch nearly the whole of the carbon is in the combined form. After undergoing a thorough cleaning by sand blast or rumbling, they are packed in cast-iron boxes. It will be obvious that the heat treatment to be subsequently applied must be limited in temperature to something under the softening of the containing boxes.

According to the quality of the iron used, the material in which the castings are bedded in the boxes must either be of an oxidising character, as in the Réamur process, or neutral when black heart castings are required, and in either case the temperature to cause a re-arrangement or oxidisation of the carbon ranges from 1,650 deg. to 1,750 deg. Fah. The effect of heating white cast iron in different ingredients is well shown by the following results, given by

---

* "Engineering Castings," by Arthur Caddick, *Practical Engineer*, October, 1908.

Mr. G. P. Royston,* obtained from bars of the same composition:—

	Graphitic carbon.	Combined carbon.	Total carbon.
	Per cent.	Per cent.	Per cent.
16. White iron	0·19	3·69	3·88
17. White iron bedded in raw hematite	0·36	0·73	1·09
18. White iron bedded in limestone	0·49	0·58	1·07
19. White iron packed in lime, lids of pots not luted	1·79	0·64	2·43
20. White iron packed in sand, lids of pots not luted	1·75	0·63	2·38
21. White iron packed in bone ash, lids of pots not luted	1·60	0·68	2·28
22. White iron packed in wrought-iron drillings, luted	2·30	0·81	3·11
23. White iron packed in grey cast-iron drillings, lids luted	2·73	0·99	3·72
24. White iron packed in charcoal, lids luted	2·80	0·94	3·74
25. White iron annealed thrice over in a mixture of 3 of spent ore and 1 of raw ore	Nil	Trace	Trace

In the castings annealed in an oxidising mixture there will be observed a more or less complete removal of the carbon, while when the bedding mixture is neutral the results show combined carbon changed to graphitic carbon or black heart castings.

TENSILE TESTS.

No.	Tons per square inch.	Elongation on 6 in.	Reduction of area.
		Per cent.	Per cent.
16	7·80	Nil	Nil
17	16·30	4·60	2·10
18	15·40	5·60	3·10
19	19·30	1·90	3·15
20	18·40	2·10	2·10
21	20·10	2·20	3·05
22	22·20	Nil	Nil
23	14·10	Nil	Nil
24	13·95	Nil	Nil
25	16·60	10·80	7·96

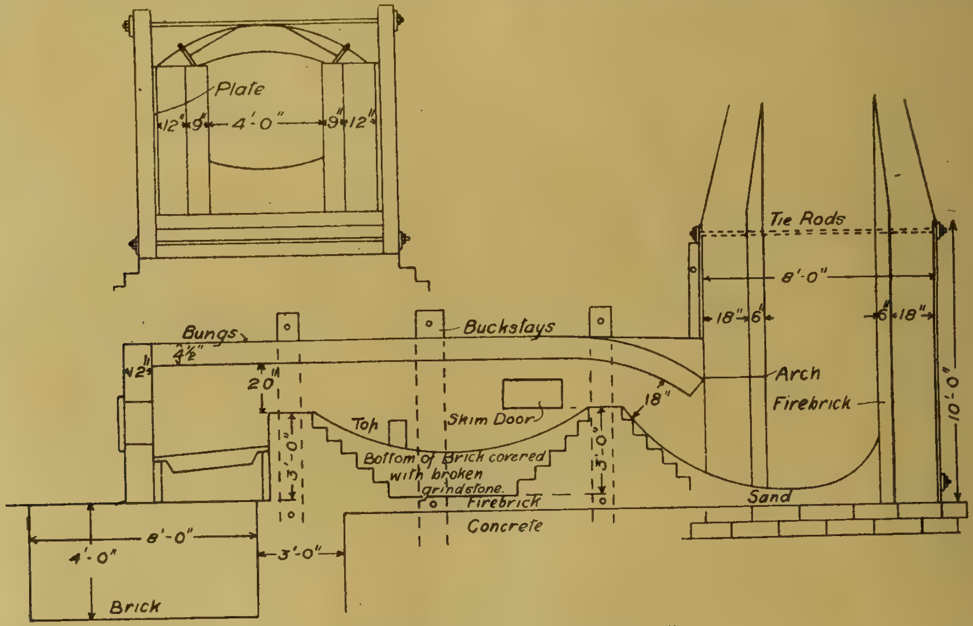


FIG. 69.—10-TON MALLEABLE FURNACE.

Mr. Royston gives a description of the work's procedure as carried out at the works of Messrs. T. Francis and Co., Birmingham, from which the following particulars are extracted:—

White refined hematite iron was melted in a crucible, which was closed to prevent the metal from absorbing sulphur from the gases, and castings were made in green sand. Though the white-iron castings contract about ¼ in. per foot, the process of annealing causes an expansion of about ⅛ in., so that it is only necessary to allow ⅛ in. for contraction in making patterns. After adhering sand has been removed by shaking in a revolving barrel, they are ready for annealing. Suitable sized cast iron annealing pots are filled with castings bedded in a mixture of spent and raw hematite ore, the former being ore which has been previously used, the proportions being about three or four parts of spent ore to one part of raw ore, all being about the size of a pea, packing being done carefully to bring all surfaces in contact with the bedding mixture, but not allowing the castings to touch one another.

When filled the pots are placed in the annealing oven and heated up gradually, so as not to cause the fracture of any of the castings or to soften the pots, the proportion of the weight of the pots, bedding mixture, and castings being about: pots and ore 2¼ cwt., and castings ¾ cwt. On the third day the temperature reached about 1,580 deg., and was maintained for the next three days between that and 1,650 deg., the consumption of coal by the oven amounting to about 36 cwt. per ton of castings treated.

The temperature was then allowed to fall; on the seventh day it was about 1,250 deg., when the pots were withdrawn, and when cool the castings were again rumbled in a barrel to remove the adhering grains of ore. The simple heating of white iron to 1,830 deg. does not cause decomposition of the combined carbon into the graphitic state, though if the temperature is raised to about 1,885 deg. and cooled, there is a very considerable change, 3·85 per cent. of combined carbon becoming 1·5 per cent, with 2·3 per cent of graphitic carbon. However, annealing white iron bedded in sand or lime to 1,530 deg. and slowly cooling below 1,230 deg. brings about the change of combined carbon to graphitic and producing black heart castings.

These castings, being about twice the strength of ordinary castings, may be made of half the weight. Malleable castings can be made up to considerable weights, half a ton and upwards, and as small as nails; although if white iron is subjected to the action of nitrogen, hydrogen, carbon monoxide, carbon dioxide, coal gas, or ammonia vapour, at a temperature of 1,650 deg. for 12 hours, without any change taking place in the carbon, if the heating is prolonged the iron will be softened. An atmosphere of carbon dioxide causes scaling of the surface of the castings, so that it is better to mix raw ore with some that has already been used in annealing boxes, when the carbon combines with oxygen to form carbonic oxide.

---

* Iron and Steel Institute Meeting, 1897.

The successful production of malleable castings depends greatly upon the working of the annealing oven, as the temperature to which it is essential that the castings must attain is not far removed from that at which the cast-iron pots and the oxide of iron soften, and any great increase in temperature would mean that the product would be waste, while to prevent the delicate castings from being fractured by being too rapidly heated, the oven must be brought up gradually to its annealing point.

The capital expenditure upon a malleable casting foundry need not be very considerable, for the apparatus required only consists of a crucible furnace, an air furnace, or a cupola for melting, and an annealing oven with the ordinary accessories.

The castings on removal from the pots are often somewhat twisted, but this can usually be corrected by hammering on a levelling plate in a cold state, unless the dimensions are such as to make it necessary to heat up to dull red.

Malleable castings can be welded when necessary, and can be case-hardened for wearing surfaces. They can be machined where required, but it is not advisable or advantageous to remove more of the surface than can be helped, for the skin is the most malleable and the interior of the metal is not of quite the same quality.

Though under tensile test malleable castings give little extension, they can usually be bent to a considerable angle; they are capable of very rough usage without damage, for the writer has seen malleable fittings for binding tubes together applied by means of a sledge hammer and a podger as the only tools.

Certain classes of small malleable castings can be produced at a cost of under 3d. per lb., and when the order assumes favourable working conditions as low as 2½d. per pound. In the United States black heart castings can be sold at about 1½d. per pound.

Fig. 69 gives a diagrammatic sketch of a furnace of suitable proportions to melt charges up to 10 tons for malleable castings.

(*To be continued.*)

THE EXPLOITATION OF THE PEAT BOGS OF CANADA.*

In a country, such as ours, where independently of the continually increasing amount of fuel required for industrial purposes, we are during the long winters dependent upon artificial heat in our homes, the item of cheap fuel becomes one of the most important factors in the prosperity of the nation. Our coal deposits are situated in the far east and west, and the long hauls to bring this fuel to the central provinces render the price of our own coal prohibitive, and leave us dependent on outside sources for the necessary supply of fuel in these provinces.

The rapid industrial development of Canada and increase of our population render therefore the intelligent exploitation of our abundant and excellent peat deposits for fuel purposes of supreme importance.

We can at present form no estimate of the enormous extent of our peat bogs. The 37,000 square miles already known form probably but a small fraction of the amount of this valuable fuel asset in existence in Canada.

The necessity of utilising the peat deposits scattered throughout the provinces in the more settled portions of them has within recent times been appreciated, and efforts have been made by some of our enterprising citizens to establish a peat industry. Much money, thought, and energy have been spent on this problem. Many plants have been erected, but unfortunately so far without reaching commercial results.

Only in rare instances is progress made in improvement of processes of manufacture by those who are unfamiliar with what has already been achieved, and the causes which have led to failure. This may have been one of the reasons why the efforts so far made in utilising our peat deposits have not been attended with success.

To prevent further failure from this cause in the manufacture of peat fuel, an investigation was made by our department three years ago, and a report issued on the manufacture of peat for fuel and other purposes in the peat-using countries of Europe.

This investigation has demonstrated that:—

1st. For the economic production of fuel from peat, machinery driven by power must be substituted as far as possible for manual labour.

2nd. That processes so far invented for removing the water content of the peat by pressure and artificial heat have not led to commercial results, and after trial have been abandoned.

At any rate the existence of plants in any country furnishing regularly and at reasonable prices artificially dried and briquetted peat are not known at our office. The recent reports received by us regarding two very promising processes employing artificial heat in the production of peat fuel are very disappointing—namely, the process ot the Electropeat Syndicate, with the head office at Newcastle-on-Tyne, England, and the somewhat famous Ekenberg process.

The Electropeat Syndicate erected an extensive plant at Kilberg in the county of Kildare, Ireland, for the production of a substitute for coal from peat, which they expected to sell at six shillings per ton. No money was spared in trying to make the experiments a success, and most expensive machinery was put down. Experts were brought from Germany to look after the work under the superintendence of Captain Verey, R.E. Large shipping companies on the strength of samples submitted, and representations made to them, promised some very large contracts for fuel, but the company, at the end of over one year's experimentation, found that their process was a failure. The peat made by them looked like coal and burned well, but was hygroscopic, and after a short time crumbled to powder. All efforts to overcome this defect failed, and the project was permanently abandoned in June last.

The Ekenberg process of the wet carbonisation of peat is exceedingly ingenious, and has aroused great expectations, but is still in the experimental stage after the expenditure of 20,000 kronor in Sweden to place it upon a commercial basis.

The endeavour to accomplish economically by artificial means in a short time what has been accomplished by nature in exceedingly long periods of time, namely, the changing of peat into a substance similar to coal, has so far apparently not been attended with success. I would not like to say that it cannot be done, since it is unsafe to make any statements regarding the possibilities of future achievement, but at present the outlook in this direction is certainly not encouraging.

In view of these facts, the only proper course for us in Canada to follow, if we desire to establish a peat industry and render ourselves at least to some extend independent of outside sources for our fuel, is to introduce such processes and such machinery as have proven successful and are now in actual commercial operation in Europe.

---

*An address delivered by Eugene Haanel, Ph.D., President of the American Peat Society, at Ottawa, July 25th, 1910.

We may safely leave experimentation and the development of new ideas to the future, when our peat industry is on a secure basis, and peat fuel in abundance on the market. We will then have gained in the manufacture of peat fuel along lines which are at present commerical the necessary experience to warrant the hope that proposals for modifications and improvements of present processes will be based upon a thorough and practical understanding of the nature of peat and the principles upon which future economy may reasonably be expected. This is a safe proceeding for our country, and above criticism. It will give us the required fuel and prevent waste of capital in experimentation. Departure from this principle has led to failure and the creation of a profound distrust in everything connected with peat and the utilisation of our peat bogs.

To re-establish the confidence of the people of Canada in the value of peat as a domestic and industrial fuel, and to stimulate renewed activity in the development of our peat resources, the Government has acquired 300 acres of peat bog, with an average depth of 9 ft., for the purpose of manufacturing peat fuel on a commercial scale, and by a method which has proven successful in European practice. At this plant interested parties will have an opportunity of ascertaining for themselves the working of the bog as well as the suitability of the peat fuel produced. The capacity of our plant is a production of 30 tons per day. For a large commercial plant, mechanical excavators should replace the manual labour employed at our plant, if the bog to be exploited is suitable for this class of labour-saving machinery.

The plant at Alfred is to serve as a model of a successful process, and not for the production of peat fuel on an extensive scale. We expect, however, to manufacture during this season, about 2,000 tons of peat fuel, part of which is to be used in our peat gas producer at Ottawa.

Allowing 140 days for a season's operation, the cost per ton of air-dried machine peat, including interest on capital invested, amortisation, oil and repairs, is as follows:—

Cost of fuel on the field	\$1·40
Cost of fuel stored in shed	1·65
Cost of fuel loaded on car	1·65
Cost of fuel in stack	1·70

By the employment of mechanical excavators and the manufacture of peat on a large scale, the cost of production per ton should be considerably less than the figures here given.

The objection to the air-drying process, practised at our plant, is that it is not a continuous process, that it can be worked only during the summer months, and that the amount of fuel which can be produced during one season is dependent upon weather conditions.

These statements are quite true, and yet Sweden, Finland, Denmark, Germany, Holland, Austria, and Russia depend for a large part of their fuel supply on the simple process of pulping the peat, forming it into bricks upon the field and harvesting it as air-dried fuel. The weather conditions in Canada are as favourable, if not more so, for the production of air-dried machine peat as in the countries mentioned. To prevent shortage of peat fuel on account of unfavourable weather conditions during a season's work, a year's supply of peat fuel should always be kept in storage.

Russia is the largest producer of peat fuel in the world. In 1902 the production was 4,000,000 tons of peat fuel, and the annual increase of production has since then amounted to nearly 200,000 tons. Many private plants exist in Russia in connection with cotton mills for the production for their own use of 200,000 tons of peat fuel annually; 1,300 plants making machine peat are now in operation in Russia.

I admit that the hardness of anthracite permitting long hauls without much waste—the small volume it occupies requiring a minimum of space for storage—and the small amount of volatile matter it contains insuring a nearly smokeless flame, are such valuable properties of this fuel that so long as it can be obtained it will be used by those who can afford to pay for it. Peat fuel is, however, admirably adapted for use in grates during the late fall and early spring, when our heating furnaces are not in operation. This fuel will compete in price and cleanliness with soft coal for the purpose stated in our most luxurious homes. For the inhabitants of our rural districts, villages, and certain parts of our cities, whose homes are not supplied with hot air, hot water, and steam systems of heating, but require the use of stoves, peat fuel will prove a cheap and excellent fuel, far superior to wood, and far more convenient to handle.

The economy which may be effected by the use of peat is readily understood when it is stated that in Ontario and Quebec the average price of anthracite with a high percentage of ash, is \$7·50, and in Manitoba \$10·00 per ton, whereas air-dried machine peat, containing only about 5 per cent of ash can be manufactured at a cost of considerably under \$3·00 for an amount having the same calorific value as a ton of the anthracite we import. This could be sold at places conveniently situated as regards transportation facilities and not too far from the place of manufacture for a little more than one-half the price paid for anthracite in Ontario and Quebec, and for a little more than one-third of the price paid for anthracite in Winnipeg.

Some few years back the labour troubles in the United States taught us a lesson which should be heeded, and which should enable us to conceive what a real fuel famine would mean for Canada. Anthracite coal in Ottawa at that time was sold at \$12·00 per ton. What if it could not be got at any price, and if we had to pay the transportation costs of fuel from either Nova Scotia or the far west? Who can even imagine the suffering it would entail upon our population? It is very easy to say that such a state of affairs is not likely to occur, but who will guarantee that it might not?

The central provinces of Canada have accumulated no stores of fuel ready to be drawn upon in cases of emergency. We import what we need from year to year, and any shortage of supply from whatever cause affects seriously our industries and the comfort of our people.

We cannot afford, in the light of past experience, to waste capital on the experimentation for the discovery of processes which shall be continuous in operation and furnish a fuel from peat similar to coal, nor can we wait until someone at some time in the future will invent such process and demonstrate its commercial possibilities.

Neither should prospective manufacturers listen to the marvellous representations made by promoters of schemes and processes, which promise great profit for production at excessively low costs of a peat fuel superior to anything yet put upon the market, but wisely adopt processes which are already an assured commercial success in the peat-using countries of Europe.

The peat bog at Alfred was acquired by the Government for the purpose of demonstrating to prospective manufacturers of peat fuel one of these processes, and to prevent failure from choosing bogs unsuitable for their purpose the Mines Branch has recently undertaken a systematic investigation of the more easily accessible peat bogs. In carrying out this investigation, our peat expert has been instructed to determine and map their extent, ascertain their depth, and also the quantity, character, and calorific value of the peat contained in them. So far, twelve bogs have been investigated, mapped, and reported upon. In case of need, the staff performing this work can be increased to meet the requisitions made upon the department.

The successful inauguration of a peat fuel industry in Canada may be looked forward to with confidence if, content to accept European practice, we establish peat plants at strategic points on the workable bogs scattered throughout the farming regions of those provinces which require to import coal, and operate them in the interests of the neighbouring communities. This will avoid long hauls, for which air-dried machine peat is not fitted.

Air-dried peat is not alone an excellent fuel for domestic use, but for the production of power it proves an ideal fuel in the peat gas producer, which is to-day as reliable and efficient in its operation as the coal gas producer. I do not hesitate to say that it is an ideal fuel, because the peat from most bogs is free from a clinkering ash, and yields on combustion a fine white residue, which readily allows of the thorough cleaning of the fire, and the property of not fusing or caking in the producer assures regular operation. Moreover, since gas leaves the producer with a high degree of sensible heat, which must be cooled to the temperature of the atmosphere before being used in the gas engine, it is exceedingly important that as much of this sensible heat as is possible be utilised in the producer itself in order to increase its thermal efficiency. This is accomplished in coal-gas producers by the introduction of water vapour, which passes through the incandescent fuel with the air supplied for combustion. This water vapour is decomposed, yielding hydrogen and oxygen. The latter combines with the carbon of the fuel, forming carbon monoxide. This chemical reaction absorbs a large amount of heat and lowers the sensible heat of the gas, but the heat absorbed in liberating the hydrogen is to a large extent restored and utilised when the gas enriched by hydrogen is burned in the gas engine or other apparatus. With peat containing from 25 to 30 and more per cent of moisture, the moisture content is sufficient to accomplish all that is required without the introduction of water in the producer from an outside source.

To demonstrate the value of peat for the production of power for industrial purposes, a modern German peat-gas power plant has been erected by the department in Ottawa. Its capacity is 60 H.P., and consists of a double fire zone Körting peat-gas producer, with the necessary gas cleaning apparatus, and a Körting four-cycle single-acting gas engine direct connected to a Westinghouse 50 k.w. direct-current generator.

While no definite figure can at present be given of the consumption of peat per brake-horse-power hour, since the investigation begun some time ago is not yet completed, our preliminary trials, however, bear out the results obtained in Swedish and German plants, where the amount of peat consumed per brake-horse-power hour ranges from a little over 2 lbs. to about 3 lbs., depending on the calorific value of the peat employed. Since the peat of the different bogs so far examined has a high calorific value, we expect that our figure for the consumption of peat per brake-horse-power hour will be in the neighbourhood of 2 lbs.

The erection of gas producers designed for the recovery of by-products is not recommended except in localities where such by-products would command a ready and profitable market. In Canada it is far more economical to aim at the complete gasification of all the heat elements in the fuel.

Peat-gas producers for power purposes should, whenever possible, be erected on the bog, and the energy generated in the form of electricity transmitted to neighbouring towns and villages for power and lighting purposes as in the case of water power. This is the policy adopted in European countries.

Whatever other valuable products may be obtained, such as moss litter, peat mull, alcohol, packing paper, millboards, ammonia and nitrates, the great and important need for us in Canada is the production from the peat deposits of a constant reliable supply of fuel for domestic and industrial purposes.

When this has been attained and peat fuel is put on the market in abundance and sold at a reasonable price, we shall not alone have rendered ourselves to a great extent independent of outside sources for this necessity, thus enabling us to retain in our own country a large part of the capital now spent annually for the purchase of fuel from abroad, but a new era of industrial development will dawn upon our nation, and we shall here see repeated what has been accomplished in Europe—the establishment of large industrial concerns on the waste areas of our country underlaid by peat, and the wide stretches of these solitudes will become resonant with the welcome sounds of industrial activity.

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"Experimental Applied Mechanics for Technical Students." By James E. Maxim, B.Sc. (Vict.). London: Longmans, Green and Co. Price 2s.

The changes brought about in educational methods by the revisions made by the Board of Education create demands for new works adapted to the new requirements. This is the case with the subject of "Applied Mechanics," and Mr. Maxim has taken the opportunity of bringing out a small laboratory book to meet the needs of elementary students.

An essential feature in learning a subject is to have a general knowledge of allied matters in order to facilitate calculations and bring out the reasoning powers. Observation is the basis of modern tuition, and students are expected to verify theories and laws by experiment. This book treats in an elementary way how to carry out these experiments, and includes many of the mechanical movements and operations met with in practice, as will be seen by the following sectional headings:—States, friction; simple machines; transmission and conversion of motion; properties of materials; dynamics, work, energy and power; hydraulics; roof, trusses, bridges, etc.

The usefulness of this excellent help is increased by an appendix containing table of logarithms, sines, cosines, etc., useful numbers, and sets of examination questions.

Books Received.

"Applied Mechanics and Mechanical Engineering." Vol. V. Theory of Machines. By Prof. A. Jamieson. London: Charles Griffin and Co. Ltd. Price 7s. 6d.

"Official Gazette of the United States Patent Office." Vol. CLVI., Nos. 2, 3, and 4. Published by Authority of Congress, Washington.

"The University of Leeds." Sixth Report, 1908-9. From the Registrar.

"Iron Ore Deposits of the Bristol Mine, Pontiac County, Quebec." By E. Lindeman. "Magnetic Concentration of Ores." By E. C. Mackenzie, B.Sc. Canada Department of Mines, Ottawa.

"Tables for Transition Curves." By E. H. Rigby, B.Sc., and W. M. Bergin, B.A. London; W. Dawson and Sons Ltd. Price 2s.

VENTILATION AND DUST REMOVAL IN COTTON MILLS.—V.

[CONTRIBUTED.]

(*Continued from page 140.*)

Arrangements Relating to Card Rooms.

The nature of the material detached from the cylinder and doffer of a carding engine by the stripping brush is shown at fig. 30, which is taken from a photograph of the contents of a filter bag attached to a dust-collecting hood placed around the stripping brush during the stripping process. This material, in the absence of special dust and fluff collecting means, is dispersed into the atmosphere of the card room, and is inhaled by the operatives. The carding machine from which the above-mentioned strips were obtained was working on low-grade Egyptian cotton.

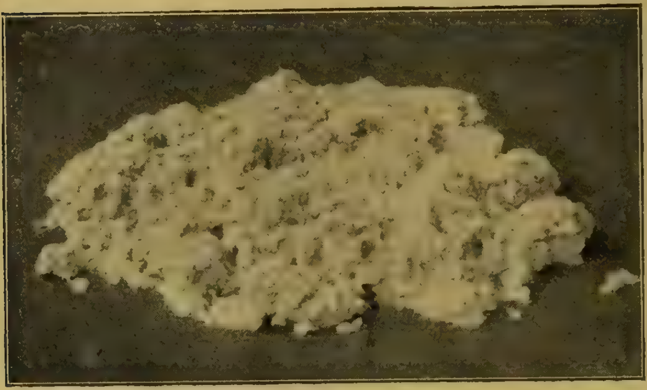


Fig. 30.

A method generally adopted for removing the dust and fluff from carding engines during stripping consists in providing a hood, which is placed around or above the stripping brush. The hood is connected to a system of pipes which are exhausted by a fan, pump, or ejector, and through these pipes the dust is drawn and discharged outside the cotton mill.

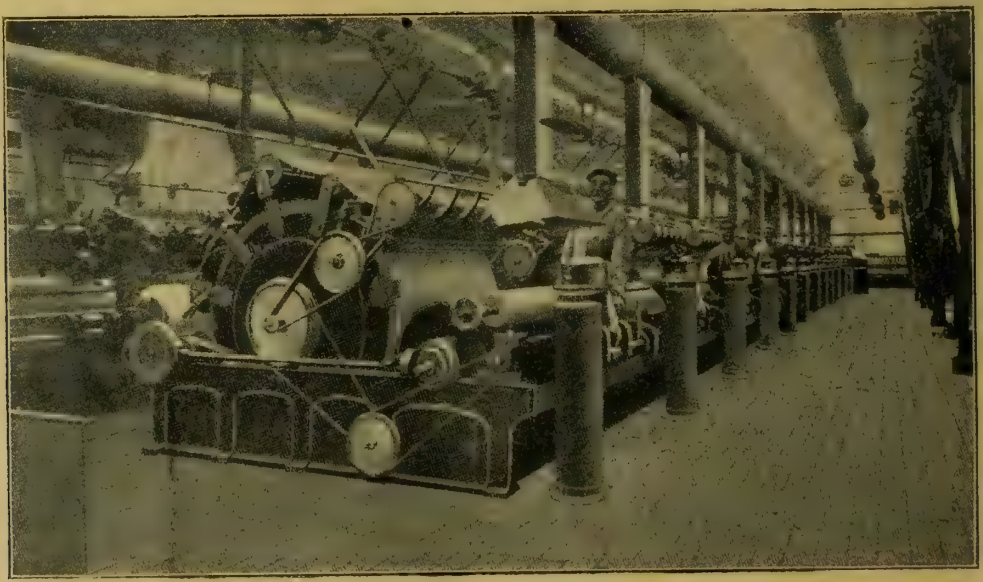


Fig. 31.

An example of such a method is given at fig. 31, which illustrates one of the installations fitted by Messrs. James Stott and Company, of Vernon Works, Oldham. A branch exhaustion connection with a fixed hood at its lower end is arranged over each carding engine.

In the patent specification No. 17,268, of 1897, of Bridge, the branch exhaust pipes to each carding engine are swivelled about the main exhaust pipe, and the lower end of each branch terminates in a hood which surrounds the stripping brush. The arrangement is illustrated at fig. 32, where *a* indicates the main exhaust pipe, *b* the branch pipe, *c* a valve on the latter, *d* the stripping brush, and *e* the hood which surrounds the brush. The parts of the hood are hinged together to facilitate the removal of the stripping brush.

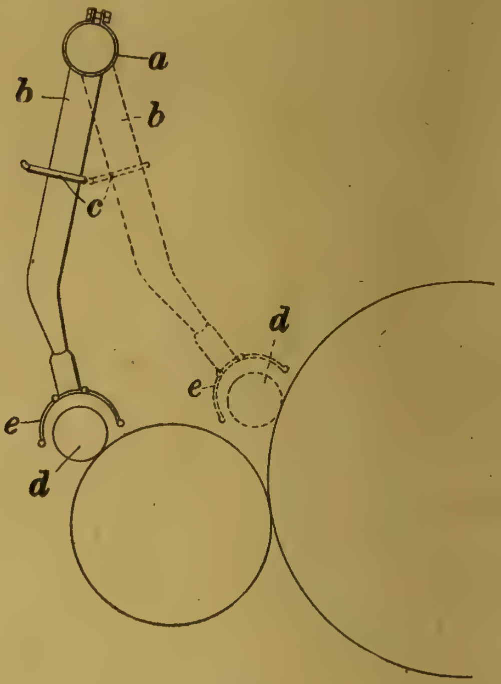


Fig. 32.

In Booth's patent No. 17,433, of 1901, owned by The British Vacuum Cleaner Company Limited, of London, S.W., a claim is made to "The combination of an extracting implement connected with a power-driven suction pump, and dust-collecting means interposed between the said implement and pump, substantially as and for the purpose specified." Booth states: "I find that it is essential to practical success to drive the pump by power, and to maintain a vacuum of at least 5 lbs. per square inch in the filter at the side of the filtering medium where the air and dust enter when the apparatus is at work."

The Booth apparatus has, we are informed, been adapted to the process of dust removal from carding engines. The makers state that the pump employed is of a capacity not less than 10,000 cubic feet of air per hour, when running at 180 to 200 revolutions per minute, so as to maintain a filter vacuum with a continuous flow of air of 12 in. to 15 in. of mercury. With this size of pump it is possible to have six dust-removing hoods in action simultaneously.

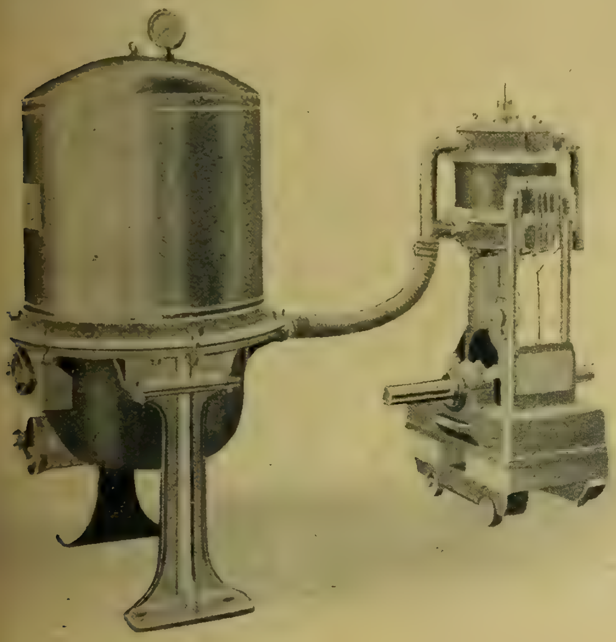


Fig. 33.

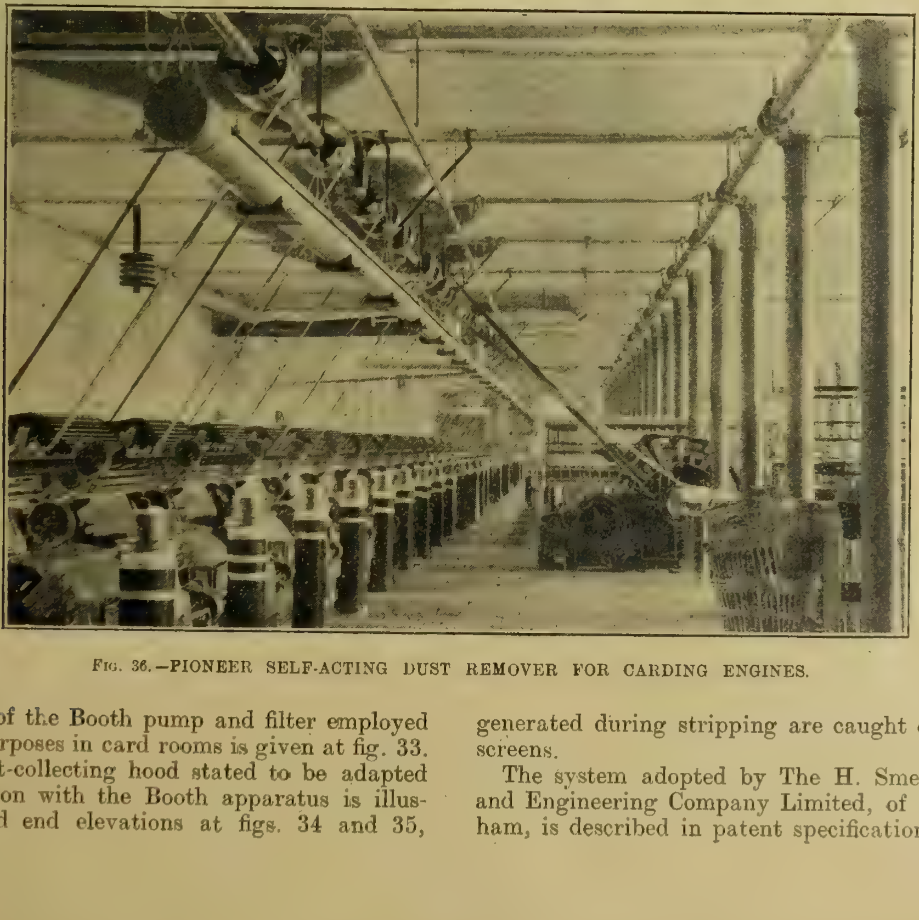
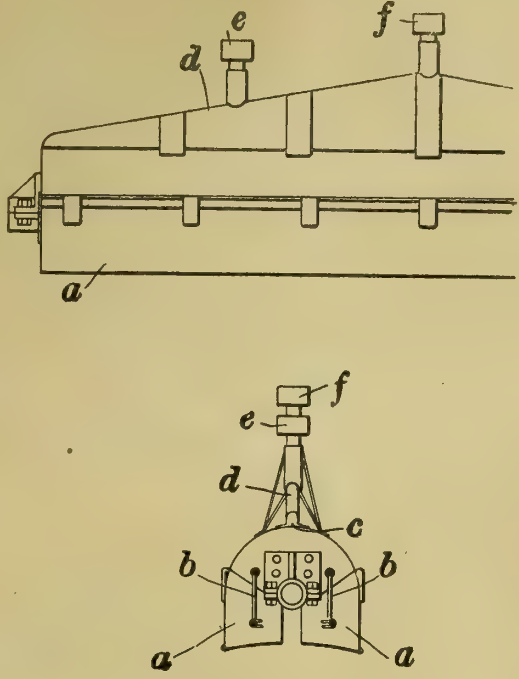


Fig. 36.—PIONEER SELF-ACTING DUST REMOVER FOR CARDING ENGINES.

A general view of the Booth pump and filter employed for dust-removal purposes in card rooms is given at fig. 33.

One form of dust-collecting hood stated to be adapted for use in connection with the Booth apparatus is illustrated in front and end elevations at figs. 34 and 35, taken from Clench's patent specification No. 10,919, of 1905. The hood is made from sheet metal, and is rounded at its upper end to fit over the stripping brush. The lower parts *a* of the hood are hinged and kept in position by hooks *b*. The dust-laden air from the brush is carried away through the long slit at *c*, the space *d*, and the pipes *e*, *f*.



Figs. 34 and 35.

In the patent specification No. 16,250, of 1907, of Lelarge, a system is described in which the dust and waste generated during stripping are caught on travelling filter screens.

The system adopted by The H. Smethurst Ventilating and Engineering Company Limited, of Hollinwood, Oldham, is described in patent specifications Nos. 26,403, of

1907, and 25,049, of 1909. The makers term it the "Pioneer" system. Fig. 36 shows a portion of a card room in which it is installed. Fig. 37 represents the dust-collecting hood in position over the stripping brush, which is working on the doffer of one of the carding engines. Figs. 38 and 39 are views at right angles to one another, taken from specification No. 25,049, of 1909, showing the apparatus employed.

There is arranged along the card room an exhaustion conduit *a* (figs. 38 and 39), having a series of inlets *b*, one over each carding machine. Each inlet is controlled by a valve *c*, which is normally held in its closed position by springs *d*. At the sides of the conduit *a* are rails *e*, upon which runs a trolley or carriage *f*, carrying the hood *g* so supported as to be capable of being over the stripping brush whilst it is working both on the cylinder and on the doffer. The stripping brush may, if desired, be supported within the hood. When the carriage *f* is brought beneath an inlet *b* it automatically opens the valve thereon, and so puts the hood *g* under the suction action of the fan or exhauster. When the carriage is again moved forward to the next machine, the inlet valve which it leaves automatically closes.

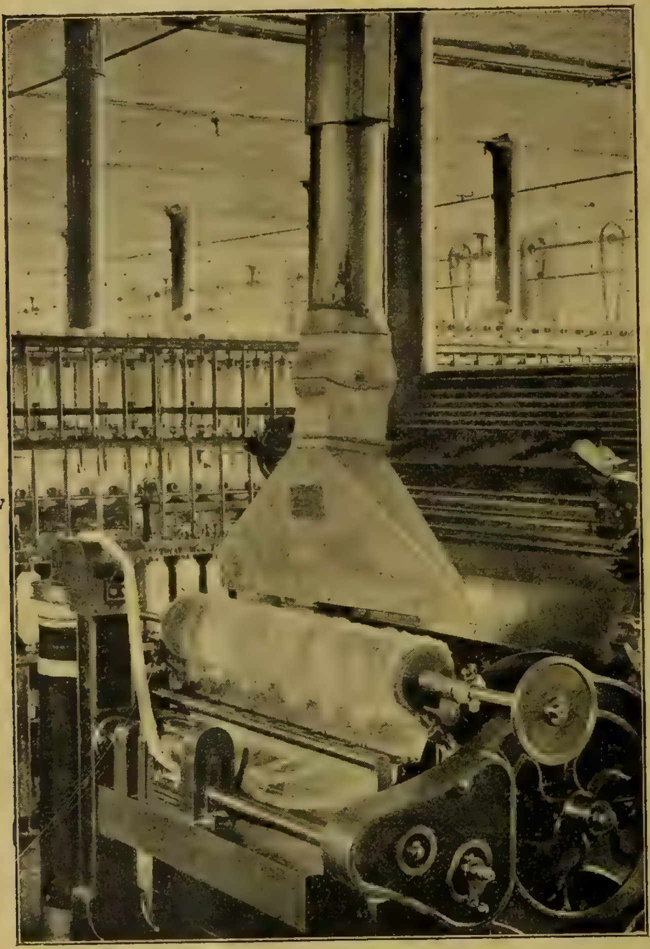


Fig. 37.—Pioneer Self-acting Dust Remover for Carding Engines.

It will be seen that the main feature of this system is that one carriage *f* and hood *g* serves for a whole row of carding engines, and so does away with the necessity for a down pipe to each machine. A further feature of the system is that by opening all the inlet valves on the conduit *a* it can be employed for general ventilation purposes.

For removing the dust which collects about the carding machine generally, and also about the card room, a nozzle *h* is employed, which is connected to the hood uptake by a flexible tube *i*.

In the system described in Honegger's patent specification No. 68, of 1908, the exhaustion conduit is provided with an inlet over each carding engine, and the collecting hood is carried from carding engine to carding engine, and connected up to the respective inlets as required.

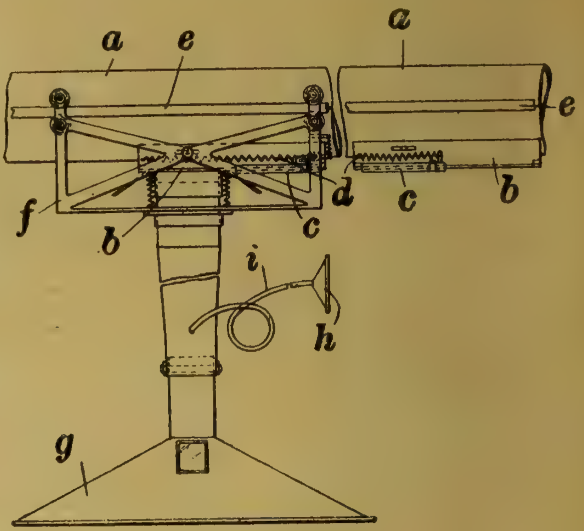


Fig. 38.

In Hall and Kay's system, described in patent specifications Nos. 397, of 1908, and 2,577, of 1909, the valve provided on each inlet to the exhaustion conduit, extending the length of the card room, is capable of resting either in its open or in its closed position, the valve being of trough shape to receive the open end of the inlet pipe.

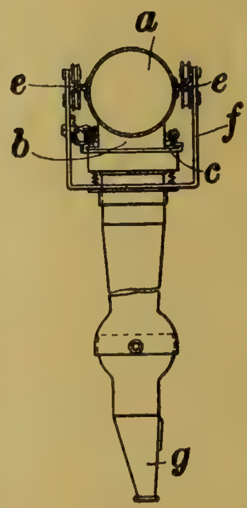


Fig. 39.

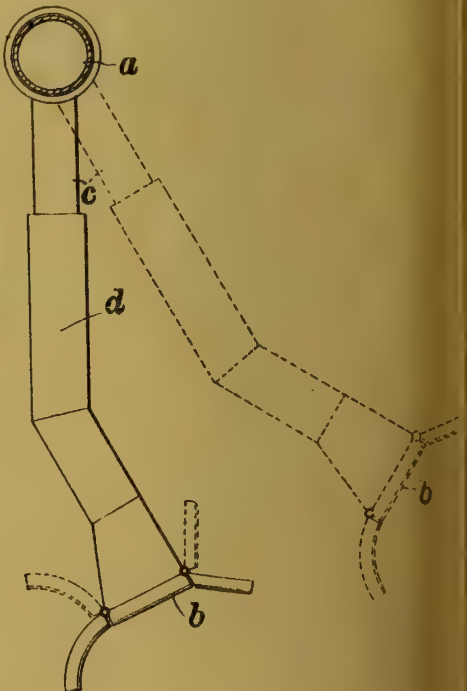


Fig 40.

In Gregson's arrangement, described in specification No. 11,207, of 1908, and illustrated at fig. 40, the conduit *a* is connected to the hood *b* by telescopic pipes *c*, *d* in order that the hood may be raised or lowered as desired. The upper pipe *c* is capable of revolving about the conduit *a* to allow of the hood being brought over either the cylinder or the doffer.

(*To be continued.*)

CONDENSING WATER ARRANGEMENTS.

[SPECIALLY CONTRIBUTED.]

(Concluded from page 201.)

The table below gives the results on a 1,500-k.w. plant giving the temperatures, etc., in different parts of the system. In removing nearly the whole of the air from the condenser, the apparatus also brings the steam into more intimate contact with the surface of the tubes, and it is found in practice that by its use the vacuum can be raised from 26 in. to 27½ in., or 28 in., without any alteration to the plant, except in some cases an increase in the volume of the circulating water.

TABLE I.—1,500 Kilowatt Turbo-alternator with and without Vacuum Augmenter.

Pressure above atmosphere.	Superheat.	Vacuum.		Cooling water temperatures.			Speed.	Load.	Steam used, including 450 lbs. per hour in vacuum augmenter.	
		At turbine cylinder.	At condenser.	Inlet.	Outlet.	Air pump discharge.				
Lbs. per sq. in.	Deg. Fah.	In.	In.	Deg. Fah.	Deg. Fah.	Deg. Fah.	Revs. per min.	K.w.	Lbs. per hour.	Lbs. per k.w.
* 113·5	103·3	26·69	26·95	67	94	104	1445	1316·5	24732	18·76
* 111·6	156·4	27·12	27·4	64·5	85	99	1500	1061·6	19830	18·66
* 141	113	27·72	27·85	60	72·5	83	1500	512·7	11425	22·3
* 154	47·5	27·72	27·92	59·5	62·5	92·6	1500	....	3127·7	....
† 115·6	143	25·18	25·32	63	84	92	1500	1029·3	21264	29·7
† 137	119	25·97	26·12	61	72	75·6	1500	534·02	12820	24·02
† 150·3	72·4	26·62	26·82	58	61·5	64	1500	....	29574	....

* With vacuum augmenter. † Without vacuum augmenter.

The proportions of jet condensers may be made to agree with the following practical rules: For capacity of single-acting air pump

$$C = \frac{V}{8},$$

in which V = the volume of low-pressure cylinder, C = capacity of air pump; for double-acting air pump C = one-half the above. Volume of air pump being made

$$= \frac{\text{I.H.P.}}{N} \times K,$$

in which N = the number of the revolutions per minute, K = 700 single-acting pumps, 470 double-acting pumps. The capacity of the condenser for the first formula is to be taken from 1 to 1¼ times the capacity of the air pump, often taken at 1½ to 4½ times the volume of the low-pressure cylinder. On these lines a formula can be obtained for air pumps and cylinder volumes connecting the latter with the indicated horse power revolutions per minute, and the mean effective pressure, and pounds per square inch referred to low-pressure cylinder, letting

A = area of cylinder, in square feet,

S = stroke, in feet,

p = mean effective pressure referred to low-pressure cylinder,

x = ratio of air-pump in condenser volumes to cylinder volumes.

then

$$\text{I.H.P.} = \frac{144\,A \times p \times 2\,S \times V}{33000},$$

or

$$\text{A.S.} = V = 114{\cdot}5 \times \frac{\text{I.H.P.}}{N\,p},$$

from which

$$C = 114{\cdot}5\,x \times \frac{\text{I.H.P.}}{N\,p}.$$

p varies from 18 or 19 to 35 or 36, so that the ratio of air pump capacity to low-pressure cylinder volume varies from 0·075 to 0·3, the lowest values referring to pumps of the double-acting type, from an examination of a fairly large number of recent compound and triple-expansion engines land practice.

In the case of steam engines, no reduction can be expected in the coal consumption after 27 in. of vacuum, much less any saving to balance the extra cost of the condensing plant, whereas with a turbine a reduction in coal cost can always be obtained by an increase in the vacuum, but in many cases this is obtained at too great a cost, as previously pointed out. Below is found two tables compiled by Mr. Frank Foster, which will be found very useful in fixing on a condensing plant. In Table II. is given best—commercially most economical—vacuum for a turbine when no charges are made for water, cooling tower, etc., but only for the condensing plant proper. In Table III. we have the figures when a cooling tower and some extra buildings are charged, for the former represents about the cheapest condensing arrangement possible.

Where water is dear an allowance—as a percentage of the saving in coal—should be made.

Table II.

Load factor per cent.	Coal—Shillings per Ton.				
	6	8	10	12	14
5	..	..	18	20	22
10	20	23	25	26·5	27
15	24	26·5	27	27·5	27·7
20	26·5	27·3	27·6	27·8	27·9
30	27·5	27·8	28	28·1	28·2
50	28	28·2	28·3	28·4	28·5

For continuously running plant a very high vacuum is desirable, but not so for turbines in intermittent use. To give the best results non-condensing reciprocators should take care of the peak loads and condensing turbines of the day loads. Where several turbines or engines are in a power station, only a portion should be equipped with condensers, although it is frequently desirable to connect the "peak" engines to the condensers of the day engines.

Table III.

Load factor per cent.	Coal—Shillings per Ton.				
10	..	..	8	20	22
15	17	20	22	24	25·8
20	20	23	25·5	27	27·5
30	24	27	27·6	27·8	28
50	27·6	27·9	28	28	28

In Tables IV. and V. is given the best vacuum for reciprocating engines, the latter being for a condensing plant with a cooling tower, etc., added.

TABLE IV.

Load factor per cent.	Coal—Shillings per Ton.				
	6	8	10	12	14
10	..	15	18	20	22
15	16	20	22	22·5	24
20	22·5	23	23·5	24·5	25
30	24	24·5	25·5	26·4	26·8
50	25·5	26·7	27·2	27·5	27·7

TABLE V.

Load factor per cent.	Coal—Shillings per Ton.				
15	..	..	..	16	20
20	..	..	20	21	22
30	16	21	22	23	24
50	22	23·5	25·5	26·3	27

Where the condensed steam is used as feed for the boilers the vacuum given in the last two tables should be reduced considerably, and in no case should the vacuum then exceed 26 in. or 26½ in. for reciprocators.

A NEW TWO-STROKE CYCLE INTERNAL-COMBUSTION ENGINE.

THE following article refers to some recent improvements in the design of two-stroke cycle engines of the kind which have a single sleeve or liner, reciprocated by means of eccentrics from the crankshaft, and provided with two sets of ports which at the end of the working stroke coincide with the inlet and exhaust ports in the cylinder. According to the improved construction of engine, the piston reciprocates within the sleeve, and the length of motion imparted to the sleeve is about half the length of the piston stroke. The stroke of the piston and sleeve are in phase, or nearly so; that is, the sleeve and piston arrive at the end of their outward strokes, and similarly at the end of their inward strokes at, or about, the same time. The eccentric operating the ported sleeve is arranged slightly in advance of the piston crank, so that the exhaust ports are opened just before the opening of the inlet ports.

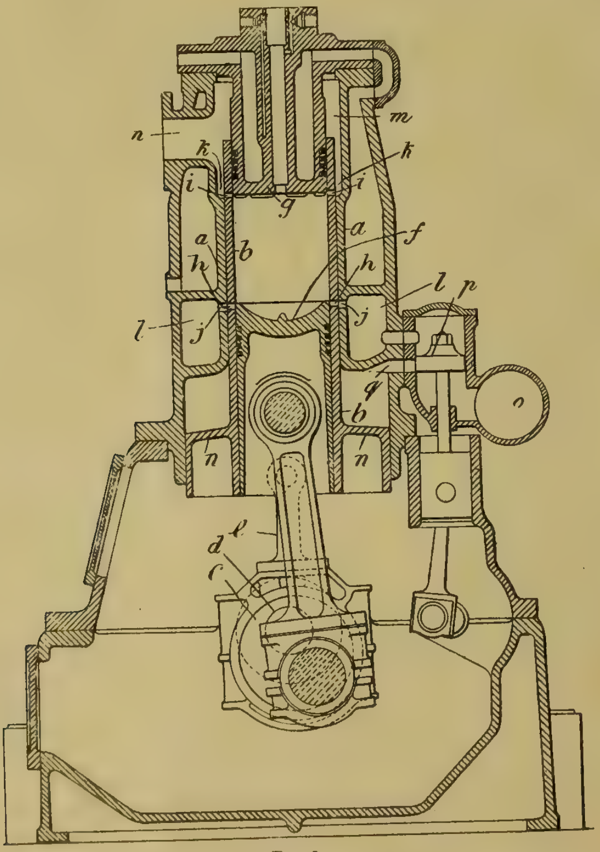


FIG. 1.

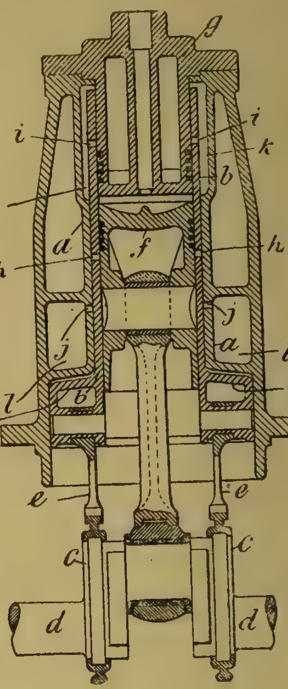


FIG. 2.

Referring to the illustrations, *a* is the cylinder in which a sleeve or liner *b* is reciprocated by means of eccentrics *c* on the crankshaft *d*, a rod *e* being connected from each eccentric to the sleeve. The piston *f* reciprocates within the sleeve *b*. The cylinder head has upon it a cylindrical projection *g* which extends within the sleeve *b* and is provided with packing rings.

In the sleeve *b* are two rings of ports, one ring *h* towards the inner end and one ring *i* towards the outer end, whilst there are corresponding ports *j* and *k* in the cylinder, which ports coincide with the ports *h* and *i* at the end of the working stroke.

At the end of the outward stroke, that is at the end of the stroke away from the crankshaft, the outer ring *i* of ports has passed beyond the packing rings of the cylindrical projection *g*, and the packing rings of the piston *f* have passed the inner ring *h* of ports in the sleeve. The explosion having taken place, the piston *f* and sleeve *b* move towards the end of their inward strokes until towards the end of the stroke the outer ring *i* of ports in the sleeve has passed beyond the end of the cylindrical projection *g*, and the piston *f*, as is shown in fig. 1, is about to pass beyond the inner ring *h* of ports in the sleeve, which ports at the end of the stroke are uncovered. At the end of the inward stroke the port *j* leading to an annular space or receiver chamber *l* is opposite the inner ring *h* of ports, and the annual port *k* leading to another annular space or chamber *m* is opposite the outer ring *i* of ports. Scavenging air is blown through the annular space or receiver chamber *l* and through the inner rings *j* and *h* of ports into the sleeve, and the products of combustion are blown by the scavenging air through the outer ring *i* of ports and the annular port *k* into the corresponding annular chamber *m*. On the return stroke the air contained in the sleeve or liner is compressed as the piston approaches the cylinder head. With an engine of the Diesel type the fuel is injected in the usual way at the commencement of the following or working stroke. With a gas or carburetting engine, the fuel is introduced with the scavenging air at the end of the inward stroke.

For providing scavenging air an annular piston *n* is formed on the inner end of the sleeve *b*, working in an enlarged part of the cylinder bore; *o* is an air inlet pipe, *p* a valve by which a port *q* leading into the enlarged part of the cylinder bore can be opened either to the air inlet pipe *o* or to the receiver *l*. On the outward stroke air will be driven by this annular piston through the port *q* into a receiver *l*, and on the ports opening at the end of the next inward stroke, air from the receiver will be blown through the liner for scavenging and charging purposes.

The above improvements have been patented by the well-known firm Messrs. Willans and Robinson Ltd., of Rugby, in conjunction with J. C. Peache.

THE ELECTRIC FURNACE.

At the recent annual convention of the British Foundrymen's Association, held at Manchester at the early part of this month, some valuable figures regarding cost were given by Mr. W. S. Gifford, and will be found in the following remarks:—

The electric steel furnace has been causing so much interest of recent years, and so many papers and articles have been written about it, that it is difficult to say anything original on the subject. There is one of its uses, however, which has been comparatively neglected in the technical literature of the day, although it is of great importance, and has been considerably developed in practice. I refer to its application for making castings; and the object of this paper is to give an idea of what has been done in this direction.

The use of the electric furnace in the foundry has long since passed the experimental stage, and British foundrymen must now consider it as a process which is accepted on the Continent, and with which they must reckon in England in the near future. It has been to some extent assumed in this country that it can only be economically adopted in places where the proximity of water power makes electricity extremely cheap, but it must be remembered that cheap power is less important to the steel maker than accessibility, and the two are seldom found together.

The various types of electric furnace have been described so often that it would serve no useful purpose to go over the ground again. I will therefore only take one furnace which has been adopted by many more firms in England, America, and the Continent, than any other, and mention some of its main points. The Héroult furnace is not a complicated electrical contrivance, but a simple tilting basic open-hearth furnace in which the heat is applied by electricity instead of by some fuel which is bound to introduce sulphur and gas. The bottom is lined with dolomite, and the roof with silica, and any man who can line a basic furnace can do this work on the electric furnace. The electrodes are moved up and down by an automatic regulator, and consequently there is very little labour required.

The cost of repairs is very low. The roof lasts from 100 to 130 heats for refining molten steel. The cost of repairing a roof for a 2½-ton furnace is £3, which amounts to about 2½d. per ton of steel. The bottom is merely fettled with dolomite between the heats, the total cost for refractories being about 6d. per ton. These figures are obtained from South Chicago, where a 15-ton furnace has been in steady operation for 15 months, refining molten steel from a Bessemer converter and turning out about 15 heats every 24 hours. The electrode consumption amounts to 6 lbs. per ton in large furnaces, and 10 lbs. in a small furnace in Germany, which, at 2d. per lb. (the cost of manufacture being less than 1d.) is equal to from 1s. to 1s. 8d. per ton of steel. The idea, by the way, that with an arc furnace it is impossible to make a low-carbon steel owing to the carbon from the electrodes getting into the metal is quite erroneous. There is no difficulty at all in keeping the carbon contents down to 0·03 per cent.

In places where the cost of power is high enough to make its consumption a matter of prime importance, the most economical method is to take molten and dephosphorised steel from a basic-lined furnace, preferably of a tilting type, and remove the gases and sulphur in the electric furnace. Even when using the commonest raw materials the sulphur can be brought down to below 0·02 per cent, and the gases completely removed in the Héroult furnace for a power consumption of from 100 kw. to 150 kw. hours per ton, which, at a rate of 0·6d. per unit, works out at from 5s. to 7s. 6d. per ton. This expense, together with that for labour, repairs, electrode consumption, etc., can, as a rule, be more than counterbalanced by the saving in the cost of raw materials. The complete deoxidation is an especially important point, which is not generally sufficiently recognised.

Where power is cheap the whole process of melting and refining can be performed in the electric furnace. The procedure is then very simple. Lime and mill scale or iron ore are put in first, and scrap is added. The slag gradually works its way upward through the scrap, and by the time the steel is melted the phosphorus is removed. This oxidising slag is then skimmed off and the sulphur is removed by a basic slag. This slag is extremely basic, and falls to pieces after teeming. The extreme reducing atmosphere of the furnace at this stage is shown by the fact that powdered charcoal put on the surface of the slag remains unburnt for a long time.

The arc on the lime slag forms calcium carbide, which in its nascent condition is very active in combining with sulphur. The presence of calcium carbide can be proved by putting a piece of slag in water, when a strong smell of acetylene is given off, and the slag is seen to be white in colour.

The power required for melting and refining common scrap to 0·02 S. and P. in this way is about 750-kw. hours per ton. For intricate casting the great fluidity of the steel, owing to its complete deoxidation, is very advantageous. Castings of less than $^{1}/_{25}$ in. in thickness have been made in Germany for aeroplane radiators. Another point is that the amount of grits can be decreased. Owing to the extreme reducing atmosphere of the furnace the addition of numerous deoxidising agents and other sorts of physic are avoided, so that more homogeneous castings are made, and there are fewer wasters and blow holes. The product obtained either by melting cold scrap or refining open-hearth steel is of the quality of good crucible steel, so that the advantage of the electric furnace over the open-hearth is that it produces a superior steel for the same price.

In comparison with the crucible process the gain of the electric furnace is one of cost. In this case there is a very large saving when making castings, as the cheapest raw materials can be used and the cost of pots is eliminated. In addition to this economy, amounting to several pounds per ton, there is a further saving in the process. The cost of melting in the open-hearth and refining in the electric furnace is considerably less than that of melting in crucibles. In the case of one steel foundry in England, which is engaged principally in making cycle parts and other intricate small castings, where the crucible process, working on the best raw materials, has always been used, an electric furnace is now being erected to replace it entirely. In Germany this has been done in many places, and a marked reduction in costs has been effected, while the castings are in no way inferior to those previously made from the best crucible steel.

For the manufacture of heavier castings, where the margin of profits is much smaller, each case requires careful individual consideration. A short refining process in the electric furnace may often be adopted advantageously, more for removing the gases, and consequently increasing the fluidity, than for obtaining extreme purity of chemical analysis. In such a case complete deoxidation with partial refining can be obtained for about 100-kw. hours per ton. The cost of this treatment is often counterbalanced by the smaller proportion of wasters, and the decrease in the number of grits and runners.

Some tables are appended showing the analyses of steels made by the Héroult process, and the consumption of power both in refining alone and in melting and refining.

TABLE I.—Refining Molten Steel from Bessemer Converter.

Five consecutive heats.

Weight of charge.			Kw. hours.	Kw. hours per ton.
Tons	cwt.	qr.		
12	10	0	1300	115
12	13	2	1300	113
12	8	1	1000	89
12	6	2	1500	134
12	10	2	1200	106
			Average	111

TABLE II.—Melting and Refining Common Scrap without Pig Iron.

Five consecutive heats.

Charge (scrap).		Product.			Time.		Kw. hours.	Kw. hours per ton.
Tons	cwt.	Tons	cwt.	qr.	Hr.	min.		
2	9	2	8	2	4	40	1680	686
2	9	2	5	3	5	00	1800	735
2	9	2	5	3	5	30	1980	809
2	9	2	6	1	5	15	1890	771
2	9	2	5	3	5	05	1830	747
							Average....	750

TABLE III.—Analysis of Steels in Table II.

C.	S.	P.	Mn.	Si.
0·86	0·014	0·011	0·31	0·23
0·85	0·013	0·020	0·31	0·23
0·95	0·013	0·017	0·14	0·25
1·00	0·012	0·016	0·18	0·16
0·85	0·013	0·008	0·16	0·17

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 11th August, 1910.

Dundee.—*First class:* J. Mollison, F. J. Adams. *Second class:* A. Black.

Greenock.—*First class:* W. Steven, J. T. Lumsden, W. L. Thorburn. *Second class:* G. Brown.

Hull.—*Second class:* D. C. Carson.

Liverpool.—*First class:* J. J. Morrison, T. H. Finn. *Second class:* R. O. Batchelor, G. F. Lees.

London.—*First class:* J. F. Ryan, E. C. Hepworth, L. J. Smith. *Second class:* R. Freeman, T. H. H. Windebank.

North Shields.—*First class:* T. Stephenson, A. Purves. S. R. Taylor. *Second class:* C. Boyd, W. B. Laird, D. H, Nicholson, P. Phiampolis, R. C. Pidgeon.

THE PATTERNS AND THE MOULDING OF CONICAL CAPS.

By H. J. M'Caslin.

Most castings can be moulded in one position better than in any other; hence the first thing to think of in looking over a drawing and studying its patternmaking and foundry possibilities is, "Is this position the most advantageous for moulding both as to quality and dispatch?"

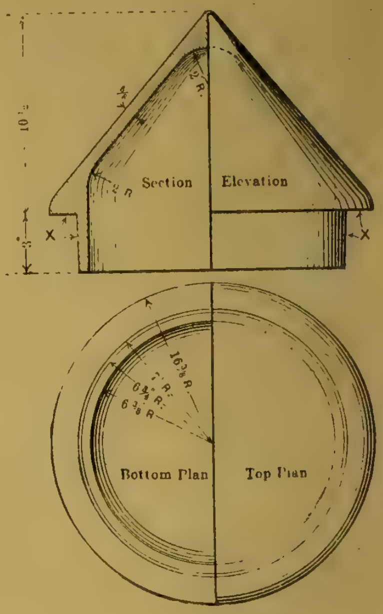


Fig. 1.

Most Advantageous Method.

The author states, in *Castings*, that very often some concession as to quality must be made for the sake of getting the casting quickly, but this is not required in the case of conical caps. The form of the object permits it to be moulded in the easiest way, and the one most favourable to the casting requirements. The indicated surfaces at X, fig. 1, which must be clean and true to dimensions, may be placed down or at the bottom of the mould.

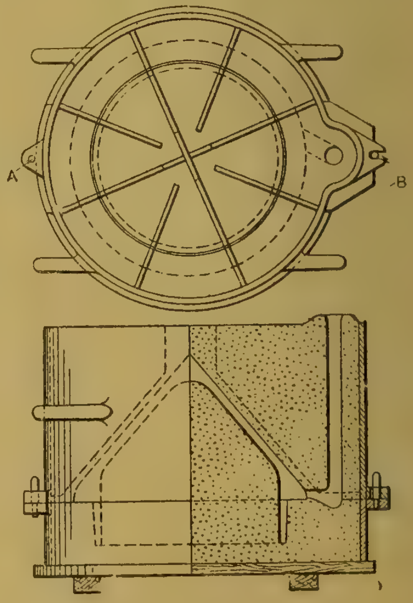


Fig. 2.

Perhaps a wider choice of ways and means to effect an end is afforded in moulding than in any other department of a factory. So before proceeding with the method illustrated and recommended for this particular instance, let us consider one or two other ways, noting their advantages and drawbacks.

For handling and drawing, a wood pattern is the most convenient. But from the size, shape, and section of the object, the frailty of a wood pattern would not withstand the foundry ways nor the distortion likely to occur in storage. Its existence would probably be short.

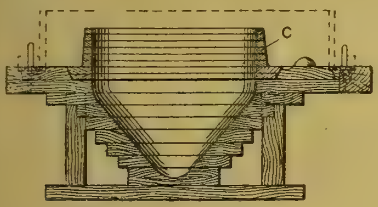


Fig. 3.

However, by making a master pattern, from which a metal pattern is produced and properly worked up and follow-boarded, we have an arrangement which has an advantage over the previous method. It permits the use of flasks of any convenient size; whereas in the case of matchboard practice the flask parts must be interchangeable and accurately located upon the board with pins and plates.

The initial cost of the flask equipment may be higher, but there is a decided gain in dispatch, because cope and drag sections are rammed up simultaneously and placed together as from a moulding machine.

A Good Job for the Machine.

It is hardly necessary to state that the piece is a good job for a machine when of sufficient number. When only a few are required the work can be handled upon the side floor in an economical manner, as here shown.

Fig. 1 shows four views of the casting, and though the pattern work and moulding operations are of a very simple nature, the manner of handling the job and its wide range of application may render some features worthy of notice.

Make-up and Gating of Mould.

The three views of the completed mould, shown in fig. 2, illustrate clearly its general make-up and manner of gating, the metal being introduced at a point about ¼ in. above the parting, as shown.

For assembling the flask parts and locating them upon their respective boards it is best to use a hole and slot, as shown at A and B. This feature has a decided advantage over the two holes as often used, since the binding due to the distortion of flasks is eliminated. Fig. 3 shows the drag matchboard, and fig. 4 illustrates the one employed in ramming up the cope. Durability should be sought in the construction, the material being well glued and nailed or screwed together when building.

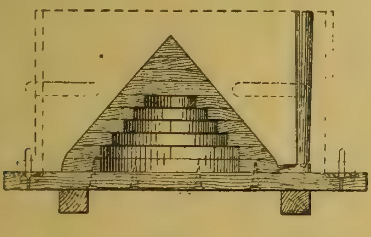
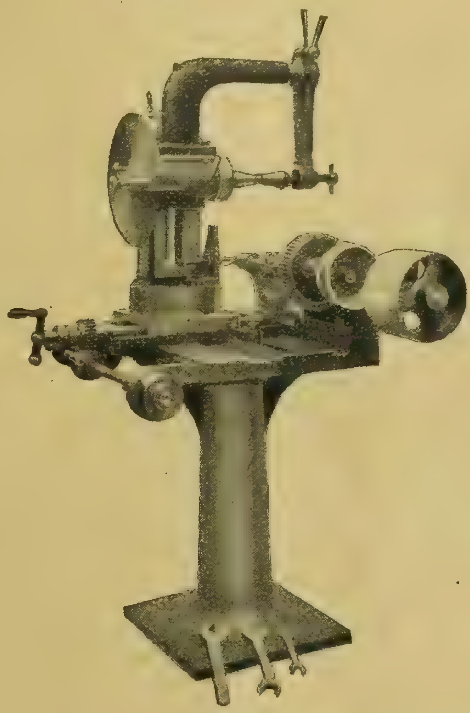


Fig. 4.

Ring C may be turned up and seated in the plate, as shown, but owing to its light section and its position it is very liable to suffer severely from the effects of the rammer, and for this reason it is best to make it of metal.

AN IMPROVED GEAR-CUTTING MACHINE.

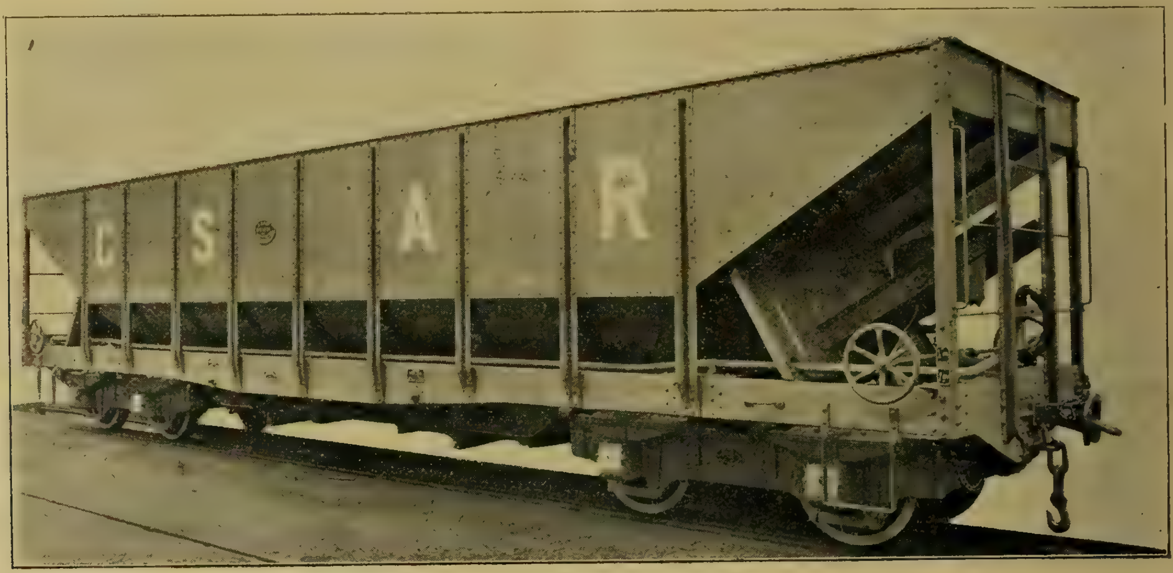
During a recent call on the Globe Engineering Co., of Sowerby Bridge, our representative had brought to his notice a gear-cutting machine fitted with their latest improvements and especially adapted for cutting light pitch gear wheels. We are able to give a few particulars of this tool, which is shown in the illustration. The machine is simple in construction and action, and capable of dealing with iron and steel wheels up to 18 in. diameter by 6 in. pitch at one depth of cut. The vertical standard is graduated with a depth gauge, so that the required depth of tooth can be set instantly. The circular base of the standard is also graduated, so that the correct angle of a worm wheel can be also set at a glance. It is semi-automatic, and is fitted with an adjustable stop motion, which can be set to throw the slide out of action as soon as the required length of tooth has been cut. These machines are at work in some of the largest engineering firms in the country, and in all parts of the world, and repeat orders are being constantly received denoting the usefulness and satisfaction given.



H.M. Trade Commissioner for Canada (Mr. R. Grigg) reports that a notice, recently issued by the Deputy Minister of the Canadian Naval Service, and published in the *Montreal Gazette* of 26th July, contains the following conditions concerning the construction in Canada of vessels for the Canadian Navy: The vessels are to be built according to the plans and specifications of the British Admiralty, which being of a confidential nature will only be exhibited to approved firms. The Department of Naval Service will be glad to hear from any Canadian or British firm who would wish to tender for the building in Canada of these warships. It would be necessary for such firms to show that they have, or propose to put in, a shipbuilding plant that will be considered sufficient for the building of cruisers of the Bristol type, and that they have had such experience as will enable them to guarantee the building of such ships in accordance with the Admiralty specifications. It should be borne in mind that the Rush-Bagot convention provides that no warships should be built on the Great Lakes, and, therefore, shipbuilding firms should arrange for establishments elsewhere than on these lakes. Further information can be obtained by firms who propose to tender, on application to G. J. Desbarats, Esq., Deputy Minister of the Naval Service, Ottawa, Canada.—*Board of Trade Journal.*

50-TON ALL-STEEL SELF-CENTRE DISCHARGING WAGONS.

Five all-steel self-centre discharging wagons of a new type have just recently been added to the rolling stock equipment of the Central South African Railway, and they are now being used for coal traffic in the Rand district. These wagons, designed and constructed by the Leeds Forge Company Limited, have each a carrying capacity of 100,000 lbs., and having been built for the 3 ft. 6 in. gauge, they rank as the largest freight rolling stock that has yet been constructed for any narrow-gauge railway system. From the accompanying illustration it will be seen that the body of the wagon, which is constructed throughout of steel, is carried on a Fox's patent pressed-steel underframe, the latter being carried at either end on the spherical centres of the two four-wheeled bogie trucks. In order to give the wagons the maximum effective width and capacity with the minimum overall dimensions, the Leeds Forge Company's patent arrangement of pressed steel inside stanchions has been adopted. The design has been arranged so as to discharge the whole of the contents at the centre, and the doors can be opened and closed from either side of the wagon by turning the transverse shaft. This shaft carries levers fixed to it, which are connected by links to toggles, the bottom ends of which are attached to the door at the opposite side to the hinges. The toggles are so arranged that when the doors are closed they are in line with each other, and they thus resist any tendency of the doors to open through the action of the load on the doors. The toggle bars are prevented from accidentally lifting at the centre, due to vibration or shocks caused through shunting operations, by reason of the fact that when the doors are closed the fixed levers on the longitudinal shaft are in line with the links connecting same to the toggles; consequently, not only may the doors be opened and closed by merely turning the handles at the end of the transverse shaft without having to lift any pawls, but the arrangement of toggles, links, etc., provides an automatic locking device. The wagons are fitted with Westinghouse friction draft gear, and are provided with both vacuum and hand brake installations. The former system is operative on all wheels of both bogies, and is arranged to exert a brake force of 90 per cent of the total tare weight; the latter is operated from hand wheels placed at both ends of the frame, and is arranged to act independently on each bogie, the brake pressure on each bogie being equal to 70 per cent of the half of the tare weight of the wagon. The principal dimensions are:—Length over buffers, 42 ft. 9 in.; width over all, 8 ft. 4 in.; total height, 10 ft.; bogie wheelbase, 5 ft. 6 in.; centres of bogies, 28 ft. 6 in.; net capacity, 1,700 cubic feet; and tare weight, 40,880 lbs. (20·44 short tons).



50-TON ALL-STEEL SELF-CENTRE DISCHARGING WAGON.

THE ARMOURED CRUISER LION.

The latest addition to H.M. Navy, the armoured cruiser Lion, was launched at Devonport Dockyard on July 6th. She represents a considerable advance in point of size and many other respects in this type of vessel. This is best illustrated by comparison with another vessel of a similar nature. The Lion has a length of 700 ft., with a beam of 88½ ft., and displacement of 26,350 tons. The Indefatigable, which was launched in 1909, has a length of 596 ft., with a beam measurement of 80 ft., and a displacement of 18,750 tons. The designed speed is 28 knots, but it is expected that she will be capable of steaming at 30 knots. The vessel will be propelled by Parsons' turbines, to be constructed by Messrs. Vickers, Sons and Maxim, driving four screws, and an installation of 42 water-tube boilers will supply steam to the same. The estimated horse-power (70,000) is a record for propelling machinery, and the main armament will consist of eight 13·5 in. guns.

The armour protection will extend from the upper deck to about 7 ft. below the water-line, instead of there being a belt only, as in the Invincibles. The armour, moreover, will have about 30 per cent more resisting power than that in the earlier battleship-cruisers. The four barbettes will be on the centre line, the second and third being raised above the foremost and after ones, to enable the guns in them to be fired both ahead and astern, as in the other barbettes, and the whole of the main armament to be trained on either broadside. The bilge keels are of unusual width and length, extending from the extreme end of the curvature of the hull fore and aft. They are designed so as to form a pair on either side, connected by a narrow strip in line with the centre section. The length of the vessel as given above, viz., 700 ft., is that between perpendiculars, the length overall being about 720 ft.

After Viscountess Clifden had named the vessel, the work of knocking out the blocks as the tide advanced up the slipway was then resumed, until at last only 22 remained in position out of the 134 which had taken the entire weight of the ship previous to the commencement of the launching arrangements. Soon after a bell was rung, warning all the workmen to come out from under the hull. As soon as "all clear" was reported, Lady Clifden took the mallet and chisel, and severed the cord that passed over a shield on the bow of the vessel. This released a weight on either side of the ship, and these in falling displaced the dogshores which held the cruiser in position on the slip. The weights had no sooner fallen than the vessel began to move. The vessel, with the Union Jack, White Ensign, and Admiralty flag flying from temporary masts, glided gracefully into the waters of the Hamoaze, where she swung round with the tide, revealing her full length to the spectators, and was brought up by Government tugs.

Launch of H.M.S. Lion.

The total weight launched was about 8,800 tons, which established a record, the hull weighing 8,057 tons, and the balance of 743 tons represents the cradle and other launching gear. The ship has been built under the direction of Vice-Admiral C. H. Cross.

CYLINDER CASTINGS FOR BORING OUT.

By Walter J. May.

In making castings for cylinders which are open at both ends there is little difficulty beyond that which is incident to work of this class, and, assuming that suitable iron is used, the castings will come out well in the majority of instances. Of course, the lower side of the castings will be denser and closer in grain than that on the top side, especially where the cylinders have a fairly large diameter, but this occurs in all cases, and has to be arranged for in the machine shop. Mixtures of iron which are liable to stratify should not be used for any class of work which has to withstand pressure, and occasionally such mixtures are found, but for pressure work a really homogenous iron is necessary.

In making cylinders with one closed end, however, the foundry is very often soundly cursed in the machine shop, for, while the greater portion of the walls of the cylinder and part of the flat end—if necessary—will machine out cleanly enough, there is always trouble at the junction of the end and the walls of the cylinder, as the tools do not work well into the angle thus formed. The trouble is not exactly a fanciful one, and often to get the corners cleaned out takes nearly as long as to bore the cylinder.

To get over the difficulty is simple if care is taken, as usually a $^1/_{16}$-in. cut is all that is necessary in boring out, and if in making the core a recess is allowed in the core, as shown in fig. 1, and in the casting, as shown in fig. 2, all trouble will be overcome. The recess need not be more than ⅛ in. deep and about ¼ in. long, as this will clear the tool at the end of the cut, but it makes all the difference in time in the machine shop, while it does not increase the time in the foundry, and the casting is not weakened appreciably.

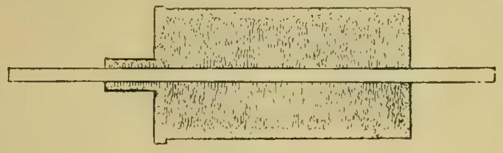


Fig. 1.

Another thing in cylinders where steam passages are cast in is to have the cores so made that they will come out cleanly and freely, so that a clean passage is left, while they should be so joined to the main core that they leave a clean passage through the cylinder wall. This usually means that the core sand must be weak and sufficiently friable to jar out when the casting is rapped, and, being made on frames, this can be arranged better than with cores, which are self-supporting. Very great care must be taken that the cores are smooth and coated with plumbago wash, and after the casting is made the cores should be taken out in the foundry and not sent into the machine shop to be dealt with. As a matter of fact, castings leaving one's own foundry should be in a fit state to be placed in the machines without further treatment, the fettlers being able to get the pieces ready this far if they are allowed reasonable time.

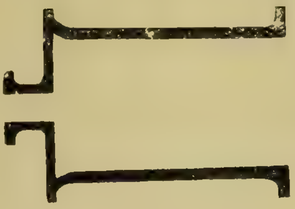


Fig. 2.

In making castings which have to be machined, care should be taken to face the moulds and cores so that the sand does not burn in, this being easier and cheaper than having to dislodge or dissolve the sand after it has become fixed in the metal. A good wash for moulds and cores is composed of, roughly, 80 per cent plumbago and 20 per cent china clay, this standing against metal well, while for dry sleeking nothing beats pure plumbago, so far as refractoriness is concerned, "blackings" not being at all satisfactory in all cases. Indeed, it may well be a matter of serious consideration whether it is not cheaper to use simply charcoal and plumbago for different forms of dry sleeking, and the mixture mentioned above for wet work, than to use made "blackings," most of which are dependent chiefly on charcoal or plumbago for their usefulness.

THE ELECTRIFICATION OF RAILWAYS.*

An Imperative Need for the Selection of a System for Universal Use.

By George Westinghouse.

(*Concluded from page 212.*)

Requisites for a Universal Electric System.

In selecting a proper electrical system for railway operations, it will probably be generally conceded that the following elements are of prime importance:—

(*a*) The electric locomotives should be capable of performing the same kinds of service which the steam locomotives now perform. This will be most readily secured by electric locomotives which can practically duplicate the steam locomotives in speed and power characteristics. This includes a wide range of performance, embracing through passenger service at different schedule speeds, local passenger service, through freight service in heavy trains, the handling of local freight by short trains, and a variety of switching, terminal, and transfer movements. This naturally calls for wide variation in tractive effort and in speed, both for the operation of different kinds of trains and also for the operation of the same train under the varying conditions usually incident to railway service.

(*b*) The electric locomotive should be capable of exceeding the steam locomotive in its power capacity. It should be able to handle heavier trains and loads, to operate at higher speeds, and in general to exceed the ordinary limits of the steam locomotive in these regards. The readiness with which several electric locomotives can be operated as a single unit enables any amount of power to be applied to a train.

(*c*) The electric system should adapt itself to requirements beyond the ordinary limitations of the steam locomotive in small as well as large things. It should be adapted for use on branch lines, and for light passenger and freight service similar to that so profitably conducted by inter-urban electric roads, which in many cases run parallel to steam roads, not only taking away the traffic of the steam roads, but building up a new and highly profitable traffic, both in passenger and in express service.

(*d*) A universal electrical system requires that power should be transmitted economically over long distances and supplied to the contact conductor. The system should utilise the most highly perfected apparatus for the electric transmission of energy and its transformation into suitable pressures for use.

(*e*) The contact conductor in an ideal system should be economical to construct, both for the heaviest locomotives where the traffic is dense, and for light service on branch lines. It should impose minimum inconvenience to track maintenance, should give minimum probability of disarrangement in case of derailment, or in case of snow and sleet, and should in general be so placed and constructed as to give a maximum assurance of continuity of service.

The use now made of electricity in steam railway service has been brought about, generally speaking, through compulsion. The steam locomotive has reached its limitations and has been found unsuitable and inadequate in tunnels or in terminal service. Even where other considerations may have been controlling, the problem has usually been a specific one of electrifying a relatively small area. The problem has been solved by considering those factors which were of immediate importance, without giving weight to uniformity with other systems or of extension.

Now the natural course of development will be the extension of these limited zones, until after a time they meet. Then there will arise great inconvenience and expense if the systems are unlike. For the present it may be a matter of little moment whether different systems have their contact conductors in the same position, or whether the character of the current used is the same or different. In the early days of railroading, it was of little consequence whether the tracks of the different systems in various parts of the country were alike or unlike, but later it did make a vital difference, and the variation resulted in financial burdens which even yet lie heavily on some railways. It is this large view into the future of electrical service which should be taken by those responsible for electric railway development.

The Future of Electrification of Railways.

The complete electrification of a railway will necessitate a rearrangement of ideas and practices in regard to operations. Coaling and watering places will not be needed; passenger trains will be differently composed, some classes being of less weight; and they will operate more frequently, thus promoting travel; other trains will be heavier than at present, or will operate at higher speeds; and branch lines, by the use of electrically fitted cars, can be given a through service not now enjoyed.

The movement of freight will undergo great changes, due to the fact that electric locomotives can be constructed with great excess capacity, enabling them to move longer trains at schedule speed on rising gradients.

The large percentage of shunting operations due entirely to the use of steam locomotives will no longer be required.

The railway companies can combine upon some co-operative plan for the generation of electricity, thereby effecting large savings in capital expenditures, and can utilise their own rights of way for the transmission of the current, not only for the operation of trains but for many other useful purposes.

Notwithstanding the fact that great strides have already been made in cheapening the cost of generating electricity by steam engines, I foresee, from the progress made in the development of gas and oil engine power, a still further reduction in cost which will accelerate the work of electrifying existing railways.

One important aspect of this great question will engage the thoughtful consideration of every Government, namely, the military necessity for uniform railway equipment in time of war.

There will be serious difficulties to surmount in the selection of a general system. There naturally will be arguments in favour of one or another of the systems now in use and the inclination of those who have adopted a particular system to advocate its general use. There will be enthusiastic inventors, and there will be many advocates of the common view, namely, that there is room for several systems and that each system will best meet the requirements of a particular case. There will be those who give undue weight to some feature of minor importance, such as a particular type of motor or of locomotive, instead of giving a broad consideration to the whole system, and recognising that, in the general problem of railway electrification, facility and economy in transmitting power from the power house to the locomotive are of controlling importance.

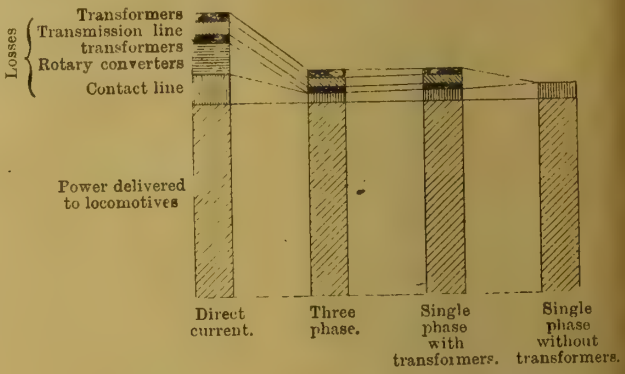


Fig. 1.—Showing Comparative Losses between Power House and Locomotives.

Were there now only one system to be considered, there would be a concentration of the energy of thousands on the perfecting and simplifying of the apparatus for that system to the advantage of railway companies and of manufacturers.

In conclusion, I can only repeat, and earnestly recommend to the serious consideration of railway engineers and those in authority, the pressing need of determining the system which admits of the largest extension of railway electrification, and of a prompt selection of those standards of electrification which will render possible a complete interchange of traffic in order to save expense in the future and to avoid difficulties and delays certain to arise unless some common understanding is arrived at very shortly.

There are five appendixes to this paper, as follows:—

1. The single-phase system on the New York, Newhaven, and Hartford Railroad.
2. Data on electric locomotives of American design.
3. Comparison of systems of electrification.
4. Electrified steam roads and electric roads for trunk line service.
5. The early history of single-phase railway motors.

Of these, an abstract of No. 3 is given:—

APPENDIX III.

Comparative Losses.

Fig. 1 shows the comparative losses between the generators and the locomotives for each of the three systems, based on a class of service where the input to the locomotives by the several systems is practically the same.

As some kinds of service render one type of motor with its auxiliary apparatus and control more efficient, while under other conditions it may be less efficient, this variable element has been eliminated by assuming the same power delivered to each locomotive as a basis for a general comparison of the transmission losses.

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* Abstract of a paper read before the Institution of Mechanical Engineers and the American Society of Mechanical Engineers, July, 1910.

The total height of each column in the diagram indicates the total power delivered by the power house in the system designated. The height of the long portion at the lower part of each column indicates the amount of power which reaches the locomotive.

The loss between power station and the locomotives is represented by the upper shaded areas. The respective losses in raising transformers, transmission line, lowering transformers, rotary converters, and the contact line (comprising trolley or third rail with track return) are segregated.

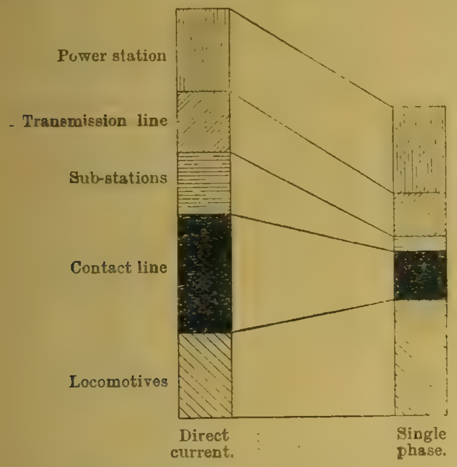


Fig. 2.—Comparative First Costs for Direct-current and Single-phase Systems in a Particular Case of 100-mile Service.

It will be noted that the large losses in the rotary converters appear only in the direct-current system. The larger single-phase column shows the losses where the distances are such that it is necessary to use a transmission line and transformers. The smaller single-phase column represents the trolley wires connected to the generators without any intervening transmission line or transformers. The loss of power between power house and locomotives is relatively small as compared with that in any of the other systems. This is the condition on the New York, New Haven, and Hartford Railroad, where the power house is distant nearly 20 miles from one end of the line.

Comparative First Costs.

Fig. 2 shows the comparative estimates prepared a short time back of first cost in a particular case for electrification by the direct-current system and by the single-phase system. In the preparation of these estimates the three-phase system was not called for, and as no estimate covering it has been prepared, it is not included in the present comparison. The estimates cover a single track line 100 miles long, involving both freight and passenger traffic in both through and local service, and include 20 locomotives.

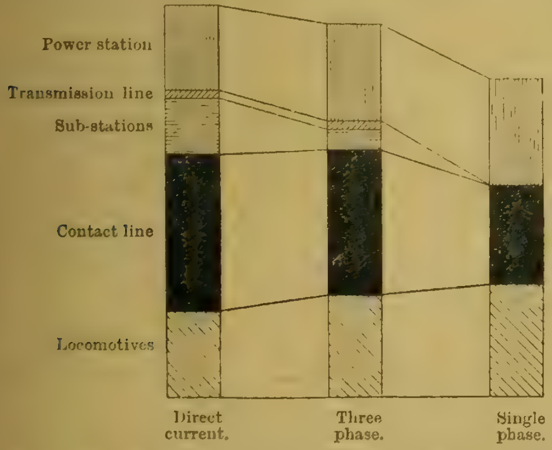


Fig. 3.—Comparative First Costs in the Different Systems for a Special Case of Pusher Service.

The costs for power station include only the machinery and building and do not include cost of hydraulic development. It will be noted that the considerably less cost of the single-phase system in this case is due largely to the lower cost of contact line and sub-stations.

Fig. 3 shows the comparative estimates of first cost for the three systems for pusher service on mountain grades in a particular case involving the use of 12 locomotives. The total length of line is 32 miles, part of which is single track, part double track, and part three tracks. In addition to the main line there is a large yard to be electrified, there being a total of 90 miles of single track. The location of the power station was fixed by non-electrical considerations. The distances were such that sub-stations were required when either direct current or three-phase current was assumed, but the entire system could be fed direct from the generators if single-phase current was used.

It will be noted that in this case the omission of sub-stations and transmission effects a very considerable saving in favour of single-phase as well as the usual large saving in cost of contact line effected by the use of this system. The cost of the part of the system between the power house and the locomotives in the direct-current system is nearly equal to the cost of both power house and locomotives. On the other hand, the cost of the single-phase contact line, the only intervening element between the power house and the locomotives, is less than one-half of the cost of the direct-current transmission and contact system.

Comparative Operating Costs.

Fig. 4 shows comparative operating costs for the three systems for the pusher service outlined in the preceding diagram of first costs. It should be noted that these costs do not include fixed charges. If fixed charges were included, the difference in operating costs in favour of the single-phase system would be much more marked.

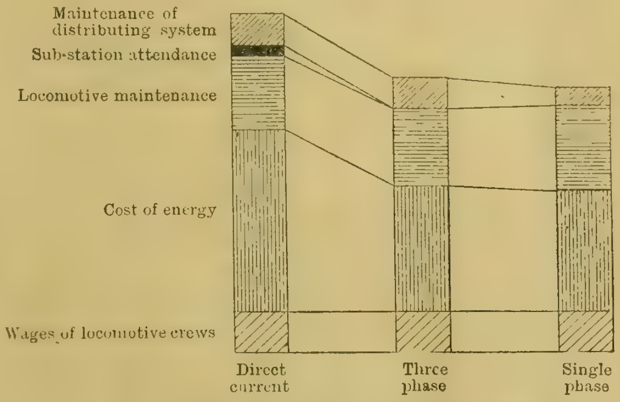


Fig. 4.—Comparative Operating Costs in the Different Systems in a Special Case of Pusher Service.

In connection with this diagram it should be noted that sub-station attendance is required for the direct-current system only. The reason for the three-phase and single-phase systems being so nearly on a par is that this case is an ideal one for the application of the three-phase system since it involves constant speed operation under constant load conditions. It is notable, however, that even under these conditions the single-phase system shows somewhat lower operating costs than the three-phase system.

The high operating cost with the direct-current system is seen to be due largely to the greater amount of power required for operation by this system on account of the large losses which occur between the power house and the locomotive in this system.

Spot Welding.—Spot welding consists in raising small areas of spots on the abutting surfaces to a welding heat and then pressing them together so as to obtain a firm weld. From a mechanical point of view this is most nearly akin to bolting or riveting the two parts together, and, indeed, spot welding is displacing riveting in many cases, particularly for thin sheets, for which riveting is not a completely satisfactory process if strength is required. Spot welding may be performed either electrically or by the oxy-acetylene process. With electrical welding it is necessary to concentrate the current between the plates at the spot to be welded. This may be done by means of pointed electrode connections pressed against the plates or by pressing slight mechanical projections on the plates, so that contact only takes place at the area itself. A much simpler method in many cases consists in placing a small thin disc of metal between the two articles at the welding spot. This necessarily concentrates the current at that spot, and the disc is fused by the current, so that it merges into the weld. With acetylene welding the two bodies are locally heated by the oxy-acetylene flame until the desired temperature is attained, but more skill is necessary than with electric welding.

MODERN EDUCATIONAL PRACTICE.

Most people with any pretensions to education are familiar with the methods in vogue at our public schools and technical colleges. Their name is legion. They are in some instances open to criticism, but taking into consideration the common object in view, namely, the training and mental development of the students' brains, whatever the individual result may prove to be, the aggregate of the whole cannot be called anything else than praiseworthy and deserving of encouragement. Taking a retrospective view over, say, a period of a quarter of a century, it is marvellous to note what rapid strides have been made in the direction of technical education. To refer to the science of engineering alone, it is well recognised that so far as the works department is concerned in matters of construction the old rule-of-thumb days are relegated to oblivion, and have been superseded by mathematical and modern methods. Where the old millwright considered a design too light, he simply put in more material to ensure a decent factor of safety; in fact, structures were erected and machinery built according to the judgment of the engineer. For the honour and reputation of the old school, if they erred at all, it was generally on the side of strength; but even engineers and manufacturers of earlier days, whose concerns are still being carried on, have been compelled to recognise that a new era has commenced. Their offices, whether in the commercial department, drawing office, or works, must be staffed by boys and men who are thoroughly equipped and up to date in their respective spheres, and are familiar with the latest methods of book-keeping, design, or construction. Even the workmen—we refer, of course, to the artisan class—must be of a higher grade than formerly. The more rigorous teaching in schools of all classes, and the advanced methods adopted, have brought about this new order of things. But while recognising to the full the advantages of advanced technical education, it is to be deplored that many ambitious and deserving men are unable to achieve their desires, and are debarred entering for higher posts in consequence of their inability to meet the expense of a technical college course of training. To meet cases of this description, and that of others who labour under no monetary disabilities, but to whom for private reasons it would be inconvenient to attend the schools, we are very pleased to be able to call attention to what has been described by a leading London newspaper as a "New Force in Education." This is to be found in the system adopted by The International Correspondence Schools Ltd., International Buildings, Kingsway, London, W.C. Its first inception dates back to the year 1891, and was first introduced by Mr. Thomas J. Foster, the founder of the schools just referred to. The idea of technical and practical education by correspondence "caught on," and its growth has been rapid and phenomenal, its influence being felt in every quarter of the civilised globe. Its success has been particularly marked in this country, and students of every class are being daily enrolled from the various centres in Glasgow, Newcastle, Leeds, Manchester, Nottingham, Birmingham, and Bristol, also from Belfast and Dublin.

Many years ago an educational institution successfully teaching practical things by post would have been considered an impossibility, but since the establishment of the International Correspondence Schools in 1891, the results achieved by the I.C.S. system of correspondence instruction have practically revolutionised educational methods. Specially prepared home study text books and instruction papers in over 200 subjects have made this possible,

In 1891 the first student completed his course; in 1908 the affiliated organisation of the I.C.S. published a book giving the names and addresses of 107,000 students who had received diplomas or made substantial progress with their courses. Besides these 107,000 students, more than 325,000, with the assistance of the faculty of the schools, have completed mathematics, physics, drawing, and other subjects; over 100,000 others, without sending written exercises for correction, have successfully studied from the specially prepared text-books forming the basis of the work.

The advantages of correspondence instruction are many. The student earns while he learns; he can move about from place to place without interfering with his studies; the schools are always open, and wherever there is a postal service the correspondence method of teaching is available.

Many persons find it extremely inconvenient to attend evening classes. The fact that this admirable institution has thousands of successful students living in towns where night classes of some sort are provided is sufficient proof of the advantages by the correspondence method of training.

The courses taught cover a vast number of subjects, and include architecture, commerce, chemistry, civil service, civil engineering, ornamental designing, miscellaneous drawing, electrical engineering, gas-power engineering, mechanical engineering, mining and motor engineering, steam navigation and aviation, also modern languages and publicity work.

We know of numerous instances of men who have raised themselves from subordinate positions to much higher ones in administration and managerial capacities as a result of the training, and testimonials are daily flowing in to the headquarters of the schools acknowledging the success of students of all grades to the teaching they have received through the correspondence courses. One student, who went through a mechanical engineering course, it is gratifying to relate, benefited so greatly by his instructions and studies that following a naturally inventive bent of mind, he was able to put his ideas into practical shape, and was instrumental in effecting numerous improvements in various machines belonging to his employers, to the material and mutual benefit of all parties concerned. Another was awarded a gold medal and diploma for draughtsmanship at an exhibition for a drawing of a 120 H.P. engine. This occurred in Manchester, and the student in question, who went through a civil engineering course, was subsequently successful in obtaining several money prizes in open competition for architectural and mechanical drawings.

Another student, also in the Manchester division, was awarded a diploma and silver medal by the exhibition authorities for his invention of a miner's self-locking safety lamp. His success in this and in other directions, including the obtaining of his present responsible position as inspector of machinery with a leading and well-known motor manufacturing company, is entirely attributable to the training received through his correspondence courses and his own industry. It is to this student's credit to state that on one occasion, when on night duty at the works for six months at a stretch, he still kept up his courses. Cases might be multiplied of success due to the system we have referred to, but we are unable, through want of space, to do more than quote one or two examples. We may state that the schools have been recommended by the officials of leading technical societies, and by many well-known engineers and manufacturers, together with professors of leading technical colleges. To be convinced of the power and activity displayed by this useful educational institution one only has to pay a visit to the headquarters in Kingsway, which can only be adequately described as a veritable beehive of industry. Everywhere the visitor is surrounded by life in its most active and interesting form. In the corridors or the reception rooms may be noticed at all hours of the day small groups of visitors, prospective students, and others, either discussing the methods and merits of the system or listening to courteous officials explaining details previously imperfectly understood.

LAUNCHES AND TRIAL TRIPS.

Kansas.—The new Bucknall Line steamer Kansas, built by Messrs. Workman, Clark, and Co. Ltd., Belfast, left Belfast Harbour on July 11th and proceeded to the Carrick Roads for adjustment of compasses, after which she proceeded on her speed trials over the measured mile course. The results attained were highly satisfactory. The Kansas is 446 ft. in length, with a gross tonnage of 6,074, and has been built under British Corporation survey for the highest class in their Registry. The vessel has five spacious cargo holds, all practically free of obstruction, and capable of receiving the largest class of consignment, such as locomotives, boilers, etc. The hatchways to each of these holds have also been made as large as possible so as to facilitate the loading and discharging of this class of cargo, and they are all equipped with steam winches, derricks, and other appliances necessary for expeditiously handling heavy cargo. The propelling machinery consists of a set of triple-expansion engines with the necessary auxiliary appliances, and supplied with steam from four single-ended steel boilers working under an approved system of forced draught.

Cannavieiras.—The Ailsa Shipbuilding Co. launched from their Troon yard on August 12th a twin-screw passenger steamer, which they have built to the order of Messrs. John M. Campbell and Son, Glasgow, for Brazilian owners. The dimensions of the vessel are: 200 ft. by 32 ft. by 10 ft. 4 in. moulded to main deck, with continuous shelter deck. She is built to the highest class at Lloyd's for the South American coasting trade. Accommodation is provided for 54 first-class and 24 second-class passengers. Machinery will be fitted by the builders, and a speed of 12½ knots is anticipated. The vessel was named Cannavieiras by Miss Campbell, North Durham.

Fulgent.—Messrs. Short Bros., Sunderland, have launched the steamer Fulgent for Mr. J. Westell, Sunderland. She is built on the Isherwood system of longitudinal framing to take Lloyd's highest class, and is the first collier to be so constructed. She has been designed with extra large self-trimming hatches and clear holds to facilitate prompt loading. To secure quick discharging 16 derricks have been supplied with tables on the masts and outriggers above. The vessel is 281 ft. in length, 40¾ ft. in breadth, and 20 ft. 9 in. in moulded depth.

Ryburn.—Messrs. W. Gray and Co. have launched from their West Hartlepool shipyard recently a handsome steel screw steamer for Messrs. J. F. Murrell and Son, of West Hartlepool. The vessel will take the highest class in Lloyd's, and is of the following dimensions: Length overall, 342 ft.; breadth, 46 ft.; and a depth of 24 ft. 4 in.; with long bridge, poop, and top-gallant forecastle. The hull is built with deep frames, cellular double bottom, and large aft peak tank for water ballast, six steam winches, steam steering gear amidships, hand screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 24 in., 38 in., and 64 in. diameter, with a piston stroke of 42 in., and two large steam boilers for a working pressure of 180 lbs. per square inch.

Corbridge.—The steamer Corbridge, built by Messrs. Robert Thompson and Sons Ltd., of Southwick Yard, Sunderland, to the order of the Corbridge Steamship Co. Ltd. (Messrs. James Hoggarth and Co., managers), of Cardiff, was taken on her trial trip from the Wear. Her principal dimensions are: Length, 361 ft. 4 in.; breadth, 50 ft.; depth moulded, 25 ft. 10 in. She is classed 100 A1 at Lloyd's, and the engines are by Messrs. The North-Eastern Marine Engineering Co., of Sunderland. The trial was in every way successful.

Ryburn.—On the 8th August Messrs. Wililam Gray and Co. Ltd. launched a steel screw steamer for Messrs. J. E. Murrell and Son, West Hartlepool. She will take the highest class in Lloyd's, and is of the following dimensions: Length overall, 342 ft.; breadth, 46 ft.; and depth, 24 ft. 4 in.; with long bridge, poop, and top-gallant forecastle. The hull is built with deep frames, cellular double bottom, and large aft peak tank for water ballast, six steam winches, steam steering gear amidships, hand screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders having cylinders 24 in., 38 in., and 64 in. diameter, with a piston stroke of 42 in., and two large steel boilers for a working pressure of 180 lbs. per square inch.

Signe.—There was launched from the yard of the Sunderland Shipbuilding Co. Ltd. on August 8th a steel screw steamer, length between perpendiculars, 290 ft.; breadth extreme, 42 ft.; and depth moulded, 21 ft. 6 in.; having poop, bridge, and top-gallant forecastle, built to Lloyd's highest class under special survey. The vessel will carry 3,550 tons dead weight on a light draught of water, and is fitted with water ballast in cellular bottom and peak. There are seven steam winches, steam steering gear, large donkey boiler, and direct steam windlass are fitted. The engines are by the North-Eastern Marine Engineering Co. Ltd., Sunderland, and have cylinders 22 in., 36 in., and 59 in., by 39 in. stroke, steam being supplied by two large boilers working at a pressure of 180 lbs. per square inch.

City of Bombay.—There was launched from the yard of Palmer's Shipbuilding and Iron Co. Ltd., Jarrow, on August 8th, the screw steamer City of Bombay, built to the order of the Ellerman Lines Ltd., of London and Liverpool. The vessel is over 400 ft. long, and will receive the highest class in Lloyd's Register. Water ballast is provided for in cellular double bottom; also in deep tank and in after peak. The vessel is lighted by electric light throughout, and is fitted with a very complete system of derrick and steam winches for rapid working of cargo; she has been designed to carry about 8,400 tons dead weight. The vessel is to be fitted with triple-expansion engines also manufactured by the builders, which will give her a speed of between 11 and 12 knots.

Ellerbeck.—On August 9th the screw steamer Ellerbeck, built by the Blyth Shipbuilding and Dry Docks Co. Ltd. to the order of Messrs. Sharp and Co., Newcastle-on-Tyne, was taken to sea for trial. The vessel, which measures 255 ft. in length, has been constructed under Lloyd's special survey for their highest class. Triple-expansion engines of good power have been supplied and fitted by Messrs. the North-Eastern Marine Engineering Co. Ltd., of Sunderland, having cylinders 20 in., 33 in., and 54 in., by 36 in. stroke, working at 180 lbs. pressure, steam being supplied from two large boilers. The representatives of owners, builders, and engineers on board were highly satisfied with the results obtained on the vessel being run over the measured mile.

Izabran.—The steamer Izabran, recently built by Messrs. Wm. Doxford and Sons Ltd., Sunderland, for Messrs. Lucovich, Banaz, and Harris Ltd., London, ran her full loaded trial from the Tyne on August 4th, when a speed of 10·58 knots was registered on the measured mile. She carries 6,900 tons, and is fitted with tri-compound engines of 1,700 I.H.P., and has been built under the British Corporation survey and classification, and also receives the classification of the Austrian Veritas for their registry.

Beverley.—Messrs. Ferguson Brothers, Port Glasgow, launched on August 8th with machinery on board the first of three powerful twin-screw tugs which they are at present building for the Port of London Authority. The machinery, which has been supplied by the builders, consists of two sets of combined surface condensing engines of over 1,000 H.P. and two Babcock and Wilcox water-tube boilers. The tugs are to have complete outfits of auxiliary machinery, and will be especially adapted for working in the London docks.

Moorland.—Messrs. W. Doxford and Sons Ltd. launched from their yard at Pallion, Sunderland, this steel screw steamer, built to the order of Messrs. Charles Swales and Son, Whitby. The vessel, which carries 6,400 tons on 21¼ ft. draught, and is fitted with tri-compound engines and high-pressure boilers, is built to Lloyd's 100 A1. She is of the single-deck principle, with long bridge.

Towneley.—The new steel screw steamer Towneley, built by Messrs. Wood, Skinner, and Co. Ltd., Bill Quay-on-Tyne, to the order of Messrs. The Burnett Steamship Co. Ltd., Newcastle, left the Tyne on August 9th for her official trial trip off Whitley Bay. The propelling machinery has been constructed by Messrs. The North-Eastern Marine Engineering Co. Ltd., Wallsend and Sunderland, at their Northumberland Engine Works, and consists of a set of their latest type of triple-expansion engines having cylinders 21½ in., 35 in., 58 in., by 39 in. stroke, steam being supplied by two large steel boilers working at a pressure of 180 lbs. per square inch. During the run over the measured mile at Whitley a speed of 12 knots was attained, the engines working to complete satisfaction of all concerned.

NAVAL NOTES.

An announcement is made by the Canadian naval authorities that three British firms—Messrs. Harland and Wolff, Messrs. Swan, Hunter, and Wigham Richardson, and Messrs. Vickers, Sons, and Maxim—have asked the privilege of viewing the Admiralty plans for the 11 vessels to constitute the Canadian Navy, with the object of putting in tenders for their construction.

NOTICES OF MEETINGS, &c.

August 25th.—The Institution of Municipal and County Engineers. Irish District Meeting, to be held at Dublin. The following papers will be discussed: "Some Impressions obtained at the Brussels International Road Congress," by H. F. Gullan, A.M.I.C.E.; "The Road Board Circular from an Irish Point of View," by John W. Leebody; "Some Notes on the Main Drainage and Sewage Purification Works, Dublin," by J. G. O'Sullivan, A.M.I.C.E.; "The Scraping of Watermains," by M. Sellard.

August 26th.—The Aberdeen Municipal Society. Excursion to Mr. Lewis Morrison's, Spey Boot Works, Leadside Road.

TRADE NOTES.

H.M. Trade Commissioner for Canada reports that a Canadian Government district engineer desires British catalogues of engineers' and surveyors' instruments and supplies. The name and address of the engineer in question may be obtained by British firms on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*

Tube Mill Contract.—**Messrs. Edgar Allen and Co.,** of Sheffield, have received an order from the Waihi Paeroa Gold Extraction Co. Ltd., New Zealand, for 16 tube mills, 16 ft. by 4 ft. 3 in. in diameter, with steel fittings throughout.

Messrs. Robert Stephenson and Co. Ltd., of Darlington, have received an order for the supply of spare and duplicate parts for locomotives of the East India Railway.

Messrs. The Anderston Foundry Co. Ltd., of Haverton Hill, Middlesbrough, have received an order for steel bolts and nuts for use with steel rails, and also points and crossings for the Burma Railways.

The **Darlington Railway Plant and Foundry Co. Ltd.** has been awarded a contract for the supply of switches and crossings for use on new extension lines of the South India Railway.

Mr. A. H. Brown, naval architect, 25, Ryder Street, London, has placed an order for a steam yacht of about 700 tons with **Messrs. Ramage and Ferguson Ltd.,** Leith, for a foreign owner.

Messrs. Henderson Brothers Ltd. (the Anchor Line) have contracted with **Messrs. Stephen and Sons,** Lenthouse on the Clyde, to build two large cargo and passenger steamers for thei rtrade from Glasgow and Liverpool to Calcutta. The new vessels will be 410 ft. in length and 53 ft. in breadth, and will have a dead-weight capacity of 8,500 tons.

President Taft has authorised the acceptance of the tender sent in by **Messrs. William Simons and Co.,** of Renfrew, to build a steel ladder dredger for the Panama Canal. Messrs. Simons' tender was for $399,340, over 50 per cent less than the only American tender submitted.

CORRESPONDENCE.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only; and if accompanied by sketches, these should be neatly drawn, and forwarded on a roll, to prevent creasing. We cannot undertake to return rejected communications, or to reply to inquiries by letter. In all cases letters must be accompanied with the name and address of the writer.

We do not hold ourselves responsible for the opinions of our Correspondents.

ALUMINO-THERMIC METHOD OF WELDING.

To the Editor of "The Practical Engineer."

Sir,—With reference to article in *The Practical Engineer* of July 29th, "Alumino-thermic Method of Welding," would you be so kind as to give the proportions which constitute the powders, namely, welding, compound, and ignition powder, or to say where the powders may be had.—Yours, etc.,

Constant Reader.

[Full particulars can doubtless be had on application to Thermit Ltd., 27, Martin's Lane, Cannon Street, E.C.—Editor.]

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2261. **Manganese and Chrome Steel.**—I shall be very much indebted to any reader for a reliable method for distinguishing manganese and chrome steel from ordinary cast steel, and from each other?—M. K. H.

2268. **Dimensions of Engine.**—Should esteem it a great favour if any reader could give me suitable dimensions for inlet, transfer, and exhaust ports for two-stroke engine $2\frac{3}{4}$ in. bore by 3 in. stroke, also compression ratics in cylinder and cylinder case. Do you know of any simple method of ascertaining these dimensions?—A. P. S.

2269. **Brazing Sheet Brass.**—Can a reader of *The Practical Engineer* inform me of a firm where I can buy metal suitable for brazing sheet brass up to $\frac{1}{32}$ in.? Also metal for repairing aluminium utensils, or books relating thereto?—F. T.

2270. **Hand Portable Boring Bar Rig.**—Will any reader give rough sketch of an up-to-date light and handy hand portable boring bar rig for boring out the stern posts of small vessels, small steam boats, tugs, etc.; largest bore 8 in. diameter? Any information on this subject as regards the making of same would greatly oblige.—Stern Post.

MISCELLANEA.

Change of Address.—Messrs. John Davis and Son (Derby) Ltd., Derby, notify us that they have removed their London offices to Angel Court, 8, Friday Street, E.C.

Mechanical Coal Cutting.—It is estimated that there are now about 1,700 mechanical coal cutters at work in Great Britain. More than half of these machines are worked by compressed air. Mechanical coal cutters have come into most use in East Scotland and the Midlands.

London's Water Supply.—The new reservoir at Chingford has a capacity of 3,000,000,000 gallons of water. The daily supply is about 226,000,000 gallons, sufficient to fill a canal 85 miles long by 20 ft. wide by 4 ft. deep. This gives approximately 32 gallons per head of population daily.

Company Registrations.—According to the January-June report of "The Investors' Guardian" Co., registrations in engineering have been steady, textile manufacturing being quiet, electric enterprises very depressed, and motor and carriage registrations have dropped to the lowest level reached for many years past.

Glasgow Harbour.—The Clyde Navigation Trustees have decided to deepen the river channel so as to meet the increased size of vessels. The work is to be carried out continuously from Yorkhill, Glasgow, to Newark Castle, near Greenock. The depth is to be increased by 2 ft. to provide a depth at low water of 23 ft. to $24\frac{1}{2}$ ft., thus permitting vessels drawing 31 ft. to leave the harbour two hours before high water.

We have received from the Town Clerk of Aberdeen a very interesting 21-page pamphlet, concluding with a map of the city, published by the Development Committee of the Corporation, with the object of making known the attractions of Aberdeen both as a suitable centre for new industries and as a residential city. Copies of the pamphlet and any further information will be forwarded on application to the Town Clerk, Aberdeen.

German Aeronautic Regulations.—In view of the accidents which have recently occurred with aeroplanes, the President of Brandenburg has issued an ordinance applying to that province and to Berlin whereby all persons who do not possess the aviator's certificate of the Federation Aeronautique Internationale are prohibited from undertaking flying machine ascents for spectacular purposes and cross-country flights. Notice of exhibition flights must be given to the police three days beforehand.

PATENTEES' CHRONICLE

OF

Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

AUGUST 8th, 1910.

18620 Wheels. Boult.
18621 Roller skates. Yoxall.
18622 Conduit fitting manf. Brampton.
18623 Steam pipe ball joint. Kewney.
18624 Talking machines, etc. Eyekiel.
18625 Puncture finder. Jones.
18626 Manf. of hemiterpenes, etc. Silberrard.
18627 Postal cards. Valentine.
18628 Pudding cloth. Braham.
18629 Cases for pottery, etc. Burgess.
18630 Wheels. Lanchester.
18531 Propulsion of vehicles. Lanchester.
18632 Sheep shearing, etc. Walton.
18633 Carriage hoods. Penman.
18634 Bucket manf. Smith.
18635 Stop valves. Ingram.
18636 Railway buffers. Gatwood.
18637 Dough working machine. Mason.
18638 Roller device. Taylor.
18539 Extensible brush handle, etc. Taylor.
18640 Message restante board. Tibbetts.
18641 Helical circulators. Baird.
18642 Relating to pneumatic tyres. Murison.
18643 Game. Scamp.
18644 Unpuncturable tyres. Culverwell.
18645 Pipe and joint. Bellamy.
18646 *Steam boiler, etc. Rosenthal.
18647 Foot stool. Hannoh.
18648 Metal coating device. Harris.
18649 Conveyors. Walton.
18650 *Rolling mills. Versen.
18651 Amusement device. Bickford.
18652 Tube. Bickford.
18653 Pipe. Dave.
18654 Tobacco pipes. Douglas.
18655 Seats, etc. Shepherd.
18656 Electric lamp holder. Amherst.
18657 Rail laying device. Little.
18658 Cable screening device. Carl.
18659 *Key locking device. Bley.
18660 *Braces. Bley.
18661 *Aeroplanes. Marcay.
18662 Cranes. Morrison.
18663 Coupling, ets. Foulshan.
18664 Fuse for projectiles. Keeson.
18665 Mash tuns. Russell.
18666 Packing cases. Violet.
18667 Cooking utensils. Lane.
18668 *Sheet embossing mills. Chartener.
18669 Sofa beds. Hulton.
18670 *Safety device for railways. Siemens.
18671 Pneumatic tyres. Motyeka.
18672 Advertising device. Wilkinson.
18673 Veil adjustments. Killingsworth.
18674 Internal-combustion engine. Martin.
18675 Airships. Brown.
18676 *Package wrapping device. Felmlee.
18677 Plate for rectifying distillation columns. Perks.
18678 *Indicating electric calls. Viette.
18679 Iron, etc., production. Simpson.
18680 Means for sterilising water. Rideal.
18681 *Check tills. Martin.
18682 Musical horns. White.
18683 *Aeronautical craft. Dugins.
18684 Air brake system. Cota.
18685 *Diamond cutting. Leperre.
18686 *Safety lock. Kotkowsky.
18687 *Cutting key bits. Kotkowsky.
18688 *Vehicles. Twombly.
18689 *Lamps. Krone.
18690 Presses. Boult.
18691 *Motor cylinders. Bowibean.
18692 Bandage. Musson.
18693 *Dough working machine. Zarth.
18694 *Treatment of gases. Barnard.
18695 Electro-plating apparatus. Cunning.
18696 Beer brewing. Kuhn.
18697 Electric signs. Gallanzi.
18698 *Treatment of gases.
18699 *Actions for grand pianos. Lake.
18700 *Spirit level. Stamm.
18701 Aeroplanes. McHardy.
18702 *Shelf adjustment. Metler.
18703 Liquid meter. Galbraith.

AUGUST 9th, 1909.

18704 Blast pipe. Kay.
18705 Penal compasses. Bayly.
18706 Internal-combustion engine. Wright.
18707 Tyres. West.
18708 Wickless lamp. Guy.
18709 Match receptacle. Davies.
18710 Pipe grip. Dunn.
18711 Envelopes. Ford.
18712 Golf ball manf. Chambers.
18713 Coupling. Price.
18714 Talking machine. Tibbits.
18715 Treatment of stone, etc. McLelland.
18716 Treatment of stone, etc. McLelland.
18717 Treatment of stone, etc. McLelland.
18718 Knife, etc., sharpener. Green.
18719 Tobacco pipe mounts. Osborne.
18720 Coal mine safety device. Bailey.
18721 *Card punching machine. Schoenfeld.
18722 Dress guard for cycles. Hutfield.
18723 *Casting reels. Illingworth.
18724 Cash register. Simm.
18725 Flushing apparatus. Adams.
18726 *Railway ties. Morris.
18727 *Staple setting machine. Michell.
18728 Needle point case. Jackson.
18729 Relating to drawing instruments. Jackson.
18730 Clothes prop. Grainger.
18731 Shields for wounds, etc. Hampden.
18732 Sausage machines. Parish.
18733 Electric vehicles. Wilkinson.
18734 *Chair bedsteads. Page.
18735 Carburetter. Williams.
18736 *Metallic sieve. Reynolds.
18737 *Knife cleaner. Madel.
18738 *Electric lamp. Weissmann.
18739 *Propulsion mechanism. Cake.
18740 Internal-combustion engine. Arnott.
18741 Carburetter. Maude.
18742 *Indicator. Gilliatt.
18743 *Drying machine. Mitchell.
18744 *Window screens. Peterson.
18745 *Scale dials. Cochran.
18746 Door handle. Bailey.
18747 *Saddle. Love.
18748 Trunks. Baudier.
18749 Dog houses. Schulz.
18750 Railway carriages. Hanelt.
18751 *Cigar case. Lindau.
18752 *Cylindrical vessels for liquids. Schmidt.
18753 *Curtain cord guide. Nesle.
18754 Stoves. Thomas.
18755 Game. Dorwald.
18756 Pump. Rose.
18757 Draught excluder for doors, etc. Thornley.
18758 *Vaginal appliance. Glover.
18759 Box. Dear.
18760 Printing machine. Pollard.
18761 Indigo manf. Imray.
18762 *Jacquard machine lifts.. Carver.
18763 Wheels. Thomson.
18764 Borax manf. Wagner.
18765 *Controlling device. Western.
18766 *Tyre holder. Alperin.
18767 *Weighing machine. Hedman.
18768 Treatment of liquids. Henri.
18769 Toy animal's eyes. Trager.
18770 Postcards. Bawtree.
18771 *Operation tables. Down.
18772 *Table for surgical use. Down.
18773 Wheels. Carmichael.
18774 *Piano player. Lake.
18775 Necktie, etc., holder. Green.
18776 Cement houses. Crook.
18777 *Anti-friction bearings. Struebner.
18778 *Pencil cases. Glöckner.
18779 *Tobacco pipe. Ingham.
18780 *Surface hardening tantalum. Marks.
18781 *Combustion motors. Offenbacher.
18782 *Ice manf. Model.
18783 Detachable rims, etc. Galley.
18784 *Illuminating indicator. Junghans.
18785 *Insertion of spindles in cops. Herzog.
18786 *Measuring device. Tobias.
18787 *Driving device for printing presses. Lake.
18788 *Stamp affixing device. Wass.
18789 Lifebuoys. Saunders.
18790 *Cash register. Haddan.
18791 *Cash register. Haddan.
18792 *Internal-combustion engine. Leoni.
18793 Fire-proof shutters. Clark.
18794 Ignition apparatus. Smith.
18795 *Railway brake mechanism. Luard.
18796 Sheaf binders. Kington.

AUGUST 10th, 1910.

18797 Ovens. Smith.
18798 Hatpins. Fox.
18799 Range finder. Barr.
18800 Clothes pin. Macdonald.
18801 Electric lamp holder. Wheelwright.
18802 Soap preparation. Hargreaves.
18803 Hairpin. Cleary.
18804 Broom handle fastener. Williams.
18805 Trousers guard. Shore.
18806 Life saving garments. Wright.
18807 Internal-combustion engine. Lindblom.
18808 Pumps, etc. Watson.
18809 Fishing vessels. Reid.
18810 Variable speed gear. Stuart.

18811 Bed table. Hulton.
18812 Flash lamp. Millichamp.
18813 Puncture finder. Gough.
18814 Extractor for condenser tubes. Murnaga.
18815 Looms. Livesey.
18816 Printing machine. Seville.
18817 Disinfecting apparatus. Burton.
18818 Relating to garments. Gundy.
18819 Motor cycle saddle. Rushton.
18820 Leather for belting. Galloway.
18821 Electric lamp. Gill.
18822 *Game. Green.
18823 *Filter beds. Leigh.
18824 Braces. Rickards.
18825 Furnaces. Tunks.
18826 Maturation of potable spirits. Hunt.
18827 Explosives. Silberrard.
18828 Explosives. Silberrard.
18829 *Machine guard. Klein.
18830 Toilet tables. Sippel.
18831 Closet seat guard. Fischer.
18832 Masonry construction. Zapletal.
18833 Buckles. Davidge.
18834 Letter, etc., file. Hymans.
18835 Door fastening, etc. Young.
18836 *Air, etc., compressing, etc. Jaeger.
18837 *Electric motor winding. Siemens.
18838 Toy. Drummond.
18839 Aerial life saving device. Cowley.
18840 Boot finishing. Rudkin.
18841 Taps. Ives.
18842 Magazine, etc., holder. Blake.
18843 Release for animals. Heinze.
18844 *Fuel economiser. Browning.
18845 *Separating device. Marshall.
18846 *Letter box. Shepherd.
18847 *Aiming device for guns.
18848 *Electric motor. Siemens.
18849 Ash holder. Fuller.
18850 *Electric vehicles. Cooper.
18851 Moving picture films. Madaler.
18852 Explosion engine. Brewer.
18853 *Feed device for typewriters. Kanzler.
18854 *Mechanical stoker. Lundbon.
18855 *Raising submerged ships. Burdfield.
18856 Oil lamps. Friedl.
18857 Pump Lush.
18858 Tobacco cartridge. Law.
18859 Relating to footwear. Boult.
18860 Cigar, etc., holder. Cresswell.
18861 Hatpins. Braig.
18862 Buffers. Johnston.
18863 Flying machines. Wilson.
18864 Split guide for cap twisting. Mortimer.
18865 Rail supporters. Hall.
18866 *Hydraulic pump, etc. Mueller.
18867 Wire securing device.
18868 Signalling system. B. T.-H. Co.
18869 Electric switch. Price.
18870 Toilet pin manf. Lewis.
18871 *Removing incrustation in boilers. Ruggles.
18872 *Gas regulator. Buwalda.
18873 *Fuses for explosives. Hale.
18874 Road making, etc. Lant.
18875 Liquid raising device. Chipchase.
18876 *Tobacco pipe. Grandclement.
18877 Ball bearings. Humphreys.

AUGUST 11th, 1910.

18878 Governors for gas, etc. Milne.
18879 Cash register. Gledhill.
18880 Carriage door lock, etc. Caygill.
18881 Aerial machine. Boulton.
18882 String cutter. Wright.
18883 Composing machine. Bowman.
18884 Bucket. Iisherwood.
18885 Bread manf. Higginbottom.
18886 *Cigarette sorting. Boult.
18887 Mixing device. Egerton.
18888 Float calf feeder. Brantom.
18889 *Moving heavy goods. MacLeod.
18890 Advertising device. Klaber.
18891 Knitting bags. Tatton.
18892 *Carpet weaving. Sandeman.
18893 *Paint brush. Hall.
18894 Safety submarine. Knifes.
18895 Tobacco pipe. Cooke.
18896 Concentrated tea, etc. Bray.
18897 Tobacco pipe filler, etc. Hoyle.
18898 Sewing machine. Heaton.
18899 Stair rod, etc., eye. Briscoe.
18900 Trousers press. Whitworth.
18901 *Needle threading. Fuller.
18902 *Internal-combustion engine. Bachtold.
18903 Elastic tyres. Beldam.
18904 Measuring instrument. Leary.
18905 Friction clutches. Coulter.
18906 Valveless engine. Filmer.
18907 Lace fastener. Sale.
18908 Grape box. Hamilton.
18909 Music desk. Andrews.
18910 Collar stud. Fletcher.
18911 Tram, etc., seats. Morgan.
18912 Photo toning, etc., solution. Simpson.
18913 Fountain pens. Boonzaier.
18914 Buildings. Bramwell.
18915 *Automobiles. Antunes.
18916 *Electric lamps. Midgley.
18917 *Typewriters. Fairweather.
18918 *Gas-lamp extinguisher. Deutsche.
18919 Signalling practice device. Eckhardt.
18920 *Hair, etc., dyeing.
18921 *Hair, etc., dyeing.
18922 Charging coke ovens. Hiby.
18923 *Field ordnance. Deport.
18924 Musical device. Vaughan.
18925 Priming malt liquors. Heron.
18926 *Elastic bullets. Gabet.
18927 *Hairpin. Mergner.
18928 *Amusement device. Crosier.
18929 *Scrapers for block machine. Marks.
18930 *Artificial leather manf. Forel.
18931 Isolation of cellulose. Silberrad.
18932 Tobacco cartridge case. Evans.
18933 *Tobacco pipes. Evans.
18933 *Tobacco pipes. Evans.
18934 Packing machine. Herlitschka.
18935 Electric telegraphy. Brown.
18936 Pneumatic wheels. Williams.
18937 Showcards. Clifford.
18938 *Spirit manf. Brangier.
18939 *Furniture castors. Loel.
18940 Angling device. Spratt.
18941 *Line casting machine. Boult.
18942 *Tin opener, etc. Standberg.
18943 Concentration of copper ore.
18944 *Valves. Malley.
18945 *Ferro-managanese manf. Musener.
18946 *Ignition machine. Boult.
18947 Railway line points. Walker.
18948 Electric signalling. North.
18949 Ship's speed recorder. Henderson.
18950 Sifting apparatus. Loison.
18951 Photo print taking. Simoni.
18952 Nails, etc. Sursham.

AUGUST 12th, 1910.

18953 Stoppers. Best.
18954 Hat rack. Alderson.
18955 Golf caps, etc. Phillips.
18956 Carriage door lock. Pirie.
18957 Turbine. Alquist.
18958 Mirror. Cleary.
18959 Fire lighter. Sullivan.
18960 Dust bins. Sagar.
18961 Crane. Willis.
18962 Ovens, etc. Lunt.
18963 Looms. Whalley.
18964 Race game. Knapton.
18965 Coin freed apparatus. Breakell.
18966 Beaming, etc., yarns. Walker.
18967 Gas fires. Aird.
18968 Compound rails, etc. Summer.
18969 Relating to organic bodies. Higgins.
18970 Photo apparatus. Ratledge.
18971 Printing, etc., machine. Graber.
18972 Electric light device. Barry.
18973 *Massage apparatus. Heywood.
18974 *Loose leaf binder. Hare.
18975 Sweeping apparatus. Constable.
18976 Collar studs. Thomas.
18977 *Box manf. Nasmith.
18978 *Golf balls. Cochrane.
18979 *Hat brush. Ashworth.
18980 *Three-speed hubs. Harley.
18981 *Ventilator. Altoun.
18982 Tyre. Hellian.
18983 Notebook. Stokoe.
18984 Measure for floor cloth. James.
18985 Sewage apparatus. Adams.
18986 Tyres. Hudson.
18987 Relating to carding engines. Beech.
18988 Relating to carding engines. Beech.
18989 Relating to carding engines. Beech.
18990 Device for delivering measured quantities. Pulsford.
18991 Dress hooks. Dickinson.
18992 Beer canisters. Jacob.
18993 Carburetters. Norman.
18994 Flying apparatus. Haynes.
18995 *Air compressors. Francois.
18996 Utilising mechanical friction. Evershed.
18997 Optical prism. Ahrens.
18998 Toy. Winzer.
18999 Lamp. Pattison.
19000 *Dye manf. Bloxam.
19001 Muscle developer. Wareham.
19002 *Loco. spark arrester. Notter.
19003 *Door locks. Dunn.
19004 *Advertising device. King.
19005 Steering device. Robinson.
19006 *Kneading machine. Aldred.
19007 *Soap, etc. Squadrilli.
19008 *Ascertaining ignitable admixture in air. Breitbart.
19009 *Advertising device. Engelschmidt.
19010 *Nonslip plate. Rougeon.
19011 Corset stiffeners. Allen.
19012 *Delivery pipe. Warren.
19013 Balloon. Hunt.
19014 Refrigeration apparatus. Sullivan.
19015 *Seal padlock.
19016 Tyres. Musköller.
19017 *Aeroplane, etc., steering. Wetterwald.
19018 *Carriage coupling. Stockburger.
19019 *Heaters. Leonard.
19020 *Sewing machine shuttle. Dow.
19021 *Lasting machine. Brothers.
19022 *Gas producer. Mathot.
19023 Churn. Jones.
19024 Artificial ageing of wines, etc. Jarrand.
19025 Wearing apparel. Tucker.
19026 Aviation motor. Letombe.
19027 *Fork. Borge.
19028 Tyre. Drury.
19029 Relating to airships. Lutter.
19030 *Filaments. Arsem.
19031 Signalling systems. B. T.-H. Co.
19032 *Massage apparatus. Johansen.
19033 *Lamp holder. Beige.
19034 *Ploughs, etc. Santachiara.
19035 *Writing tablets. Schambony.
19036 *Copyists' indicator apparatus. Gladman.
19037 Rock drill. Stephens.
19038 Motor hoods. Angus.

AUGUST 13th, 1910.

19039 *Solution of ammonium sulphate. Fabry.
19040 Tobacco pipe. Mackenzie.
19041 Match box. O'Hara.
19042 Hat guard. Morton.
19043 Talking machine. Ezekiel.
19044 Electric clock. Bentley.
19045 Hat binder. Flynn.
19046 Liquid taps. Mason.
19047 Pen clip. Ainsbury.
19048 Curtain ring. Mitton.
19049 Speed gear. Wild.
19050 Drying, etc., textile fabrics. Milligan.
19051 Oil manf. Bettcher.
19052 Perambulator. Rushworth.
19053 Signal apparatus. Nagel.
19054 Stamp affixing device. Haas.
19055 Dyeing machine. Brooks.
19056 Dental chairs. Chatterton.
19057 Wood-working vices. Mellis.
19058 Cycle signal. Du Cross.
19059 Cycle signal. Du Cross.
19060 Treatment of consumption. Glasspool.
19061 Cleaning device. Houghton.
19062 Spinning frame. Jackson.
19063 Ring spinning. Davies.
19064 Rolling strip. Moore.
19065 Amusement. Maudsley.
19066 Nut locking device. Treade.
19067 Fountain pens. Johnston.
19068 *Calculating machine. Leder.
19069 Lock nuts. Havenhand.
19070 *Bedstead. Adshead.
19071 *Electric switch. Davies.
19072 *Window fastener. Batt.
19073 *Gas mantles. Skriwan.
19074 Treating ammoniacal liquids. Lowe.
19075 Electric recorder. Johnson.
19076 Bottle stopper. Barwens.
19077 *Electric lamp. Siemens.
19078 Amusement. Huber.
19079 Descriptive labels. Breffit.
19080 Pumps. Dunlop.
19081 Pencil protector. Miller.
19082 Razor strop. Miller.
19083 Internal-combustion engine. Ellis.
19084 *Grinding mills. Lange.
19085 Buffing machine. Hope.
19086 *Aeroplane, etc., steering. Gaara.
19087 Levers. Gilbert.
19088 *Sterilisation of milk, etc. Arnold.
19089 Speed gear. Leader.
19090 *Internal-combustion engine. Gill.
19091 *Upholstering material. Eriksson.
19092 *Feed blending machine. Craig.
19093 *Electrical instrument. Hardingham.
19094 Boots, etc. Hyde.
19095 *Tungsten filament manf.
19096 Reservoir pens. Shand.
19097 Safety lamp. Boult.
19098 *Indicating device for motor cars. Faulkner.
19099 *Firearms. Searle.
19100 *Washing machine. Lofquist.
19101 Spring motors. Harvey.
19102 *Telegram transmitting. Carpentier.
19103 Sailing craft. Splinar.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to September 19th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

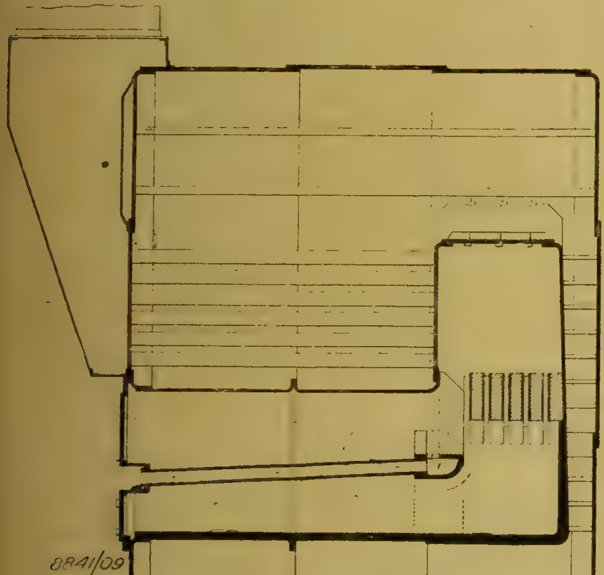
1908.

10021 Marks (McClean Arms and Ordnance Co.): Automatic machine guns. 24309 Morgan and Kemp: Explosion turbines. [Post-dated May 11th, 1909.]

1909.

8841 Cowper-Coles: Construction of furnaces.

Relates to furnaces of the kind in which coal is usually burnt and wherein the inner end of the furnace is closed, the air for combustion being supplied through hollow firebars above the fuel, the products of combustion from which pass downwards between the bars, and the invention consists in providing the combustion chamber of such furnaces with an arch of refractory material. According to the present arrangement the furnace is constructed with hollow firebars which are open at the outer end so as to permit of the passage of air through the same, the air emerging at the inner ends of the bars into an air box, the upper part of which is open to the space between the fuel being burnt and the surface to be heated in a known manner, the furnace being closed at its inner end. The air which passes through the hollow firebars becomes heated during its passage, and on issuing from the ends thereof is deflected downwards on to the fuel upon the firebars. As the rear end of the furnace is closed, the ashpit is also closed by a door at its front part, the fire burns downwards, the products of combustion being drawn through the spaces between the firebars and passing into a combustion chamber at the rear of the furnace, the combustion chamber being provided with an arch or the equivalent of a suitable refractory material.



8857 Hay: Steam generators. 11311 Seropian: Non-skid device for wheel tyres for motor cars and the like. 11387 Loibl: Mattresses. 13443 Berry and Markham: Protected or armour-clad electric switch fuses. 13460 Sherwood: Corsets. 13569 Baveystock: Folding carriages for children. [Post-dated December 9th, 1909.] 13580 Wagoner: Devices for holding or clamping sheets of paper or other material. 13702 Coplans: Process for the rapid preparation of potable water, the process being applicable for other like purpose. [Cognate Applications. 14874, 1909, 21135, 1909, and 27155, 1909.] 13853 Humphris: Aerial machines. [Cognate Application. 26165, 1909.] 13964 Howorth: Gas fittings for new or existing domestic ranges. [Post-dated July 10th, 1909.] 14285 Horton: Combined measure or measures and funnel. [Post-dated December 18th, 1909.] 14874. *See* 13702, 1909. 15888 Leitner: Automatic battery overcharge preventer. 15894 Reckard: Photo-mechanical process for engraving or etching printing surfaces. 15902 Levie: Photographic cameras. 15954 Briggs: Flexible metallic clamp band for water-closet basin and soil pipe connection. 15960 Flood: Electrolytic cell.

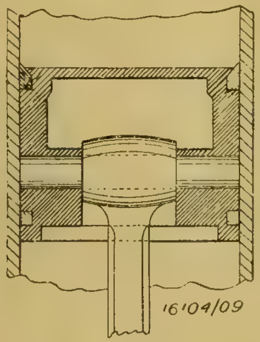
15989 Reynolds: Manf. of crucible steel.

The primary objects of this invention are to minimise the loss by oxidation of alloy substances, such as tungsten, added to the charge of iron or steel in the crucible in the manufacture of crucible steel and to minimise wear and tear of the crucibles, and with these objects, instead of charging the crucible with bar iron, together with all or a portion of the alloying substances, as in present practice, the crucible is charged with a mass of steel of suitable composition and preferably of a shape and size to fill or substantially fill the crucible, such mass of steel having a cavity in it for the reception of alloying substances or reducing agents, which cavity is then closed by means of a steel plate or plug fused or driven into the opening of the cavity or in lieu thereof a plug of other suitable material, for example, material similar to the crucible itself.

16013 Taylor and Pick: Cranes. 16070 Ratner: Incandescent gas lamps.

16104 Bradford, Bradford, and Appleyard: Pistons for steam, internal-combustion, and other engines.

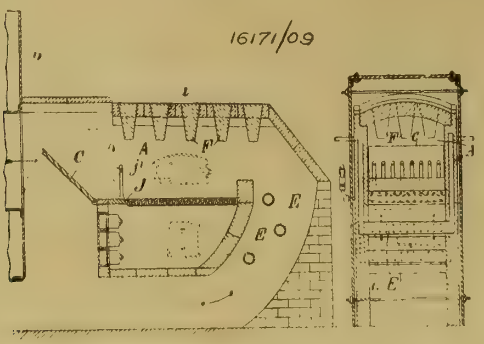
Relates to improvements in the formation, construction, and mounting of packing rings for and upon pistons of steam, internal-combustion, and other engines, the same being of the character that enables the pressure within the cylinder to be employed for causing the packing ring to form a joint with the cylinder walls by the pressure acting upon the walls of the rings which are at an angle other than a right angle to the walls of the cylinder. The invention consists in carrying out the formation of these parts in a comparatively simple manner so that they may be applied. The piston rings are constructed so that the surface of each ring, which is at an angle other than a right angle to the inner wall of the cylinder, shall extend beyond the end surface or wall of the piston upon which it is mounted.



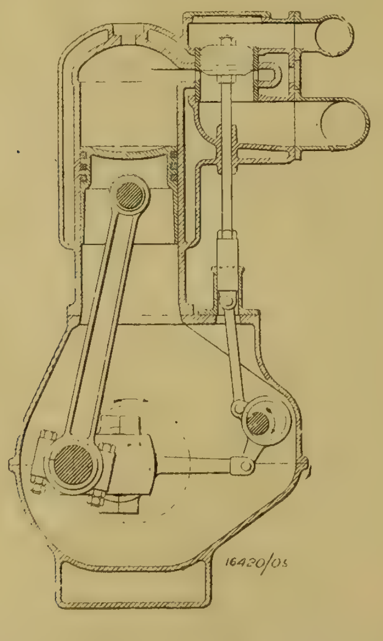
16128 Petersen: Small arms. 16150 Ruthven and Donlan: Manf. of wire screening. 16168 Morganti: Stop motion and indicating mechanism for intermediate, roving, and jack-fly frames. [Date applied for under International Convention, July 11th, 1908.]

16171 Byrne, Rogerson, Bradshaw, and Schweizer: Furnaces or apparatus for consuming smoke and the like.

The invention relates to improvements in furnaces or apparatus for consuming smoke and the like in which the smoke is not only consumed, but the calorific value of the smoke made use of in a much more effective manner than with similar apparatuses at present employed, and relates more particularly to that kind of furnace in which smoke is brought from a separate boiler furnace, but it can also be utilised for consuming the smoke from its own fire. Hitherto such apparatuses have not been satisfactory inasmuch as the whole of the smoke has not been completely consumed, and consequently the calorific effect is considerably reduced. The fire in the furnace chamber A having been lighted and the chamber in such a condition as to receive the smoke from the boiler, the damper C is opened by means of a lever and the smoke is allowed to pass from the boiler flue between, over, and about the fingers of a dead plate J in an upward direction over the fire. Air is admitted and if necessary may be heated before being admitted into or circulating through or about the blocks of the fire chamber. On passing over the fire bridge the smoke encounters the baffle plates or blocks F, the heat from the fire of the chamber being at incandescent or white heat completely or almost completely consumes the smoke, but should any smoke remain unconsumed at the time it reaches the pipes E at the back of the furnace such unconsumed smoke will on reaching the air pipes or the hot air passing therefrom be completely consumed.



16172 Willans and Robinson Ltd., and Peache: Two-stroke cycle internal-combustion engines. 16214 Lean (Schnellsetzmaschinen Ges.): Method and means for setting type by means of register bands. 16219 Douglas: Clutches. 16220 Marx: Apparatus for saving pulp in the manf. of paper, also applicable for concentrating pulp. 16231 Keck: Combination toy carriage. 16239 Langhans: Mantles for incandescent burners. 16242 Marks (Slack): Method of and apparatus for cutting metal by abrasion. 16250 Bates, Silvester, and British United Shoe Machinery Co.: Lasting or like machines. 16267 Street: Internal-combustion engines. 16313 Palmer: Photographic screen plates for natural colour photography. 16319 Fowler: Tunnelling machine. 16350 Plant: Lasting machines. 16352 Stone: Compound for impregnating fabric or cloth used for cleaning and polishing metals. 16369 Fasting: Pneumatic apparatus for filling into receptacles finely pulverised or grained substances. 16395 Wilson: Attachment of flyers to flyer spindles. [Application for Patent of Addition to 27306, 1908.]



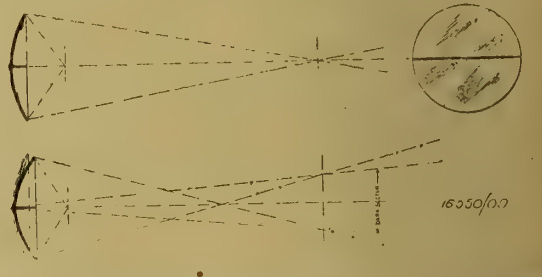
16420 Berry and Mann: Valves and valve gear for internal-combustion engines.

Relates to internal-combustion engines of the "Otto" or four-stroke cycle type. In this type of engine it is usual to employ separate inlet and exhaust drop valves which are closed by means of springs and have their opening effected by means of cams mounted on a second motion shaft driven from the engine shaft in the ratio of two to one; or in the case of an engine fitted with only a single piston or slide valve it has before been proposed to actuate the valve mechanically through the medium of a positive cam situated on the half-speed shaft or by a combined cam and spring arrangement in connection with the half-speed shaft or engine shaft. According to the invention the valve is reciprocated by a mechanism consisting essentially of two eccentrics or cranks fixed on independent shafts, one of which is the engine shaft, while the other is revolved at half the engine speed, and working on or connected to the eccentric situated on the half-speed shaft is a rocking lever which is vibrated by the eccentric and the combined movement of the other eccentric through the medium of a connecting rod or link. This rocking lever is coupled up by means of another link to the valve rod of the engine, and the positions of the two eccentrics in relation to each other are so arranged that from about the middle of the exhaust stroke to about the middle of the suction stroke they both tend to move the valve in the same direction, while from about the middle of the compression stroke to about the middle of the ignition stroke they tend to neutralise each other and so hold the valve stationary or almost stationary.

16426 Hotchkin: Operating tables, chairs, and the like for surgical purposes. 16437 Webster: Preparations for the hair. 16467 Oviedo: Fire alarms. 16494 Johnston (Bull): Flying machines. 16539 Drummond: Means for controlling and facilitating the vaporisation and combustion of liquid fuel. 16541 McCollum: Railway signalling apparatus. 16547 Ross: Electric heaters.

16550 Parsons and Stoney: Reflectors for projectors and the like.

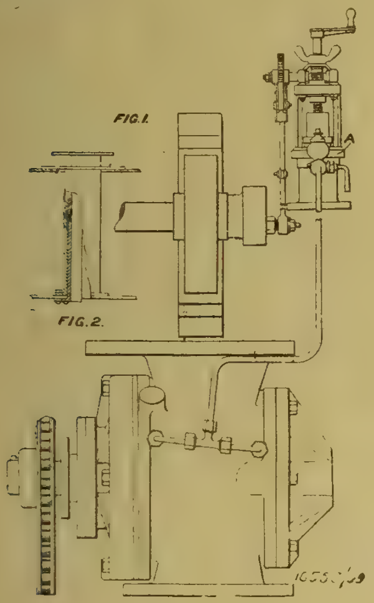
In some cases with projectors and searchlights it is necessary to produce not only a beam of light collected from a luminous source which shall have practically equal illuminating power in all parts of the beam, but to produce a beam of light with a dark portion generally in the centre of the beam or with a dark band across. For instance when ships are passings through the Suez Canal at night it is necessary to be able to illuminate the banks of the canal for navigation purpose, but in order that an approaching ship may not be dazzled by the light of the projector the beam produced must have a dark centre when another ship is approaching. This dark centre has been obtained previously in various ways such as by a suitable shutter placed generally in front of the front glass of the projector. It is evident that this method entails the loss of a certain amount of light depending, of course, upon the area of the shutter. The invention consists for this purpose in dividing a reflector of any suitable curvature into a plurality of parts, these parts being so connected together that the angle between them can be varied whereby the light reflected from each part may be combined to form a single beam which may be of variable width or be made to form a plurality of beams.



16551 Smith: Adjustable support for mirrors and the like.

16553 White: Apparatus for the discharge of ashes and other material from ships and other places below the water line.

This invention relates to improvements in apparatus for discharging ashes and other material, the type of apparatus concerned being that provided with a revoluble chambered plug, or equivalent valvular device, into which the ashes pass and from whence they are discharged by fluid or liquid pressure into the sea. The invention has for its object to prevent, reduce, or minimise the wear or erosion of parts of the apparatus due to the gravity or abrasive nature of the material expelled. According to this invention the casing containing the chambered plug, or similar valvular device, is connected with a lubricator A, fig. 1, of the kind provided with means for either mechanically or automatically supplying at intervals a certain amount of thick oil, or grease, or similar lubricant to the casing to prevent or reduce the wear of the plug or the like and of the casing. In order to reduce or minimise the wear in the discharge pipe leading from the valvular device to the sea the discharge pipe is at its outlet provided with easily applied and removable wearing parts or liners, as shown in fig. 2, or alternatively the lower part of such discharge pipe is made so as to be easily removed and replaced by a new suction when worn.

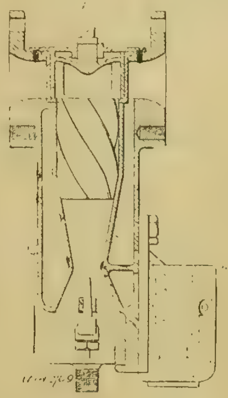


16574 Summerhill: Coating metallic surfaces, such, for instance, as of metal sheets, plates, bars, cisterns, tanks, bowls, cooking utensils, and the like. 16613 Gibson: Machines for cutting the grass at the edges of lawns or the like. 16627 Bates, and British United Shoe Machinery Co.: Power-driven pincer-lasting machines. 16630 Akt.-Ges. Brown, Boveri, et Cie.: Regulation of electric installations. [Date applied for under International Convention, September 16th, 1908.] 16672 Markus: Manf. of heel pads from manufactured rubber waste. 16675 James Challis Ltd., and Challis: Device for exhibiting showcards, glass tablets, photographs, and the like. 16676 Thompson: Inking devices of platen printing presses. 16682 Jackson: Trolley heads employed for electric traction. 16746 Rhodes, Jones, and Garnett: Gas burners. 16808 Bates, and British United Shoe Machinery Co.: Sole-bevelling and like machines. 16841 Strickland: Tobacco-stemming machines. 16867 Mackintosh: Cooking utensils, mess tins, or the like. [Cognate Application. 1481, 1910.] 16905 Van den Bergh and King: Shock-absorbing springs. 16923 Adair, Cameron, and Ainsworth: Machine for hemming handkerchiefs. [Date applied for under International Convention, July 25th, 1908.] 16924 Proctor: Electric arc lamps. 17012 Holmes: Sterilisation of ships' refrigerating or cold storage chambers or of other structures or interiors. 17030 De Fazi: Treatment of shale oil for the obtainment of a product, more especially intended for use in working internal-combustion engines. 17036 Von Kapff and Nitritfabrik Akt.-Ges.: Process for producing cellulose formate. 17038 Robinson: Wheels for roller skates. 17095 Matthewman: Tube cutters.

17148 Morgan and Wood: Carburetters for internal-combustion engines using liquid fuel.

This invention relates to carburetters for internal-combustion engines using liquid fuel, and of the type in which provision is made for an additional supply of liquid fuel which is constant in quantity, notwithstanding the varying demands of the engine, and is the same quality as that supplied to the spraying nozzle. The invention consists in a carburetter of the above type in which means are provided for evaporating the additional supply solely or partly by external heat.

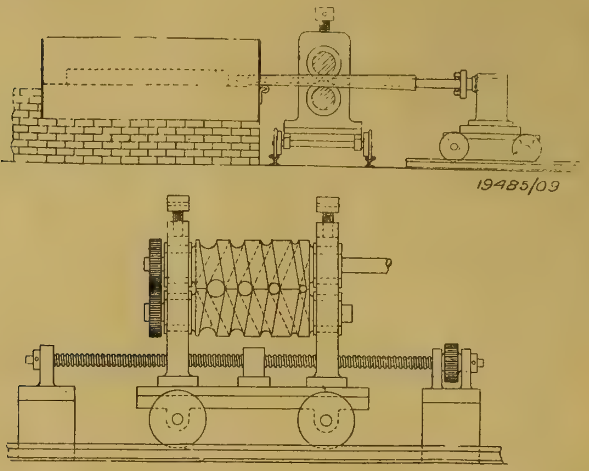
17222 Fell: Means for use in the process of decorating earthen and other ware. 17303 Oliver: Half-tone plates for printing purposes. 17449 Douque: Manf. of waterproof washable linen. 17484 McCarty: Safety valves. 17585 Elliot and Williams: Combination filter and splash preventer for household taps. 17591 Lane: Construction and method of operation of hydrogen gas-producing apparatus. 17685 Collinge and Creak: Liquid sprinkling apparatus. 17706 Marles: Nozzles or necks for vessels. 17727 Larkin, and E. M. Bowden's Patents Syndicate: Handle bars for cycles, motor cycles, and the like. 17819 Sidwell: Carburetters for internal-combustion engines. 17918 Haslam: Apparatus for drying and cooling air. 17977 Mackintosh: Picketing pegs, hoof pegs, tent pegs, and the like. 18236 Tuckfield and Garland: Means for bleaching and purifying fats and oils. 18272 Lake (Goss Printing Press Co.): Variable-speed mechanism for printing presses. 18577 Holmes: Methods of forming chain stitches. [Date applied for under International Convention, August 13th, 1908.] 18624 Viry: Electrical devices for controlling movements from a distance. [Date applied for under International Convention, August 14th, 1908.] 18656 Chandler, and Maria Louisa Chandler, Executrix of the late Josiah Chandler: Grids for gas purifiers. 18706 Lake (Goss Printing Press Co.): Variable-speed mechanism for printing presses. 18711 Dunn: Spare wheels or detachable rims. 18770 Lake (Goss Printing Press Co.): Variable-speech mechanism for printing presses. 18781 James Hawley Ltd., Hawley and Saunders: Machines for nailing, riveting, or the like. 18879 Maddock and Maddock: Placing of earthenware articles in kilns, muffles, and the like during the firing process. 18885 Holgate: Delivering approximately measured quantities of uniform weight. 18934 Edwards (Rosen): Telegraph-sending machines. 18941 Smith: Invalid lifters. 18977 Morris: Expanding mandrel. 19075 Hanline and Huxter: Machine for double seaming tins or other receptacles. 19304 Docwra: Sweetmeat and method of manufacturing the same. 19375 Murphy: Pressure-applying machines. 19399 Cunliffe and Alderman: Apparatus for signalling on railways. 19400 Ellis: Covers for the pneumatic tyres of motor cars and other road vehicles. [Post-dated February 24th, 1910.] 19403 Curr: Drawing-board photographic printing frame or the like. 19422 Goodall and Bennett: Straight-bar knitting machines. 19472 Davies and Jones: Clamp or grip for lifting armour and other plates.



19485 Curr and Thom: Tube-rolling mills

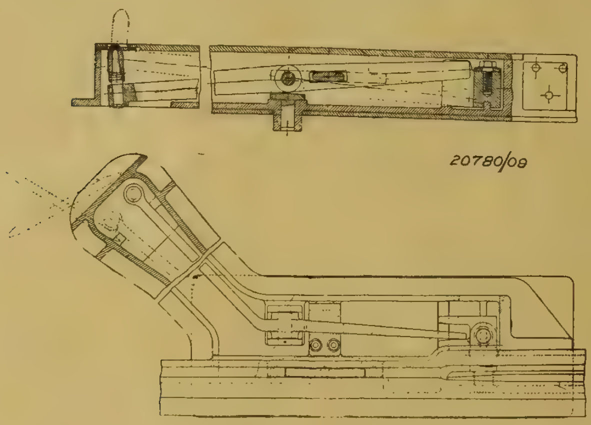
This invention relates to rolling mills which are specially adapted for rolling tapered tubes. Under this invention the rolls, which are each made with a helical surface, are carried in suitable housings mounted on a bogie carriage which may work in a pit, or rails, or otherwise, and be capable of being moved backwards and forwards in front of the furnace by means of screw and worm or other gear. The driving gear for the rolls is such that, although the rolls are laterally traversed backwards and forwards, yet they are always capable of being rotated. There may be two horizontal rolls arranged one above the other, the spiral threads of which are or may be arranged at angles to one another, the space between the threads being rounded or otherwise shaped to suit the object being rolled.

19536 Calichiopulo: Sighting devices. [Date applied for under International Convention, December 5th, 1908.] 19598 Try: Appliances for supporting tobacco pipes, cigar holders, and other articles on show boards, show cases, and the like. 19824 Soc. Anon. "Astra": Propulsion of airships. [Date applied for under International Convention, February 24th, 1909.] 19862 Grosclaude: Propellers. [Date applied for under International Convention, August 31st, 1908. Application for Patent of Addition to 21754, 1908.] 19873 Coombe: Socket for screws. 19957 Schooling and Wykeham-Fiennes: Indicators and recorders for games. 20045 Vincent: Adding machines. [Date applied for under International Convention, September 21st, 1908.] 20101 Hemphill: Circular knitting machines. 20462 Suzuki: Evaporators. 20560 Nosworthy and Prescott: Means for cleaning and sharpening knives. 20579 Talbot: Feed rollers of machines for pulling, opening, or tearing rags. 20586 Bailey: Systems of marine propulsion. 20587 Livesay: Electric generating systems. 20689 Plews and Plews: Spring wheels. 20703 Wrigley: Single-acting ammonia compressors for cold storage and ice-making purposes. 20717 Ball and Bell: Driving gear for bicycles and other road vehicles. 20769 Barberis: Method of making photographic prints, and devices for the same. [Application for Patent of Addition to 20585, 1909.]


19485/09

20780 Jones and Nelson: Means for actuating tramway rail points.

This invention relates to tramway-point controlling apparatus of the type which, being disposed below the track level, is rendered operative by a wheel of a vehicle, which in passing causes a pin or the like to rise above the track ready for lateral actuating by an adjustable wiper plate or its equivalent disposed on the vehicle. There is provided within a recess in the track and adjacent to the point a point-actuating lever capable of movement in both vertical and horizontal planes. At the extremity of one arm of the lever there is provided a projection; the other arm fits within a fork or guide attached to the outer extremity of the point by means of an arm or plate connected with the point and the fork or guide. The underside of a car is provided with a pivotal wiper plate adapted to be actuated by the driver or conductor of the vehicle in any convenient manner. Means are provided in the wheel path which, through displacement by a wheel, causes the point to be moved about its horizontal pivot, so that the pin on the lever rises above the track lever, and if it is intended to actuate the point, the wiper plate on the car has been so set that by contact with the pin in passing it moves the lever about its vertical pivot and thus the point is actuated. Means are also provided to ensure that the pin or projection referred to shall descend again below the level of the track after a car has passed the point. When it is not desired to actuate the point, the wiper plate on the car is moved to or permitted to remain in such a position that it does not operate the pin on the point-controlling lever when raised.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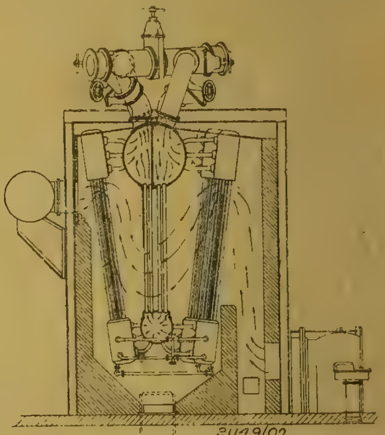
20786 Walker: Method of and means for making and breaking electrical circuits or contacts. 20900 Lee: Yarn or thread-doubling, winding and like machines. 20912 Mackenzie (Hygenia Brush Co.): Brushes. 20950 British Northrop Loom Co. (Northrop Loom Co.): Application to automatic weft-replenishing looms of pneumatic means for assisting in the self-threading of the shuttle and preventing the throwing forward of the filling in the shuttle. 20953 Callie: Ventilators. 20956 Bewick: Domestic baths. 21015 Humphrey: Means for regulating the fuel supply to water heaters. [Date applied for under International Convention, January 15th, 1909.] 21061 Mellor and England: Milling or fulling machines for treating textile fabrics. [Cognate Application. 28770, 1909.] 21135. *See* 13702, 1909.

21149 Westgarth and Taylor: Apparatus for superheating steam.

The invention consists in brief in a superheater comprising one or more upper drums longitudinally divided into steam admission and steam delivery chambers, a lower drum or drums situated below the upper drum or drums, and upper and lower headers connected respectively to the upper and lower drum or drums, each upper header being connected to a lower header by a nest of tubes. The superheater is specially intended for use in superheating low-pressure steam intended to be employed in low-pressure steam turbines, and is specially adapted to be fired by blast furnace or coke oven gas or other gaseous fuel.

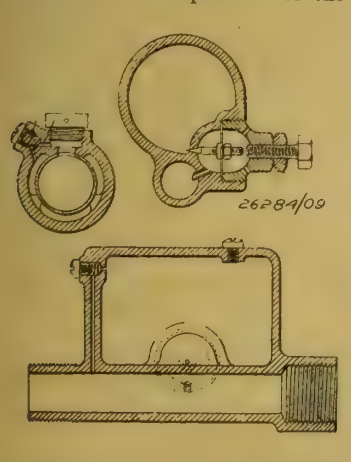

21149/09

21177 Harpham: Woven yarn supplies for twist-lace machine carriages or the like and apparatus for weaving the same. 21217 Debrie: Portable apparatus for taking pictures for cinematographs. [Date applied for under International Convention, September 19th, 1908.] 21246 Chipperfield: Means for holding flexible chases when composing or distributing type. 21334 S. Allcock and Co., and Schooling: Fishing lead. 21429 Deacon: Carpet sweeper. 21516 Hollingworth (Crompton and Knowles Loom Works): Shuttle-positioning mechanism for automatic weft-replenishing looms. 21725 Lewis: Fluid-pressure engines. 22045 Farrar: Noble combing machines. 22101 Flannery: Fastenings for doors and the like. 22102 Willis (Rutledge, Maris, and Rutledge): Steam engines. 22196 Smith: Ordnance. 22209 Chivers and Sons, and Lack: Machine for closing cans. 22366 Hamilton and Broadberry: Spring wheels for vehicles. [Application for Patent of Addition to 23246, 1908.] 22442 Maynard: Toys. 22560 Tacchi and Kirschbaum: Means for mounting or supporting the front wheels of motor or other velocipedes. 22599 Thompson (Gravenstein): Apparatus for tipping wagons or trucks and returning them into the upright position. 22668 Whitehead: Apparatus for roasting coffee and other substances. 22678 O'Neill: Device for supplementing foot power by manual power in connection with cycles. [Cognate Application. 26335, 1909.] 22745 Grieve: Circular rib-knitting machines. 22810 Hudson: Non-skid covers and means for securing same to the wheels of motor carriages. 22816 Howard and Allen: Cork or stopper for bottles. [Post-dated March 11th, 1910.] 22827 Podszus: Vapour electric apparatus. [Date applied for under International Convention, October 7th, 1908.] 22956 Purser: Garden and other syringes or spraying devices. [Cognate Application. 591, 1910.] 23013 Bohme and Wolf: Process for the production of a solid hydrocarbon soap. [Date applied for under International Convention, May 13th, 1909.] 23042 Leitner: Reversing mechanism for dynamos. 23225 British

Thomson-Houston Co. (General Electric Co.): Insulating compounds and processes of making the same. 23227 Murray: Electric cut-outs. [Date applied for under International Convention, October 17th, 1908.] 23228 Murray: Electric cut-outs. [Date applied for under International Convention, November 9th, 1908.] 23229 Murray: Electric cut-outs. [Date applied for under International Convention, November 30th, 1908.] 23264 Mather and Ballach: Machine for cutting and removing potato shaws. 23314 Fromme: Steam generators. [Date applied for under International Convention, October 27th, 1908. Application for Patent of Addition to 2488, 1909.] 23357 Rose and Rose Bros. (Gainsborough) Ltd.: Apparatus for use in applying different markings or indications to a series of papers or other material, more especially intended for use in marking upon wrappers or labels being fed to packeting, labelling, or wrapping machines for indicating which attendant has supplied the contents of any particular package to the machine. 23391 Lawrence: Casement windows. 23529 Dawson: Mules for spinning. 23535 Chevallier: Automatic firearms. 23560 Gabell: Vacuum hose coupling. 23594 Buchanan: Core-making machines. 23932 Beck: Memorandum book marker. 24017 British Thomson-Houston Co. (General Electric Co.): Signal systems for railways and the like. 24064 Waterfield: Pneumatic tyres. 24092 White: Spoons, forks, or other implements for use in eating ice creams, sweets, and the like. 24109 Carrigan: Electric switches. 24110 Moore: Tag-forming and affixing machines. 24146 Tonks: Construction of pulley or wheel to run on ball bearings. 24197 Taylor: Ferrules or packings for condenser tubes and the like. 24329 Bates and Southan: Targets. 24586 Buller: Device for incubating sour milk and the like. 24983 Dixon: Loose-leaf books. 24991 Crawford: Toy. 24997 Dickie: Excess temperature alarm device. 25105 Lake (Goss Printing Press Co.): Variable-speed mechanism of printing presses. 25154 Whitehorn: Garden tools, such as hoes, rakes, and the like. 25271 Voile and Kenning: Display apparatus. 25366 Wood: Spinning or twisting machines. [Date applied for under International Convention, February 26th, 1909.] 25399 Dependence Incubator Co., and Johnson: Incubators. 25411 Lucas and Edwards: Cycle and like lamps. 25413 Wightman: Locking nuts. 25533 Wells: Air-cooled internal-combustion engines. 25607 Hollingworth (Crompton and Knowles Loom Works): Jacquard mechanism for looms for weaving tufted fabrics. 25985 Lowe: Crochet hook. 26000 Provis: Building construction. 26030 Rockwell: Grinding machines. 26109 Priest, Marians, and Co. (Sekigawa): Diving toy. 26165. *See* 13853, 1909. 26269 Siemens and Halske Akt.-Ges.: Telephone exchanges. [Date applied for under International Convention, November 14th, 1908.]

26284 Dressler: Automatic lubricators. [Rights under Section 91 of the Act not granted.]

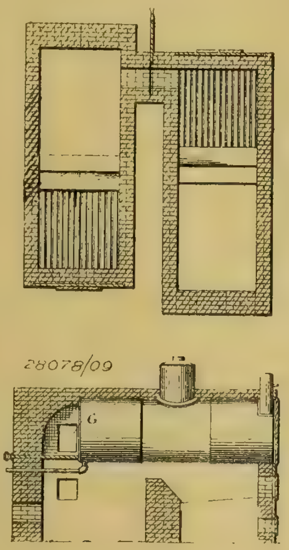
This invention relates to automatic lubricating apparatus for machines (including machine tools) actuated by elastic fluid under pressure, and more particularly to lubricating apparatus of the type wherein the pressure fluid itself opens a lubricating valve and carries the lubricant to the machine. In previously known apparatus of this type a disadvantage is liable to arise from the fact that when the flow of fluid under pressure is cut off a body of fluid under pressure remains in the receptacle over the surface of the lubricant, so that if the valve is at all loose waste is liable to occur through expulsion of lubricant by the body of fluid while the machine is not working. It may occur that the receptacle is wholly emptied by this means, so that when the machine is restarted no lubrication takes place. To obviate this disadvantage a passage is provided, which places the space above the lubricant in direct communication with the pressure conduit. This passage is normally closed by a valve held to its seat by a spring. While the machine is working, pressure fluid in the vertical part of the passage coacts with the spring to keep the valve closed, but when the pressure is cut off the pressure fluid trapped in the receptacle opens the valve, and equalisation of pressure above and below the lubricant ensues. When the machine is restarted, and the valve is opened by the pressure fluid, some of the latter passes through the hole into the receptacle, and by this means the passage for the discharge of the lubricant is kept clear.


26284/09

26303 Brown, and Chas. Macintosh and Co.: Pneumatic tyres for motor and other vehicles. [Cognate Application. 27309, 1909.] 26326 Tompkin: Peg or clip suitable for the suspension of garments and various other articles. 26335. *See* 22678, 1909. 26435 De Meza: Lamps for use on motor cars and for other purposes. 26451 Wardill and Wardill: Starting gear for motor vehicles. 26452 Falding: Apparatus for making sulphuric acid. [Date applied for under International Convention, December 31st, 1908.] 26690 Andersson, and Arthur George Hopper and Joanna Elisabeth Hopper Greenwood, executors of the late Arthur Greenwood: Steam turbines. 26838 Debois: Ball bearings. 26896 Reynolds: Warning signal for motor cars and the like. 26900 Bruck: Dress support. 27025 Parkinson: Binders or bandages, more especially for accouchement purposes. 27155. *See* 13702, 1909. 27428 Wm. Bailey and Co., and Bailey: Means for connecting pipes. 27567 Lachner: Gas stoves. 27692 Lindstrom: Apparatus for transforming a continuous pressure or suction into an intermittent pressure or suction. [Date applied for under International Convention, March 4th, 1909.] 27771 Miller: Wrenches. 27857 Pfalzgraf: Safety trip devices for power-operated machines. 28070 Edmunds: Shock absorbers or buffers for the drawbars of railway vehicles and the like.

28078 Schwab: Systems for heating a plurality of boilers.

Relates to heating systems for a plurality of boilers of the kind wherein the products of combustion from a fire in one of the boilers is adapted to pass successively through all the boilers. A plurality of boilers, each having a furnace and a conduit or conduits through which the hot gases pass to heat the water, are suitably connected together by conducting means in such a manner that the products of combustion from an active furnace, after passing therethrough, will pass through the idle furnace or furnaces of the other boiler or boilers and then through the conduit or conduits, such as tubes, of all the boilers. The boilers are preferably provided with the usual smoke stacks and the conducting means have controlling valves therein, so that each boiler may be used independently if desired.


28078/09

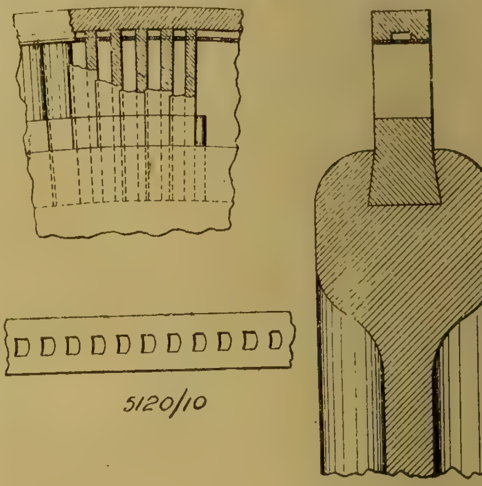
28332 Carr: Tool holder and tool for use with machines for dressing valve seats. 28361 Bloxam (Akt.-Ges. fur Anilin-Fabrikation): Manf. of para-aminophenylarsinic acid. 28487 Imbert Process Co.: Extraction of zinc from zinc sulphide ores. [Date applied for under International Convention, December 24th, 1908.] 28494 Lewis and West's Patent Press Co.: Cotton gins. 28548 Svetlik: Oil cans. 28689 Makin: Steam generators. 28742 Wolf: Process for the production of artificial honey or invert sugar syrup and white sugar from raw or crude sugar. [Request under Section 91 of the Act not granted.] 28770. *See* 21061, 1909. 28900 White: Compound boats. 29153 Flint: Anti-splashing and noiseless bed chamber pot, utensil, night commode, and the like. 29187 Lang and Watkins: Taper turning and taper boring attachment for lathes. 29225 Heilprin: Air guns. 29248 Farmer: Refrigerating cover. 29386 Heitzmann: Duplicating books and blocks. 29453 Gigot: Elastic wheels for vehicles. [Date applied for under International Convention, December 21st, 1908.] 29753 Poths: Rotary kilns for burning cement. [Application for Patent of Addition to 13440, 1908.] 29827 Sanderson: Fabric-printing machines. 29832 Brewerton: Shrapnel shell. 29870 Newhall: Water-circulating device for internally-fired boilers. 29905 Boult (Akt.-Ges. fur den Vertrieb von Kuchengeschirr-Spuhlapparaten "Triumph"): Apparatus for holding plates and plate-like articles during washing or rinsing. 29964 Osborn, and Samuel Osborn and Co.: Drills. 30048 Whitcher: Preparation for removing dirt, ink, or other stains from leather and other materials. 30232 Stoll: Cultivator with flexibly yielding times. 30340 Lake (Ingersoll Rand Co.): Channelling machines. 30385 Leuthesser: Steam, air, and water-trap valves.

1910.

138 Lilley: Angle bracket. [Date applied for under International Convention, January 20th, 1909.] 153 Frost: Hand or foot-power machines. 439 Down and Down: Electric light bracket for hospital operation theatres and elsewhere. 467 Siemens Bros. and Co., and Riber: Telephone apparatus. 471 Cattermole: Roller skates. [Post-dated February 8th, 1910.] 591. *See* 22956, 1909. 891 Carl Zeiss: Bifocal spectacle glasses. [Date applied for under International Convention, February 1st, 1909.] 1098 Wigin: Gramophones, phonographs, and the like. 1190 Gorrell, Brown, Reynolds, and Brown: Railway ties and rail fastenings. 1206 Elektriska Aktiebolaget, A. E. G.: Systems for electrically-operated submarine mines. [Date applied for under International Convention, January 18th, 1909.] 1277 Leigh: Flushing valves and apparatus. 1283 Dixon: Life belts and the like. 1400 Strodel: Automatic match delivery apparatus. 1401 Frank: Sectional domestic heating stoves. 1441 Eichengrun: Manf. of solutions and objects of cellulose acetate. [Date applied for under International Convention, January 25th, 1909.] 1481. *See* 16867, 1909. 1513 Soc. Anon. de la Pompe Vadam: Air compressor. [Date applied for under International Convention, January 21st, 1909.] 1547 Soc. Magic Publicity: Means for producing and exhibiting luminous signs, advertisements, and the like. [Date applied for under International Convention, July 27th, 1909.] 1576 Townley: Injector device for hydraulic rams or the like purpose. 1603 Read: Means for guiding paper as it is delivered from cutting or other rollers. 1610 Ross: Automatic firearms. 1618 Krueger: Railway rail joints. 1648 Maurik: Tooth brushes. 1754 Simpson: Treads for floors, steps, and the like. 1875 Fried. Krupp Akt.-Ges.: Sighting devices for ordnance. [Date applied for under International Convention, August 12th, 1909.] 1976 Heinmuller: Sanitary appliance for drinking vessels. 1995 Vogt: Steam boilers. 2002 Corey: Electro-deposition of metals. 2032 Crocker: Electrolytic cells. 2279 Michael: Combined insufflator and speculum. 2301 Schulze: Stock rest for small arms. 2303 Schulz: Room fountain. 2388 Lind: Belt joints. 2530 Upham: Rotary cylinder sheet-printing presses. [Date applied for under International Convention, February 18th, 1909.] 2555 Fish: Airships. 2593 Harrington: Spirit and the like draining and measuring sets. 2648 Poole and Abbenzeller: Cutter bars for mowing machines. 2718 Wells: Mustard pot. 2870 Springer: Apparatus for aiming drill. 2879 Harris: Bracelets or the like. 2907 Cauderay and Chauve: Gradually variable-speed gears. 3058 Behr: Apparatus for use in propelling vessels by means of oars. [Rights under Section 91 of the Act not granted.] 3088 Lake (Goss Printing Co.): Folding mechanism for printing presses. 3191 Menge: Siphon-discharge flushing cistern or the like. 3195 Hutson: Sink grates for connecting lead waste pipes to sinks. 3314 Stachow: Magnetic ore separators. [Date applied for under International Convention, February 19th, 1909.] 3434 Tetlow: Protective coverings for pneumatic tyres. 3520 Inokuty: Steam boiler. 3635 Wettstein: Sleepers for railways. 3639 Eckley: Feeding and drinking appliances for live stock. 3697 Lux: Means for electrically controlling valves. [Date applied for under International Convention, February 15th, 1909.] 3708 Sutherland and Brown: Apparatus for bending metals. [Date applied for under International Convention, February 15th, 1909.] 3733 Marseille and Gouin: Manf. of alkaline accumulator electrodes for preventing the dropping of active material therefrom. [Date applied for under International Convention, March 8th, 1909. Application for Patent of Addition to 15373, 1909.] 3960 Berner: Manf. of artificial stone. 4018 Weir and Reid: Stepped ladders for electric lamp posts, signal posts, fire escapes, and the like. 4085 Ronninger, Nacher, and Lohmann: Fenders for road vehicles. 4195 Boirault: Automatic couplings for railway vehicles. [Date applied for under International Convention, February 22nd, 1909.] 4372 Duff, and Gas Power and By-Products Co.: Process and apparatus for recovery of ammonia from producer gas. 4449 Firm G. Roth Akt.-Ges.: Combined electric and percussion primer for the cartridges of ordnance. [Date applied for under International Convention, March 11th, 1909.] 4501 Broadbent and Broadbent: Traverse mechanism for machines for winding and gassing yarns. 4526 Schmid: Device for stretching and tightening wire. 4625 Eldred: Manf. of artificial teeth. [Date applied for under International Convention, June 23rd, 1909.] 4697 White and Carichoff: Control of electrically-operated switches. [Date applied for under International Convention, February 27th, 1909.] 4790 Ewart: Production of hot water and apparatus therefor. 4796 Hartell: Shrimping or similar nets. 4805 Skippings: Chest expanders or body braces. 5067 Fox and Waters: Means for raising and supporting motor bodies on their chassis and for the like purposes.

5120 Sulzer: Steam turbine blades. [Date applied for under International Convention, May 3rd, 1909.]

> In steam turbines the shanks of the blades are fixed to the rotor in various ways, for instance, by engaging an undercut circumferential groove formed in the latter, space blocks being inserted between the blades to form the necessary steam spaces. Alternatively the shanks of the blades have been passed through perforations formed at intervals in a thin strip of metal disposed above the undercut groove and adapted thus to space the blades uniformly and cover the unoccupied portions of the groove. To secure the blades firmly in place a ring is placed over their outer ends, and to prevent this ring from moving laterally relatively to the blades a circumferential groove extending right round the ring is formed on its inner side, the outer ends of the blades engaging this groove. Alternatively a rib projecting from the inner surface of the ring and extending right round the same engages recesses in the blades, but in both cases the steam spaces between the individual blades have alternate projecting and recessed portions which bring about the formation of eddies in the passing steam. According to this invention the projecting or recessed portions are avoided by covering the inner wall of the grooved ring which surrounds the blades with a thin sheet metal strip provided with slots at the points where the outer ends of the blades engage the ring. The steam spaces are thus limited at their outer circumference by smooth walls and the formation of eddies is thus prevented at the outer ends of the steam spaces.



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5126 Marousek: Indicators. 5325 Baeten: Apparatus for crushing and sifting clay and like materials. 5516 Whiteman (Anderson Tool Co.): Weighing apparatus. 5525 Lawrence and Kennedy (Lane): Teat cups for milking machines. 5672 Newton (R. Hoe and Co.): Sheet-folding mechanism. 5789 Dawson: Loose-leaf binders. 5938 Del Proposto: Means for securing covers or ends to cylindrical containers for fluids under pressure. [Date applied for under International Convention, March 9th, 1909.] 5990 Henry Milward and Sons Ltd., and Bartleet: Spinners for natural fishing bait. 6038 Johnstone: Towing posts. [Date applied for under International Convention, March 26th, 1909.] 6066 Louvet: Device for automatically stopping the discs of talking machines. 6251 Lang: Machinery for cutting or dressing stone blocks. 6458 Fowler and Pardy: Tobacco pipe. 6492 Eaves: Games. 6658 Salzer: Supports for the filaments of incandescent electric lamps. [Date applied for under International Convention, March 19th, 1909.] 6760 Gabbitas: Sweeper for lawns, pathways, and the like. 7175 Societe l'Air Liquide (Soc. anon. pour l'etude et l'exploitation des procedes Georges Claude): Separation of nitrogen from the air. [Date applied for under International Convention, March 23rd, 1909.] 7180 Wadsley: Ladies' belts and the like. 7204 Chater: Boots, shoes, and other footwear. 7231 Mills: Knitting machine needles and the method of knitting therewith. 7282 Sykes: Anchors. 7401 Firm Fabrique d'Horlogerie de Pery Dreyfus et Cie.: Bracelet watches. [Date applied for under International Convention, March 5th, 1910.] 7447 Czerniewski: Variable-speed gears. 7582 Gore: Flying machine. 7934 Harle et Cie.: Wire ropes. [Date applied for under International Convention, April 19th, 1909.] 7978 Moore: Gun cleaners. [Date applied for under International Convention, April 5th, 1909.] 8131 Spencer: Penholders. 8200 Rheinische Metallwaaren-und Maschinenfabrik: Keys for setting timing rings of fuses for shells or the like. [Date applied for under International Convention, May 28th, 1909.] 8608 Melson: Handcuffs. 8855 Fell (Monarch Typewriter Co.): Typewriting machines. 9057 Holmes: Apparatus for the sterilisation of soil. 9079 Beaumais: Dumb bells. [Date applied for under International Convention, April 14th, 1909.] 9331 Smith: Combined siphon sink strainers and waste-pipe cleaners. 9377 Alpine Maschinenfabrik Ges. vorm. Holzhauer'sche Maschinenfabrik Ges., and Kuhr: Ball mills. 9602 Mickelson: Propelling gear for crane and like trucks. [Date applied for under International Convention, April 20th, 1909.] 9644 Kukiolka: Electric fire alarm. 9887 Firm Friedr. Carl von Bruck: Bolts for doors and windows. [Date applied for under International Convention, April 28th, 1909.] 10067 Marks (McClean Arms and Ordnance Co.): Firing mechanism for automatic machine guns and the like. [Date applied for under Rule 13, May 8th, 1908.] 10209 Thompson (Badische Maschinenfabrik and Eisengiesserei vorm. G. Sebold und Sebold and Neff): Roller machine for glazing and shagreening leather. 10246 Martin and Clark: Violins. 10360 Societe Anonyme des Glaces D'Auvelais: Apparatus for transporting and manipulating sheets of plate glass. [Date applied for under International Convention, March 18th, 1910.] 10817 Fessenden: Wireless signalling. [Date applied for under International Convention, July 19th, 1909.] 10961 Partington: Multiple fusible cut-out for electrical circuits. 11155 Fessenden: Wireless signalling. [Date applied for under International Convention, January 29th, 1910.] 11258 Somerville: Inverted incandescent gas lamps. 11333 Howard and Coad: Telephone mouthpieces. 11728 Goldstein: Lock nuts. 12425 Firm Gebruder Siemens and Co.: Protective coating for bodies consisting of carbon. [Date applied for under International Convention, May 24th, 1909.] 12426 Farbwerke vorm. Meister, Lucius, and Bruning: Manf. of a red monoazo dyestuff and colour lakes therefrom. [Date applied for under International Convention, May 25th, 1909.] 12491 Peckham: Hand-cart supports. [Date applied for under International Convention, May 22nd, 1909.] 13828 Lange: Portable electric lamps. [Date applied for under International Convention, February 28th, 1910.] 13891 Von Pittler: Rotary compressors, vacuum pumps, and other rotary fluid-pressure machines. [Date applied for under International Convention, December 9th, 1908, originally included in 13653, 1909.] 14594 Krieger and Biechy: Process of and apparatus for enclosing powders in paper capsules. [Date applied for under International Convention, June 23rd, 1909.] 15672 Reckard: Photo-mechanical process for engraving or etching printing rollers. [Date applied for under Rule 13, July 7th, 1909.]

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23041 Firm Ehrhardt and Sehmer Ges.: Regulation of jet ondensers.

1910.

349 Krause: Metal filament lamps having filament carriers rranged elastically. 5916 Barbanson and Lepersonne. Openearth process of refining steel. 7335 Compagnie pour la abrication des Compteurs et Materiels d'Usines a Gaz: Clockork movements. 7718 Dieffenbach and Moldenhauer: Production of hydrogen. 12589 Belgian Pneumatic Tool Co. (Soc. non.): Valve and mechanism for pneumatic tool engines. 2725 Lewis: Moulding machines. 13739 Herold: Primary atteries. 13937 Seabrook: Differential axles. 13938 Searook: Differential axles. 1939 Seabrook: Method of applying ubricant to bearings. 13940 Seabrook: Method of forming self-lubricating bearing and product of the method. 13941 eabrook: Method of separating frictionally engaged parts. 4007 Soc. Anon. des Filatures et Tientureries de Saint Epin:

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The Patent covers an invention interesting to manufacturers of Destination Indicators for use upon Tramway Cars.

Detailed information as to the invention will be found in the patent specification, of which a copy will be supplied to any interested party on request.

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TO INCREASE OUR FOREIGN TRADE.

THE time has long passed since we, as a trading nation, were able, to a large extent, to dictate terms to our foreign customers. The entry of other nations, in particular Germany and the United States, into our fields of export manufactures has altered these conditions, bringing in its train a competition alike severe and determined.

While we remained the workshop of the world, prosperity at home was assured, but the lead taken by Germany in technical education, and in America by the favourable disposition of its natural resources, there has developed a commercial rivalry which is destined to become more and more acute.

The thoroughness with which our Teutonic competitors carry through every phase of their industries is common knowledge, and it behoves our commercial departments to take a leaf from their book and give more attention to the business side of the sales.

The best of material and workmanship combined with a favourable price is only half way to success, the other half is to secure the buyers. It is in this direction where the British manufacturers fall short. Their endeavour should be to ascertain the requirements and then meet that demand, either by the appointment of agents thoroughly familiar with the firms' manufactures, or to employ first-class travellers who are experts in the foreign tongues and are technically acquainted with the goods they represent.

Tariffs combined with local conditions have introduced changes which can only be met by a combination of interests, and this can be best met in many countries by the establishment of sales bureaux under trustworthy management. There is a tendency to charge our Consuls and other official representatives abroad with neglecting our commercial interests. This is to some extent true, but on the other hand there are many instances where warnings and recommendations of these representatives are not acted upon. The independence of the measures taken by British houses accounts for a want of success, where unity of action by a combination of merchants would better appeal to the buyer and force his attention to our manufactures.

Some interesting and instructive remarks have appeared in a recent issue of the *Board of Trade Journal* from a British Vice-Consul in Russia pointing out in unmistakable language what our engineering firms should do to secure their share in the Russian trade and how to develop it. He points out clearly why it is that the German firms, with a heavy tariff and goods of a quality neither cheaper nor better than ours, are able to continue to export machinery into Russia. The system of giving credit and guarantees acts as an inducement to the placing of orders, and is one that works well with the Germans, the banking fraternity coming to the assistance of those who are unable to sustain long credit. The financing of industrial concerns by the banks in Germany is now quite an institution, and has been the means of enlarging the exports of the country, and it is hoped that some such combination of interests will be brought about by British manufacturers in order to meet the ever-increasing severity of the competition in our export trade.

According to the Board of Trade returns issued last week, giving the total imports and exports for the first six months of this year, it is a source of gratification to observe that the United Kingdom still stands well ahead with a satisfactory increase over the same period of 1909. In exports, however, with a total of 204 millions and an increase of 27 millions over the first half of last year for the United Kingdom, the Germans are level with us in rate of increase, although their bulk is less, the comparative figures being 174 millions and 24½ millions respectively.

New Steamship for Indra Line.—A valuable addition has just been made to the Indra Line by the completion of the twin-screw steamship Indrabarah, which is to be engaged in the trade of carrying refrigerated cargoes from Australia and New Zealand. The vessel has been built by Messrs. Swan, Hunter, and Wigham Richardson Ltd., of Wallsend, and engined by Messrs. Richardsons, Westgarth and Co. Ltd., Hartlepool. The Indrabarah has been pronounced by experts to be an exceptionally fine vessel of her kind. The gross tonnage of the vessel is about 7,000 tons, and her leading dimensions are 470 ft. between perpendiculars, with a beam of 38 ft. and a moulded depth to the shelter deck of 43 ft. She is classed 100 A1 at Lloyd's, but has been built in excess of the present rules of that classification society. The refrigerating machinery of the carbonic anhydride type has been installed by Messrs. J. and E. Hall Ltd., of Dartford, Kent. Among other modern devices on board the Indrabarah, mention may be made of the equipment of acetylene flare lights provided by the Imperial Light Ltd., of London. The lamps give a powerful light and will prove invaluable when loading or discharging cargoes at night. The twin-screw engines have cylinders 22 in., 37 in., and 62 in. by 45 in. stroke with Contraflo condensers, Howden's forced draught, cascade feed water filters and heaters. Great interest has been taken in the Contraflo condensing plant, which gives high power efficiency with the maximum economy, and the results obtained on the Indrabarah fully justify the claims made for the system. The design of this part of the engines was so carefully carried out in the Indrabarah that the low-pressure diagrams registered fully 13 lbs. below the atmospheric line at full power. On the measured mile near the mouth of the River Tyne a mean speed of 14·1 knots an hour was obtained, while on the run from the Tyne to Gravesend the average speed was 14·38 knots an hour, the engines running satisfactorily.

Working of the Boiler Explosions Acts During the Year Ending 30th June, 1909.—Under the provisions of the Boiler Explosions Acts, 85 preliminary inquiries and eight formal investigations have been held respecting boiler explosions which occurred during the year. Of these 93 explosions, 45 resulted in loss of life or personal injury—12 persons being killed and 53 injured. Although the number of explosions dealt with is considerably above the average for the previous 26 years, it is very satisfactory to note that the number of persons killed is the lowest recorded since the Acts came into operation. The number of persons injured is also below the average. In seven out of the eight cases in which these investigations were held, the Courts found that persons who had been connected with the boilers were to blame for the explosions, and they made orders for the payment of costs in three of these cases.

Large Gas Engines.—Considerable interest attaches to a paper read by Mr. E. D. Latta before the American Institute of Electrical Engineers, in which he described twelve months' operating experience at the power-house of the Charlotte Electric Railway Co. There are two gas engines of 810 B.H.P. each. They are of the twin-tandem double-acting four-cycle type, and drive alternators. For about ten hours a day both engines are in service together, running in parallel and without stand-by, the load being a very irregular traction load. For about six hours after midnight one engine runs on very light load indeed. During the year the shut-downs totalled 2¾ hours, the plant operating 24 hours a day. The causes of the stoppages are interesting, and are as follows: Two failures of the alternator exciters, two floodings of the gas main with water, and (once each) belt of oil pump breaking, defect in ignition wire, over-speed governor acted, and excessive overload. The general running of the plant was satisfactory. The principal disturbances were due to pre-ignition, back-firing, and ignition of unburnt charges in the exhaust pipe. The first of these, pre-ignition, was due to excessive hydrogen in the gas and to particles of incandescent carbon. Back-firing was due to weak gas resulting in a smouldering charge firing a fresh charge on the suction stroke, and also to leaky inlet valves. The last-mentioned disturbance was due to an unburnt charge being discharged into the exhaust pipe and afterwards ignited by the smouldering exhaust of an exploded charge. Although operating at a low average load, a condition specially unfavourable to gas engines, the total coal consumption per kilowatt hour over the whole year was just under 2 lbs., a very economical result. The total operating cost, including repairs, labour, stores, and fuel, but not capital charges, was 0·443d. per unit.

Defective Carburation.—A writer in the *Autocar* describes a trouble, due to defective carburation, which took him a week or more to diagnose, and was attended with symptoms more than usually puzzling, because they appeared so spasmodically. The car would run for a time very well, after which the engine would hesitate, missfire, and then pick up again. After much cogitation and endless alterations and dissections, it was noticed that the trouble was most pronounced at certain critical engine speeds. Being of the two-cylinder vertical type, with separately cast cylinders, the motor vibrated a good deal at particular periods. The induction pipe was long, and bent through a right angle, being coupled to the side of the carburetter by a two-eared flange. After long and repeated examinations for flaws or cracks, it occurred to the writer of the note that the flange brazed to the induction pipe seemed to spring a little. Upon unbrazing the flange and sliding it back along the pipe, an almost invisible crack was discovered in the latter where it entered the sleeve of the flange. The crack was nearly covered by the flux or spelter, and so had escaped notice. When the engine was running at a certain rate the vibration was sufficient to open it and allow air to enter. Once this fault was remedied, every erratic symptom vanished.

THE PRINCIPLES OF IRONFOUNDING.

By Prof. A. Humboldt Sexton, F.C.S., F.I.C.

(Continued from page 133.)

Moulding Sands.

The pattern having been made, the next step is to prepare the mould from it. This is done by embedding the pattern in a plastic material, technically known as moulding sand, then removing it so as to leave a cavity the form of the pattern, into which the liquid metal can be poured. The details will, of course, vary very much, and the general principles of moulding will be considered later.

Sands.

A moulding sand is a more or less plastic material in which the mould is made. It is always in the form of a sand, *i.e.*, in more or less finely divided particles, but is never a pure silica sand. Sand usually consists of particles of silica or other hard material in the form of grains which have become more or less weather-worn, the sand having been produced by the attrition of fragments of rock by the action of the sea or of running water. In the case of sea sand the washing and sorting has usually been so complete that the sands are separated into silica sands (which are nearly pure silica) and silts which form clays, neither of which are of any use for moulding purposes; but with river sands the sorting has usually been done less completely, and some clayey material remains associated with the silica, thus giving a certain amount of plasticity. Speaking generally, all natural moulding sands consist essentially of silica, with a varying amount of intermixed clay. Pure silica sand would not bind, and pure clay would not be sufficiently permeable by gases, and would shrink too much on heating. The properties required in a good sand are easily understood. The sand must have sufficient plasticity to allow it to be moulded into the required form, and sufficient binding power to enable it to retain its form after the pattern is removed, either in green sand moulding, whilst the sand is in its ordinary moist condition, or in "dry sand" moulding, after it has been dried. It must be sufficiently refractory not to be melted when the molten iron comes in contact with it; it must be sufficiently permeable by gases to allow the gas displaced from the mould by the metal, and the steam generated by the contact of the hot metal with the moist sand, to escape; and it must be sufficiently fine to give a smooth surface to the casting.

These properties are to some extent incompatible, as the constituents which are good for one quality are in some cases bad for another, so that all that can be done is to strike a mean in order to get those properties which will be most suitable for the purpose in hand. When a chemical analysis of a sand is made, it is found to consist of silica, alumina, and smaller quantities of various metallic oxides—lime, magnesia, oxide of iron, and alkalies being always present, although the last named are rarely estimated, and a variable quantity of water. Such an analysis, called an ultimate analysis, is of little value, as the characters of the sand depend not so much on the constituents present as on the way in which they are combined. Of much more use is what is called a rational analysis, which gives the amount of free silica and clay, and takes into account the fineness of the particles.

The refractoriness of a clay depends mainly on the quantity of silica, but not entirely so, as it might be possible to have a very refractory material containing very little silica; lime and alumina by themselves are quite infusible. For ordinary foundry clays, refractoriness may be said to be due to the presence of a large percentage of free silica, and the absence of any considerable quantity of lime, magnesia, oxide of iron, and alkalies, because all these, by combining with the silica, form very fusible silicates, and therefore it does not follow that two clays containing the same percentage of silica will be equally refractory; it depends on what is the nature of the impurities present. The presence of salt is extremely objectionable, as the sodium it contains forms very fusible silicates. Sea sands are therefore not good for foundry work, unless they have been washed free of saline matter. It is absolutely essential that a sand should be sufficiently refractory not to soften at the temperature to which it is exposed, as if it does it may destroy the form of the casting, by melting down, or by softening. It may become so impervious that the mixed gases cannot escape. If a sand is not sufficiently refractory it is best to discard it and secure another; for whilst the addition of silica or ganister (a very siliceous clay) may improve it, very often it does not.

Plasticity and Binding Power.

These properties go together to a very large extent, although they are not necessarily identical. They depend, under ordinary conditions, on the quantity of clay which is present; the greater the quantity of clay the more plastic will be the sand, and the greater the binding power. The plasticity and binding power of clay are well known, and a small quantity of clay will be sufficient to give plasticity and binding power to a considerable quantity of sand. Clay is a hydrated silicate of alumina. The typical pure clay, or kaolin, has the formula Al_2O_3, $2SiO_2$, $2H_2O$, and contains alumina 39·7 per cent, silica 46·4 per cent, and water 13·9 per cent; so that, assuming all the alumina present in any given sand to be present as clay, the amount of clay will be the amount of alumina multiplied by $100 \div 39 \cdot 7$, or, say, 2·5. This is, however, often not a correct assumption, as the alumina may not be all present as clay, but in the form of other aluminous minerals which do not impart any binding power whatever. A siliceous material mixed with a burnt clay, say, powdered bricks, might contain the same quantity of alumina as one mixed with fresh clay, yet the latter might have a high plasticity and binding power and the former none at all. Too much plasticity, *i.e.*, too much clay, is very objectionable; the amount of clay present should only be just sufficient to give the required plasticity.

Quite obviously, if a sand is deficient in plasticity, this may easily be imparted to it by the addition and thorough mixing in of a little dry clay, and this is frequently necessary; or other materials, which will be mentioned later, may be used.

A sand which is to be used for dry sand moulding must be more plastic than one to be used for green sand work, because the water gives some plasticity, as well as binding power, due to the cohesion of the moistened particles.

Porosity.

This is one of the most important properties of a sand, and, at the same time, the most difficult to gauge; indeed, there is some little uncertainty attached to the meaning of the term as used in connection with moulding sands. A sand obviously is not a compact whole; it is a mass of particles which do not fit perfectly together, as would a series of cubes in a box, but which touch only at certain points, and, strictly speaking, the porosity is the percentage of space not occupied by the solid particles. But this is not exactly what is meant by porosity of a sand for foundry work, it is rather permeability; that is, the readiness with which the sand permits the passage of liquids and gases, and the two are not by any means identical.

If the particles were perfect spheres the porosity would be independent of the size of the particles. The volume of a sphere which can be contained in a cubic space is

$\frac{1}{6}\pi d^3 = \cdot5236\, d^3$, where $\pi = 3\cdot1416$ and d = the diameter of the sphere equal to the side of the containing cube, and this volume is the same whether it be one large sphere of diameter d or a number of smaller spheres of equal diameter, which may be any fraction of d, so that the volume of the pores (*i.e.*, the porosity) would be 100 $(d^3 - \cdot5236d^3) = 46\cdot34$ per cent. The actual porosity is often greatest with very fine materials; indeed, a fine clay will have a higher porosity (*i.e.*, a larger amount of pore space) than a coarse sand, yet it is well known that the former may be almost impervious to liquid and gases, whilst the latter may let them pass quite freely. The reason for this is quite obvious; the freedom with which a gas or liquid can permeate a porous mass ceases to be proportional (if it ever is proportional) to the size of the air spaces as these become very small, for the friction which retards the passage becomes very much greater, and capillary attraction comes into play. The permeability is thus dependent on the size and shape of the particles, but has no connection with chemical composition, as the more finely divided a material is, the more plastic it is, other things being equal. Porosity and plasticity are antagonistic in a clay; that is, the physical condition which is favourable to the one is unfavourable to the other. It is usually said that silica gives an open, *i.e.*, a permeable sand, and this is true, simply because the silica particles are almost always much larger and more angular than the clay particles.

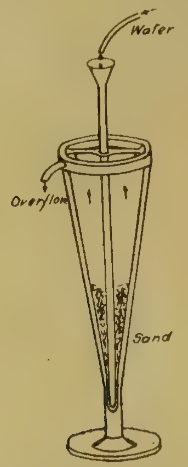

Fig. 80.—Schultze's Sand Washer.

The permeability will also largely depend on the tightness with which the sand is rammed, and, as far as the permeability to gases is concerned, on the amount of water present, a dry sand being much more permeable than a wet one. If the sand consisted of perfect spheres in actual contact, the tightness of the ramming could make no difference; this, however, is not the case, as the particles are always more or less irregular, both in size and shape, so that shaking may make them lie more compactly, or they may be pressed into closer contact. The particles may also be separated by a layer of air, and when this is even partially displaced by water the particles are brought into closer contact, so that the sand always shrinks, and becomes less porous and permeable when wetted. The form of the grains also has great influence on the "strength" of the sand, irregular grains giving a stronger sand than regular rounded grains.

Analysis of Sands.

The actual chemical analysis of a sand is, of course, quite beyond the power of the founder, and even if it could be simply made it would probably be of little real benefit; but there are some tests which can be made easily, and which will give really useful information.

One of the most important questions to decide is the quantity of clayey matter and fines present in a sand, and this can be determined by the use of a Schultze's apparatus mentioned by Dr. Percy and shown in fig. 80. Water is allowed to enter by the funnel until a steady overflow is obtained; then a weighed quantity of dry sand is introduced into the conical vessel in small portions at a time. The clean sand falls to the bottom and, by suitably regulating the outflow of water, only the clay which dissolves in the excess of water passes away with a little of the very finest sand particles. The washing of 50 grammes of sand should be complete in about three hours if the funnel be periodically used as a stirring rod; then the residue is carefully washed out, dried, and weighed to give an approximate idea of the silica present. A less reliable method is to stir up a quantity of the sand repeatedly with water in a beaker or tin and pour off the supernatant liquor, after allowing to stand for two minutes. A sample of Belfast sand and a fire clay compared in this way gave—

	Belfast sand Per cent.	Fire clay. Per cent.
Silica and insoluble	85·5	60·5
Clay and fines	14·5	39·5

Another very simple test to ascertain the proportion of the constituents in a sand by measure instead of by weight is to half fill a stoppered, graduated cylinder with the sand, add water to the 500 c.c. mark, and shake until all lumps are broken down, then allow to settle. The heavier grains are seen settling to the bottom, and the layers of sand get gradually finer until on the top of these a depth of mud, due to the clay, is noticeable, and above that clear water (see fig. 81). The texture of the sand, that is, the fineness of the grains, is also of very great importance. If the grains are of very different sizes, as in the case of a sand with much coarse material (or which may look coarse to the eye), it may have little permeability, because of the finer admixed material. It is therefore of great advantage to have some idea of the size of the grains and the proportion of various sizes. This can be obtained by sifting through fine mesh screens, and may be done either wet or dry.

A series of sieves is required, those usually used having 20, 40, 60, 80, and 100 wires to the inch run. If the test is to be made dry, some means must be taken to break up any clayey lumps, and this must be so gentle as not to actually pulverise the sand. The following method used in the J. T. Case Threshing Machine Co., Racine, Wis., U.S.A.* This consists in placing 10 grammes of the sand on the 100-mesh sieve along with 10 $^7/_{16}$-in. steel ball-bearing balls, and shaking with a circular motion for one minute. The sand passing through is weighed and credited to the 100-mesh sieve. The sand remaining in the meshes of the sieve, together with the balls, is emptied on to the 80-mesh sieve; the operation is repeated and so on up to the 20-mesh sieve. Mr. Scott claims that this method is more expeditious and more accurate than the wet method.

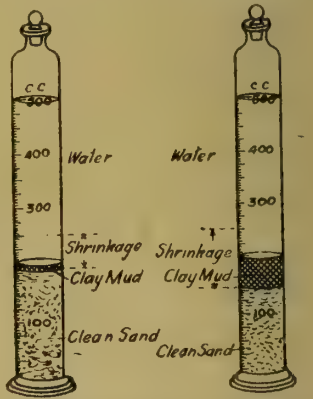

Fig. 81.—Comparison of Two Sands showing Proportions of 5 per cent to 25 per cent of Clay to Sand.

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* Professor H. Ries's paper read before the A.F.A., Cleveland, June, 1906.

Professor Ries uses a wet method, which he describes as follows:* "Fifty grammes of the sand were put into an 8-oz. bottle, and the latter half filled with water. The mixture was then put into the shaker for four hours, after which it was washed through a set of 20, 40, 60, 80, and 100-mesh sieves. The sand retained on each was dried and weighed. That which passed through the 100 mesh was caught in a jar. When all the water and suspended matter had been run through the sieves the contents of the jar were stirred up, and after standing 45 seconds the water with suspended clay and fine silt were decanted off. More water was added to the contents of the jar, and the decantation repeated. In this way two sizes were obtained. That which remained in suspension has been termed the clay, and that which settled is indicated by 100†, and most of it is retainable on a 150-mesh sieve."

In the work on the Wisconsin materials, about 50 moulding sands were analysed mechanically, and the limits of variation of the different sizes are given below:—

Sizes of mesh.	1 Per cent.	2 Per cent.	3 Per cent.
20	0 — ·04	0 — ·6	0 —12·76
40	·02— ·90	·16— 9·08	72 —35·06
60	·04— 2·3	·34—42·00	19·96—56·24
80	·02— 2·2	·12—11·64	4·92—11·78
100	·12— 1·84	·18—39·16	3·24—30·06
100 +	49·98—87·82	12·76—78·66	1·54—37·32
Clay	11·92—52·64	·36—35·52	·4 —18·26

1. Brass sand.
2. Sands for general work.
3. Core sands.

It will, of course, be understood that the actual percentage of clay may be larger than that given, as some may be retained on the other sieves, the grains retained not being by any means simple. A larger percentage would be obtained by thoroughly breaking up the sand, but this would not represent its actual condition in working. The method of calculating the average size of the grains is thus explained by Professor Ries.*

The average may be defined as the sum of the quantities considered divided by the number of separate items.

Now if in a sand we have

N_1 grains, size S_1;
N_2 ,, ,, S_2;
N_3 ,, ,, S_3, etc.,

then average size of S

$$= \frac{N_1 S_1 + N_2 S_2 + N_3 S_3 +}{N_1 + N_2 + N_3} \text{ etc.}$$

If the total number of grains is N, then $N_1 + N_2 + N_3$, etc., equal N, and S

$$= \frac{N_1 S_1 + N_2 S_2 + N_3 S_3}{N} \text{ etc.,}$$

or

$$\frac{N_1}{N} S + \frac{N_2}{N} S_2 + \frac{N_3}{N} S_3, \text{ etc.,}$$

but $\frac{N_1}{N}$ the fractional part of the whole quantity, which has a size S_1. So if the total number is taken as 100 (or proportional to 100) $\frac{N_1}{N}$ = per cent of size S_1, $\frac{N_2}{N}$ = per cent of size S_2.

In order to apply this formula to the mechanical analysis of a sand it is necessary to assume an average size for each mesh. In the case of grains retained on the 20 mesh, it was assumed that they averaged $^1/_{15}$ in., and few of them were much larger. Thus size would then be expressed decimally as ·066 in.

Those grains which rested on the 40 mesh might range from $^1/_{20}$ in. to $^1/_{40}$ in., averaging ·037, and so on. The average size of grains on the 100 sieve was taken as $^1/_{100}$ in. or ·008, whilst that of the silt or clay was assumed as ·004 in.

As an example, the mechanical analysis of one sand was—

Mesh.	Per cent.	In 1 part.		Size.		Average.
20	·44	·0044	×	·066	=	·00029
40	2·82	·0282	×	·037	=	·00104
60	5·76	·0576	×	·019	=	·00109
80	1·44	·0144	×	·013	=	·00019
100	2·86	·0286	×	·011	=	·00031
100 +	51·96	·5196	×	·008	=	·00415
Clay	34·46	·3446	×	·004	=	·00137
		Average grain size				·00844

In other words, if all the grains of the sand (whose mechanical analysis is given above) were reduced to a uniform size, they would pass through a 74 mesh. The average fineness of the sand is given as 74.

The following figures are selected from a table given by Professor Ries. The sands being all American, their names are of no importance, therefore they are indicated by numbers only:—

No.	Average fineness.	Specific gravity.	Per cent pore space.
1	174	2·50	42·45
2	163	2·72	44·70
3	131	2·62	40·43
4	103	2·57	43·20
5	88	2·62	38·00
6	70	2·73	32·91
7	63	2·55	39·52
8	54	2·61	38·83

It will thus be seen that, contrary to what would be generally thought, the so-called finer sands have a much larger percentage of pore space than the coarser. The average fineness is not all that is needed to decide this, the difference between the sizes of the grains having some effect in allowing the interspaces of the large grains to be filled with small sand particles. If, however, the various sizes be separated by sifting and the porosity determined for each, the smaller sizes are really found to have less porosity; as, for example, a Belfast sand which as received gave an average porosity of 44 per cent, when tested on the 81 per cent of its weight which passed through a 100-mesh sieve gave a porosity of only 38 per cent.

A much shorter method is used in the author's laboratory to obtain what may be termed a percentage degree of fineness. One hundred grammes of the dried sand is sifted as before, and the weight of the material found on each sieve is multiplied by the number of the meshes in the sieve through which it has passed. The total of these multiplicands divided by 100 gives the degree of fineness, and the figures got afford an easy method of comparison of various grades of sand. If any coarse particles are left on the 20-mesh sieve their weight is added direct, and loss which is inevitable in the siftings and weighings is assumed as an average to have passed the 40-mesh sieve. Comparing (1) Clyde River with (2) Belfast red and (3) German yellow sand, we get the following figures:—

	I.	II.	III.
Through 100 mesh	4·3 = 430	81·0 = 8100	78·0 = 7800
,, 80 ,,	2·1 = 168	2·6 = 208	3·0 = 240
,, 60 ,,	8·4 = 504	4·0 = 240	6·5 = 390
,, 40 ,,	29·0 = 1160	3·5 = 140	5·0 = 200
,, 20 ,,	40·5 = 810	6·5 = 130	4·0 = 80
Not ,, 20 ,,	14·2 = 14	1·5 = 2	1·5 = 2
Loss (× 40)	1·5 = 50	0·9 = 36	2·0 = 10
	100·0 3146	100·0 8856	100·0 8792
Degree of fineness	= 31·5	= 88·5	= 88·0

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* Professor H. Ries's paper read before the A.F.A., Cleveland, June, 1906.

The range of fineness for various kinds of sands are:—

Fine light sand	90 to 100 fine.
Medium sand	75 „ 90 „
Coarse sand	55 „ 75 „
Extra coarse sand	30 „ 55 „

(*To be continued.*)

AN ELECTROMAGNETICALLY ACTUATED ELECTRIC SWITCH.

An improved type of electromagnetically operated electric switch is shown in figs. 1, 2, and 3. The device is of that kind in which there is a blow-out magnet having pivoted pole-pieces, which can be swung aside to permit access to the contacts of the switch, and is being introduced by the Adams Manufacturing Co. Ltd., London.

In order to facilitate the outward movement of the blow-out pole-pieces, they are arranged to turn about the same axis as the core of the blow-out magnet. For instance, they may be fixed to the core itself, which is arranged to turn in the coil or bobbin of the magnet. In this way the pole-pieces can be very conveniently and rapidly moved into and out of position, and a strong magnetic field can be obtained between the pole-pieces with a low expenditure of energy in the blow-out coil by reason of the low magnetic reluctance of the joints between the core and pole-pieces. An extension, adapted to bear against a stop, which may consist of the base of the switch, is formed on one of the pole-pieces, and when the pole-pieces are in their operative position this serves as a stop.

The several parts of the switch are preferably mounted on an insulating base 1, secured to which by bolts 3 and 4 is a frame 2. The bolt 4 forms one terminal of the switch, and is, therefore, preferably formed of brass, and provided with a binding nut; 6 are two substantially parallel arms, through the ends of which extends a pin 7, held in place by cotter pins. Fulcrumed on the pin 7 is a switch member 8, made broad and flat at its lower end, and provided with angularly disposed extensions 9, arranged to engage a projection 10 provided on the frame so as to limit the movement outwardly. A spring 11 tends to force the switch member outwardly. The core 13 of an electro-magnet 14 is secured to the frame 2 by a screw 12, the head of which is countersunk in the end of core. The winding 14 surrounds the core 13, and is retained in place by means of insulating discs 15, the ends of the core being formed of reduced diameter so as to form shoulders against which the discs 15 bear, and being retained in position by flattening the ends of the core. Projecting outwardly from the upper end of the frame is a pair of horns 16, which project beyond the magnet 14. Secured to the base by means of a bolt 18 is a contact holder or support 19, prevented from turning by a screw. The holder 19 is provided at its outer end with a portion adapted to receive a wedge-shaped carbon contact block 21, held in place by means of a clamping member 22, secured to the holder by the screw 23, and the holder is recessed to receive one end of a main contact 24. This main contact is formed of a plurality of elastic sheet metal plates or laminations, held together and secured to the holder 19 by a bolt or screw 25. Secured to the member 19 is one terminal of the blow-out coil 28, the opposite terminal of which is secured to a terminal block 29, provided with a screw-threaded stem which extends through the base and carries two nuts, the end of the stem forming a binding post. The blow-out coil 28 is formed of heavy copper strip, and is self-supporting. Extending through the blow-out coil 28 is a core 33, secured to the ends of which are a pair of pole-pieces 35, which are provided with polar faces 36 disposed on opposite sides of the carbon contact 21. The core 33 is adapted to turn in the blow-out coil, whereby the pole-pieces may be raised to the position illustrated in fig. 3 to give access to the carbon contact. One of the pole pieces is provided with an extension 37, adapted to bear against the base to limit its downward movement. Interposed between the ends of the blow-out coil and the pole pieces are insulating discs 38, and interposed between the polar faces 36 is an insulating chute or barrier 40, which is supported by bolts passing through these polar faces. The insulating chute 40 shields the arcing contacts from the polar faces, which are arranged to extend inwards towards the arcing contacts.

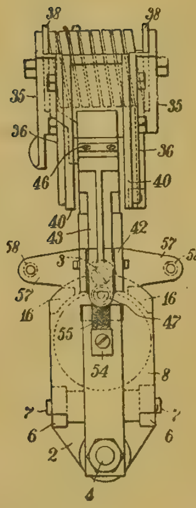

Fig. 1.

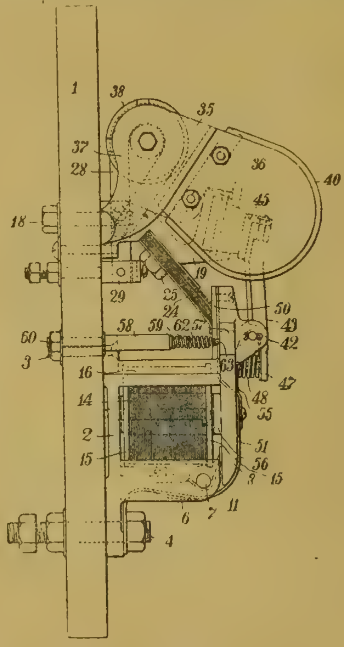

Fig. 2.

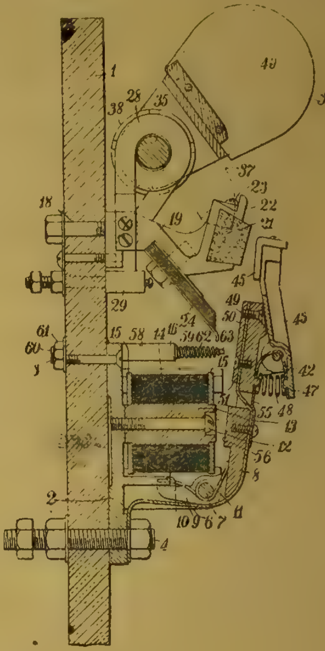

Fig. 3.

Adjacent to its upper end the switch member 8 is provided with a bifurcated projection 42, adapted to receive one end of an auxiliary contact member 43, which is fulcrumed on a pin passing through the bifurcations. At its upper end the contact member 43 carries an arcing contact 45, adapted to engage the carbon contact 21, and formed of an angle plate. The contact member 43 is provided with a tail piece 47, interposed between which and the arm 8 is a coil spring 48, which tends to throw the upper end of the contact member 43 inwardly against the upper end of the switch member 8, which forms a stop. 50 is a contact plate adapted to engage the main contact 24, and interposed between which and the arm 8 is a conducting strip 51, having a flexible extension which passes through an aperture in the arm 8 and downwardly on the outside to the terminal 5, to which it is secured by a screw which also electrically connects one end of a flexible conductor 55 to the conducting strip. The conductor 55 passes upwardly and has its opposite end electrically connected to the arm 43. Adjacent to the outer end of the core 13 of the magnet 14 the arm 8 is provided with a projection 56. The arm 8 forms the armature of the magnet 14, and hence when this magnet is energised the arm is drawn inwardly until the projection 56 engages the end of the core 13, and the contact plate engages the ends of the horns 16. This results in completing a plurality of magnetic circuits for the magnet 14, and hence the arm 8 is firmly held in its innermost position.

As the arm 8 is drawn inwardly, the arcing contact first engages the carbon contact 21, and inasmuch as the member 43, which carries the arcing contact, is pivoted to the arm 8, a rubbing action between the two arcing contacts is produced. This keeps the contact clean, and insures a good electrical contact between the same. As the arm 8 is still further drawn inwardly, the contact plate 50 is moved into engagement with the end of the main contact brush 24.

It will be seen that the circuits for the magnet 14 extend from one end of the core through the frame 2, through the horns 16, and through extensions 6 to the contact member, and thence to the other end of the core, a strong pull being thus exerted on the switch member and the magnetic attraction gradually increased as the switch member moves inwardly. In this manner the closing of the switch with the desired force is effected.

The several parts of the device are preferably castings. They may, however, be formed of sheet metal.

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"Practical Electro-plating." By George Gentry. Marshall's Practical Manuals, No. 9. London: P. Marshall and Co. Price 1s.

The object of this handbook is to give to the beginner and amateur just that information he requires to successfully carry out the operations of electro-plating, and to include as much of the rudiments of the sciences involved as will enable them to understand the underlying principles. There are already standard works on the subject, but they are unnecessarily abstruse for the beginner, besides being expensive.

No attempt is made to deal with the modern methods of rapid deposition, but simply to give the usual processes for copper, silver, gold, and nickel plating as carried out in a small way. There is a chapter on the after-process of polishing.

This handbook throughout is thoroughly practical and fully reaches the high standard of, and deserves its place in, the Manual series to which it belongs.

"General Foundry Practice." By W. Roxburgh, M.R.S.A. London: Constable and Co. Ltd. Price 10s. 6d.

The founding of iron and its alloys is of importance, second to none, in most iron-raising countries; in fact, it constitutes the basis of the machinery industry. The general practice in the foundry has perhaps undergone less changes than any other branch of engineering, but a work based on modern lines of theory and practice, and dealing with the subject from one who has had many years' experience in the foundry, will be appreciated by moulders, pattern makers, draughtsmen, students of metallurgy, and others engaged in engineering generally.

For convenience, the matter is divided into three divisions—general ironfounding, jobbing loam practice, and moulding and casting the finer metals.

The first division covers over half the book. In this, which opens with some notes on starting a small iron foundry, are paragraphs on practical hints on moulding sands, core making, shrinkage, the use of risers, the mixing of metals, defects, pipe and cylinder work, chilled casting, and the location of gates.

The practice of moulding in loam is most effectively treated in Division II. It is exemplified in the moulding of a 36 in. cylinder liner, a slide-valve cylinder, cylinder cover, piston, and a loco boiler front cross block.

In connection with the working of the finer metals, there are some suggestions on the starting of a small brass foundry, with accommodation required, type of furnaces, moulding for brass, brass mixtures, the working of bronzes, speculum metal, aluminium alloy, and malleable cast iron.

A number of tables are given of the analyses of English pig from leading firms, and in addition are notes on pattern making from the moulder's point of view, including stucco pattern making, foundry ovens, fuels, and general shop tools.

The book is eminently practical throughout, being the outcome of 30 years' experience. It is well written, concise, and accompanied by over 160 illustrations, mostly section views, showing methods of the various operations, which add considerably to its value.

"Tables for Transition Curves." By E. H. Rigby, B.Sc., and W. M. Bergin, B.A. London: Wm. Dawson and Sons Ltd. Price 2s.

In order that there may be a minimum of shock to a train when passing from a straight line to a curve or *vice versa*, it is necessary that the transition curve shall vary from the circular curve, so that the tangential portions shall partake of the straight line and curve. The cubic parabole fulfils this condition, and upon this curve the tables have been prepared. Some examples are given for the sake of clearness. A table gives the increase of superelevation for permissible speeds on radii from 300 ft. to 3,000 ft., also gradients compensation for curvature and the laying out of vertical curves where gradients meet.

This is a handy little pocket book, about 5 in. by 4 in., and will be found indispensable to the railway engineer and his draughtsman.

Books Received.

"Official Gazette of the United States Patent Office." Vol. CLVII., No. 1. Published by Authority of Congress, Washington.

"Summary Report of the Mines Branch for the Year 1909." Department of Mines, Ottawa, Canada. Price 10 cents.

"Board of Education's Reports for Year 1909 on The Geological Survey, The Geological Museum in Jermyn Street, The Science Museum at South Kensington, and the Work of The Solar Physics Committee." From the Secretary. Price 9d.

"Regulations for Technical Schools, Schools of Art, and Other Forms of Provision of Further Education in England and Wales." Part I., Grant Regulations. From the Secretary, Board of Education.

"The Construction and Working of Internal-combustion Engines." By R. E. Mathot. Translated by W. A. Tookey. London: Constable and Co. Ltd. Price 24s.

MODERN AUTOMOBILE PRACTICE.

By A.M.I.A.E.

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(Continued from page 164.)

SIDE THRUST ON PISTON.

In order to arrive at a comparison of the side thrust in an engine with offset and of one without, we must first of all consider what the side thrust on the piston of an ordinary engine actually is. Considering fig. 17,

If P = the total pressure on the piston,
ϕ = the angle which the connecting rod makes with the perpendicular through the centre of the cylinder,
T = the side thrust on the piston, then

$$T = P \tan \phi,$$

and the thrust T therefore becomes a maximum, when $P \tan \phi$ is a maximum.

Now $$l \sin \phi = r \sin \theta,$$

$$\therefore \sin \phi = \frac{r}{l} \sin \theta,$$

and $$\phi = \sin^{-1}\left(\frac{r}{l} \sin \theta\right)$$

and assumes maximum values when $\sin \theta = 1$, *i.e.*, when θ is 90 deg., hence

$$\phi_{\max} = \sin^{-1}\frac{r}{l}.$$

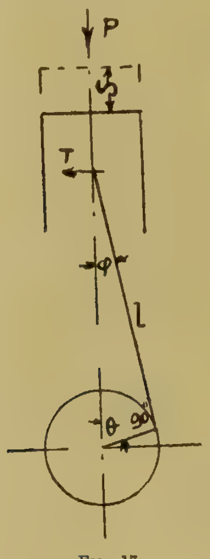


Fig. 17.

If p = the pressure per square inch,
and d = the diameter of the piston in inches,

then $$T = \frac{\pi d^2}{4} \times p \tan \phi$$

$$= \frac{\pi d^2}{4} \times p \tan\left(\sin^{-1}\frac{r}{l}\right);$$

$$\therefore t \times d\, L = \frac{\pi d^2}{4} \times p \tan\left(\sin^{-1}\frac{r}{l}\right);$$

where t = the thrust pressure per square inch,
and L = the length of the piston,

hence $$t = \frac{\pi d^2 p \tan\left(\sin^{-1}\frac{r}{l}\right)}{4\, d\, L} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

We have shown above that T is a maximum when $P \tan \phi$ is a maximum, but when ϕ is greatest, that is when the crank has passed through a quarter of its travel, and $\theta = 90$ deg., the pressure on the piston has obviously decreased from its maximum value, which is of almost instantaneous duration, the value of P at the instant under consideration is given by the expression

$$P\, V^n = K;$$

where V = the volume of the gas at this particular instant.
n = the ratio of the specific heat of the gas at constant pressure to the specific heat at constant volume.
K = a constant for a particular engine.

For petrol n = 1·333 for compression and 1·363 for expansion; it is usual, however, to take

$$n = 1{\cdot}333.$$

Therefore, when θ is a maximum, *i.e.*, when $\theta = 90°$ the distance swept by a piston $= r + \frac{r^2}{2\,l} = \frac{r\,(2\,l + r)}{2\,l}$

so that if

V_c = the volume of the combustion space above the piston when at the top of its stroke,

the volume required is

$$V = V_c + \frac{\pi d^2}{4} \times \frac{r\,(2\,l + r)}{2\,l};$$

but $$P = \frac{K}{V^n};$$

therefore by substitution

$$P = \frac{K}{\left[V_c + \frac{\pi d^2 . r . (2\,l \times r)}{8\,l}\right]^n}$$

and $$p = \frac{4\,K}{\left[V_c + \frac{\pi d^2 . r . (2\,l + r)}{8\,l}\right]^n \times \pi d^2}$$

hence by substituting the value of p in our former equation (1) we have

$$t = \frac{\pi d^2}{4\,d\,L} \times \frac{4\,K \cdot \tan\left(\sin^{-1}\frac{r}{l}\right)}{\pi d^2\left[V_c + \frac{\pi d^2\, 4 . (2\,l + r)}{8\,l}\right]^n}$$

$$= \frac{K \tan\left(\sin^{-1}\frac{r}{l}\right)}{d\,L\left[V_c + \frac{\pi d^2\, r\,(2\,l + r)}{8\,l}\right]^n} \quad . \quad . \quad . \quad (2)$$

The maximum thrust on the side of the piston which exists at a point somewhere between the two points considered is found in the following manner:—

From formula (1) we know that

$$t = \frac{\pi d^2 p \tan\left(\sin^{-1}\frac{r}{l}\right)}{4\,d\,L}$$

$$= \frac{\pi d^2 p \tan \phi}{4\,d\,L} \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

p is here the pressure at the moment required; the other variables are t and ϕ; two of these, viz., p and ϕ, can be expressed in terms of θ, for we know that

$$\sin \phi = \frac{r}{l} \sin \theta,$$

$$\text{that } \cos \phi = \sqrt{1 - \sin^2 \phi}$$

$$= \sqrt{1 - \frac{r^2}{l^2} \sin^2 \theta}$$

$$= \frac{1}{l} \sqrt{l^2 - r^2 \sin^2 \theta},$$

$$\text{and } \tan\phi = \frac{\sin\phi}{\cos\phi}$$

$$\therefore \tan\phi = \frac{r\sin\theta}{\sqrt{l^2 - r^2\sin^2\theta}}.$$

The distance which the piston has travelled at the instant considered

$$= \mathrm{S} = r\,(1 - \cos\theta) - \frac{r^2}{2\,l}\,(\sin^2\theta),$$

and the volume V swept out

$$= \mathrm{V} = \mathrm{V}_c + \frac{\pi\,d^2}{4}\mathrm{S}$$

$$= \mathrm{V}_c + \frac{\pi\,d^2}{4}\left[r\,(1 - \cos\theta) + \frac{r^2}{2\,l}\sin^2\theta\right]$$

but $\mathrm{P} = \dfrac{\mathrm{K}}{\mathrm{V}^n}$;

$$\therefore \frac{\pi\,d^2}{4}\,p = \frac{\mathrm{K}}{\left\{\mathrm{V}_c + \dfrac{\pi\,d^2}{4}\left[r\,(1 - \cos\theta) + \dfrac{r^2}{2\,l}\sin^2\theta\right]\right\}^n}$$

but from equation (3)

$$t = \frac{\pi\,d^2}{4\,d\,\mathrm{L}} \times p \times \tan\phi\,;$$

therefore by substitution,

$$t = \frac{\pi\,d^2}{4\,d\,\mathrm{L}} \times \frac{4}{\pi\,d^2}$$

$$\times \frac{\mathrm{K}}{\left\{\mathrm{V}_c + \dfrac{\pi\,d^2}{4}\left[r\,(1 - \cos\theta) + \dfrac{r^2}{2\,l}\sin^2\theta\right]\right\}^n} \times \tan\phi$$

$$= \frac{\pi\,d^2}{4\,d\,\mathrm{L}} \times \frac{4}{\pi\,d^2}$$

$$\times \frac{\mathrm{K}}{\left\{\mathrm{V}_c + \dfrac{\pi\,d^2}{4}\left[r\,(1 - \cos\theta) + \dfrac{r^2}{2\,l}\sin^2\theta\right]\right\}^n}$$

$$\times \frac{r\,(\sin\theta)}{\sqrt{l^2 - r^2\sin^2\theta}}$$

$$= \frac{\mathrm{K}\,r\sin\theta}{d\,\mathrm{L}\sqrt{l^2 - r^2\sin^2\theta}\left\{\mathrm{V}_c + \dfrac{\pi d^2}{4}\left[r\,(1 - \cos\theta) + \dfrac{r^2}{2\,l}\sin^2\theta\right]\right\}^n} \quad . \quad . \quad . \quad . \quad (4)$$

By substituting actual values and differentiating, we can find the value of θ to make t a maximum, and thence we can find ϕ from our original equation

$$\phi = \sin^{-1}\left(\frac{r}{l}\sin\theta\right).$$

These values of t assume that the pressure is evenly distributed throughout the length of the piston; we shall show in a later article how to ensure this.

Side Thrust on Piston of Offset Cylinder.

Coming now to the case of the piston belonging to the offset cylinder, which is the object of this article. In addition to the symbols already in use, let x = the amount of offset in inches (fig. 18),

$$\text{then } \tan\phi = \frac{r\sin\theta - x}{\sqrt{l^2 - (r\sin\theta - x)^2}},$$

$$\text{and } \mathrm{V} = \mathrm{V}_c' + \frac{\pi\,d^2}{4}\mathrm{S}_x\,;$$

where $\mathrm{S}_x = \sqrt{(l + r)^2 - x^2} - \sqrt{l^2 - (r\sin\theta - x)^2} - r\cos\theta,$

but $\mathrm{P} = \dfrac{\mathrm{K}}{\mathrm{V}^n}$ as before;

$$\therefore \mathrm{P} =$$

$$\frac{\mathrm{K}}{\left[\mathrm{V}_c + \dfrac{\pi\,d^2}{4}\left(\sqrt{(l - r)^2 - x^2} - \sqrt{l^2 - (r\sin\theta - x)} - r\cos\theta\right)\right]^n}$$

$$\text{and } p =$$

$$\frac{4\,\mathrm{K}}{\pi\,d^2\left[\mathrm{V}_c + \dfrac{\pi\,d^2}{4}\left(\sqrt{(l + r)^2 - x^2} - \sqrt{l^2 - (r\sin\theta - x)} - r\cos\theta\right)\right]^n}$$

By substitution in equation (3)

$$t = \frac{\pi\,d^2}{4\,d\,\mathrm{L}} \times$$

$$\frac{4\,\mathrm{K}}{\pi\,d^2\left[\mathrm{V}_c + \dfrac{\pi\,d^2}{4}\left(\sqrt{(l + r)^2 - x^2} - \sqrt{l^2 - (r\sin\theta - x)} - r\cos\theta\right)\right]^n}$$

$$\times \frac{r\sin\theta - x}{\sqrt{l^2 - (r\sin\theta - x)^2}}$$

$$= \frac{\mathrm{K}\,(r\sin\theta - x)}{d\,\mathrm{L}\left[\mathrm{V}_c + \dfrac{\pi\,d^2}{4}\left(\sqrt{(l + r)^2 - x^2} - \sqrt{l^2 - (r\sin\theta - x)} - r\cos\theta\right)\right]^n\sqrt{l^2 - (r\sin\theta - x)^2}} \quad . \quad . \quad (5)$$

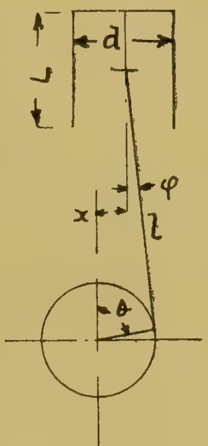


Fig. 18.

from which we can find the values of θ and ϕ as already described.

The method has been worked out somewhat fully above, so as to illustrate the derivation of the formula, but the work can be much simplified if $\dfrac{l}{r}$ equals, say, 4, 4·5, or 5. By referring to pages 266—269 in *The Practical Engineer* Pocket Book, where the actual travel of the piston is given for various ratios, these values are given in decimal fractions of the stroke, and must therefore be multiplied by two to obtain the travel in terms of the crank radius.

Thus, if the connecting-rod centres = $11\frac{1}{4}$ in.,

the stroke = 5 in.,

then the ratio $= \dfrac{11\frac{1}{4}}{2\frac{1}{2}} = 4\frac{1}{2}$ in.,

When the crank axle = 90 deg., the piston has moved ·5563 of the stroke, or 5 × ·5563 = 2·7815 in.

NUMERICAL APPLICATION OF PRECEDING FORMULÆ.

Taking the case of a well-known car on the road,

Let $d = 4$ in.,
$r = 2{\cdot}25$ in.,
$l = 11$ in.,
$V_c = 16{\cdot}9$ cubic inches,
$L = 4{\cdot}625$ in.,
$n = 1{\cdot}333$,
$p = 350$ lbs. square inch absolute explosion pressure.

Assume explosion to occur on top dead centre,

then
$$K = P V_c^{\,n};$$
$$\log K = \log 350 + 1{\cdot}333 \times \log 16{\cdot}9;$$
$$\therefore\ K = 15170;$$
$$\sin^{-1}\frac{r}{l} = 11^\circ\ 50'.$$

From equation (1)

$$t = \frac{\pi d^2 \times p \times \tan\left(\sin^{-1}\frac{r}{l}\right)}{4\,d\,L}$$
$$= \frac{\pi \times 4^2 \times 350 \times {\cdot}2095}{4 \times 4 \times 4{\cdot}625}$$
$$= 49{\cdot}8 \text{ lbs. per square inch.}$$

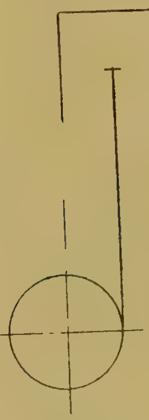


FIG. 19.

From equation (2)

$$t = \frac{K \tan\left(\sin^{-1}\frac{r}{l}\right)}{d\,L\left[V_c + \frac{\pi d^2 r\,(2\,l + r)}{8\,l}\right]^n}$$
$$= \frac{15170 \times {\cdot}2095}{4 \times 4{\cdot}625\left[16{\cdot}9 + \frac{\pi \times 4^2 \times 2{\cdot}25\,(22 + 2{\cdot}25)}{8 \times 11}\right]^n}$$
$$= \frac{15170 \times {\cdot}2095}{4 \times 4{\cdot}625 \times 174{\cdot}6}$$
$$= {\cdot}98 \text{ lbs. per square inch.}$$

From this we see that the side pressure when P is a maximum is far below what it is when p is a maximum, and in this particular engine is only ·2 per cent. Similarly by substitution in equations (4) and (5) we find that side pressure when $x = 1\frac{1}{4}$ in. is approximately only two per cent of a similar engine without offsetting.

When $x = r$, as in fig. 19,

$$K\,(r\,.\,\sin\theta - x) = K\,(r - r)$$
$$= 0,$$

so that theoretically there is then no side thrust whatever, but in practice this amount of offset is not easily possible, and it will be found most convenient to make $x = {\cdot}2\,r$, which gives very good results, and permits of a very good arrangement.

(*To be continued.*)

BOILER EXPLOSIONS.

ABSTRACTS FROM RECENT BOARD OF TRADE REPORTS.

Explosion from a Main Steampipe on the Steamship "City of Edinburgh."

Report of Preliminary Inquiry No. 1931.—The explosion occurred about 6 a.m. on the 20th February last, when the vessel was in the English Channel, on a voyage from Dunkirk to Glasgow. The vessel is owned by Messrs. The Ellerman Lines Ltd., 12, Moorgate Street, London, E.C. No person was injured by the explosion. The pipe which failed was a straight length, about 10 ft. long and 9 in. in diameter, made of copper about $^{11}/_{32}$ in. in thickness, the edges being lapped and brazed, with a brass flange brazed on at each end. The working pressure was 200 lbs. per square inch. About three years ago a crack, about 3 in. long, was found at the back of the forward flange of the pipe that failed. This fault was remedied by brazing over the crack. The vessel and her machinery are classed with Lloyd's, and under the inspection of their surveyors. The pipe fractured circumferentially for a short distance on the after side of the forward flange, a slight escape of steam taking place. This fracture gradually extended, until when it was examined, after the vessel's arrival in port, it was found to be about 7 in. long. The fracture was probably caused by the vibration of the machinery during very heavy weather, described as a hurricane, experienced on a voyage from Dunkirk to Glasgow, when the vessel was light.

Explosion from the Evaporator of the Steamship Anglo-Saxon.

Report of Preliminary Inquiry No. 1932.—The explosion occured about 9 p.m. on the 31st December, 1909, when the steamer was off Cape Palliser, New Zealand. The steamer is owner by the Nitrate Producers' Steamship Co. Ltd., Billiter Buildings, London, the managers being Messrs. Lawther, Latta and Co. The chief engineer, Mr. Francis Lawrence, was so severely injured that he died within a few minutes of the explosion. The evaporator, which was cylindrical in section with hemispherical ends, was of cast iron, 2 ft. 9 in. in diameter, and 6 ft. 6 in. high, and was originally of an average thickness of $\frac{3}{4}$ in. The door, which was secured by 24 $\frac{7}{8}$-in. bolts, was fitted obliquely, and was so shaped as to form a portion of the cylindrical shell; its average thickness was $\frac{3}{4}$ in., increased at the flanges to 1 in. Six ribs were cast on the door, four in line with the hinges and two vertically. The shell flange was of an average thickness of $1\frac{1}{8}$ in., and was cast with a groove $\frac{7}{8}$ in. wide by $\frac{3}{8}$ in. deep to carry the jointing material, which was of asbestos, and projected about $\frac{1}{8}$ in. above the flange. A steel bar 3 in. deep by $\frac{5}{8}$ in. thick was bolted to the upper portion of the shell and supported two flanges joining the heating coils, which were also fitted with flanges at their lower extremities and connected to the steam admission and drain flanges at the base of the evaporator. The coils were $1\frac{5}{8}$ in. bore and No. 10 L.W.G. in thickness. The evaporator was supplied with water by a small pump worked off the air pump levers, drawing its supply from the circulating discharge pipe. During March, 1909, a portion of the coil was renewed, and a new spring was fitted to the safety valve about two years ago by the engineers of the ship. The evaporator was constructed under the supervision of the surveyors to the Board of Trade, and was also inspected by the surveyors to Lloyd's Register when building. The explosion was of a violent nature, the evaporator bursting with a loud report, and being completely wrecked. The fractured portions were thrown with great force against pipes and other fittings at the back of the engines, damaging steam, exhaust, suction, and delivery pipes. The explosion was caused by excessive pressure due to the safety valve being practically inoperative, and the vapour cock being shut, the door and shell of the evaporator being at the time also considerably reduced by internal corrosion.

Explosion from a Jacketed Colour Boiling Pan.

Report of Preliminary Inquiry No. 1933.—The explosion occurred on Friday, the 18th April last, at about 5-30 p.m., at the calico printing works of Messrs. Robert Hindle and Co., Sabden, near Whalley, Blackburn. The proprietors are Messrs. F. Steiner and Co. Ltd., Church Works, Church, near Accrington, Lancashire. The pan attendant, Mr. John Birtwell, was scalded on the face and arms by the hot liquid contents of the pan falling upon him immediately after the explosion occurred. He was in consequence unable to follow his employment for some days. The inner pan is made of copper, No. 12 I.W.G. (*i.e.*, ·104 in.) in thickness. The depth inside is 2 ft. 5 in., and the greatest diameter is 2 ft. 7 in., the pan being somewhat barrel shaped from 2 ft. 6 in. at the top to 2 ft. 3½ in. at the lower part where the concave bottom commences. The body consists of two pieces in the circumference, joined by lap joints, placed at opposite sides, having copper rivets ⅜ in. in diameter, pitched 1½ in. apart. At the top of the pan is fitted a flanged ring of copper, 3 ft. 1½ in. in outside diameter, 1¾ in. deep, and of the same thickness as the body of the pan, and is attached to the body by copper rivets ¼ in. in diameter, pitched 2½ in. apart. The bottom of the pan is also made of the same material and thickness as the other portions. It consists of one piece of hammered copper, concave in form to the extent of 5 in. below the level of the joggled lap joint, whereby it is secured to the body by rivets ⅜ in. in diameter, pitched 1½ in. apart. The interior of the pan is formed to have a smooth surface, the heads of all rivets and joints being flush and soldered. The pan, as above described, rests within another pan of cast iron, being jointed at the top and forming a cavity between the two pans. The outer or cast-iron pan is 2 ft. 9¼ in. in internal diameter, and 2 ft. 7⅜ in. deep, having a flat bottom and a flange around the top, the uniform thickness of the metal throughout being ¾ in. There is an inlet branch pipe 2 in. in diameter near the top, and an outlet branch 1⅞ in. in diameter near the bottom. The two pans were joined together at the top by an ordinary red lead putty joint, being held together by a brass ring, ½ in. thick, on top of all, and secured by 23 iron bolts ½ in. in diameter. Steam or cold water could be admitted as required to the cavity between the pans through a 1-in. pipe attached to branch pipe near the top of the outer pan. To the outlet branch, near the bottom of the outer pan, was fitted an ordinary straight-through brass cock, ¾ in. in diameter, which was always half open, allowing a free passage from the cavity into the room where the pan was situated. A small brass air cock, ½ in. in diameter, was fitted near the inlet branch at the top of the pan; this was also always open. An alteration in the method of working the pan was made about November last, when for the first time the pan was used as a jacketed pan, for which it was originally designed. The pan had been used at intervals during the day on which the explosion occurred, and was entirely in the charge of the same attendant during that time. The last charge for the day was just about completed, and the attendant was in the act of shutting the steam stop valve, when the explosion occurred with a loud report. The bottom of the pan had bulged upwards and ripped to the extent of about 8 in., just below the bottom circumferential seam, the contents of the pan being violently ejected and scattered over the attendant. The explosion was due to the steam pressure within the jacket being allowed to exceed what was intended or what the pan was capable of withstanding, no pressure gauge or other means for ascertaining the amount of pressure being provided. The copper appeared to be very brittle and liable to crack. No evidence can be found of water-hammer action or external violence of any sort.

Explosion from a Cast-iron Feed Pipe.

Report of Preliminary Inquiry No. 1934.—The explosion occurred at 1-25 p.m. on the 5th April last, at the Coppull Ring Spinning Co.'s mill, Coppull, near Chorley. William Margison, fireman, was injured by being scalded on the arm and burnt on the hand. He also had his collar bone broken. He has since recovered from his injuries, and probably returned to his employment at the mill. The pipe that exploded formed a portion of a range of cast-iron pipes for supplying three Lancashire boilers with feed water from pumps driven by the main and auxiliary engines situated in the engine house. The pipe was of cast-iron, with a right-angled bend, having a branch pipe with flange. It was 19½ in. long between centres, 5¼ in. in diameter outside, and 4 in. in diameter inside. There was a flange at each end of the pipe 10 in. in diameter and 1¼ in. thick, having six 1-in. clearance holes, and being stiffened by three webs ⅝ in. thick. The branch pipe was 6¼ in. long from the centre of the main pipe, 4¾ in. in diameter outside, and 2½ in. in diameter internally, with a flange 7 in. in diameter and 1 in. thick, having two stiffening webs ⅝ in. thick between the flange and the main body of the pipe. The pipe was situated horizontally above No. 3 boiler, with the branch pipe flange facing downwards for connection to the pipe leading to the check valve of this boiler. The feed pipe fractured at the bend, and allowed the steam from No. 1 boiler to escape into the boiler house where the injured man was working. The outrush of steam and water, at the time of the explosion, forced the pipe away from the supports on the front wall and fractured the pipe about 9 ft. away from where the original fracture took place. This portion of the feed pipe fell upon the injured man at the time of the explosion. The explosion was due to water-hammer opening of the "Hopkinson" valve, by the boiler atten- action taking place in the feed pipes, being caused by the dant, when the check valve seat of No. 1 boiler was out of its place, thereby admitting the steam from the internal feed pipe, situated in the steam space of the boiler, to the feed pipes which had been partially drained of water by leakage from a relief valve on the feed pipe range near the economiser.

THE DESIGN OF STEAM TURBINES.

In designing a steam turbine, the first and most essential step is to estimate the highest suitable speed of rotation in order that the turbine may be made as small as possible for the required efficiency. While there is now no great difficulty in accurately determining the proportions of turbines to insure certain results, with ample confidence to enable a stiff guarantee being made both for speed and economy, the principal dimensions involve considerable calculation.

Although fig. 2 illustrates a Parsons marine type of turbine, the method of calculation of the proper dimensions is carried out in exactly the same manner as for a land turbine, except that the most economical speed of the propeller has to be considered first of all. The Parsons marine type of turbine differs from the land type in that it has no dummy cylinders to counteract the end thrust of the shaft, caused by the expansion of the steam issuing from each set of blades. These dummy cylinders P P P, fig. 1, are not needed in the marine turbine, because the end thrust of the turbine is taken up by the thrust of the propeller, which is on the same shaft.

Roughly, the weight of turbines will vary inversely as the square of the revolutions, while the economy will remain almost constant if the turbines are designed for the same internal conditions.

The laws governing the best theoretical velocity of the steam and the blades in impulse turbines are similar to those for water turbines, but in practice some modification is necessary, and the best ratio of blade speed and steam speed is still a matter of opinion. The ideal condition for impulse turbines occurs when the peripheral velocity of the buckets is one-half that of the jet, or in reaction turbines when it is equal to it.

Parsons turbines have been built with V_t, fig. 3, varying from 0·25 to 0·85 of V_s, where V_t represents blade velocity at mean diameter, and V_s the steam speed across the row in question. A very usual ratio for large units in electrical work has been

$$\frac{V_t}{V_s} = 0·6.$$

These ratios require very careful calculation. The steam consumption must be accurately known in order to proportion them correctly throughout the turbine, and the necessity of having the same area of openings in so many rows while the steam volume increases so rapidly adds to the difficulty of close circulation.

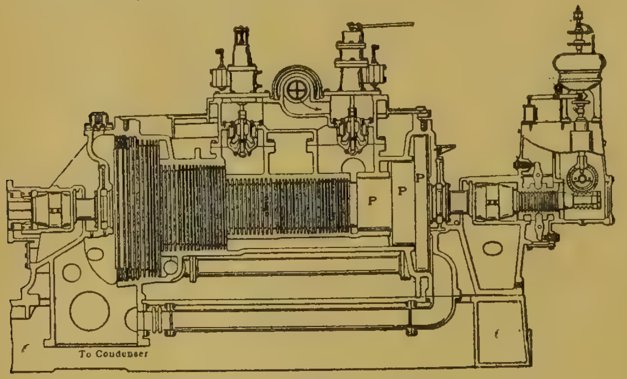


FIG. 1.—Parsons Turbine, Land Type.

The potential energy of the steam, corresponding to the "head" in water turbines, can easily be calculated for given pressure differences.

The well-known expression connecting energy and velocity is

$$E = \frac{W V^2}{2g},$$

where E = kinetic energy,
W = weight,
V = velocity,
g = acceleration due to gravity.

Taking the weight W as one pound of steam, expressing the velocity V and the acceleration due to gravity g in feet per second, and the energy E in foot-pounds, $g = 32·16$ and $E = 778 \times$ B.T.U. utilised. Then,

$$V^2 = 2 \times 32·16 \times 778 \times \text{B.T.U.},$$

and $V = \sqrt{50040·96 \text{ B.T.U.}} = 223·81 \sqrt{\text{B.T.U.}}$

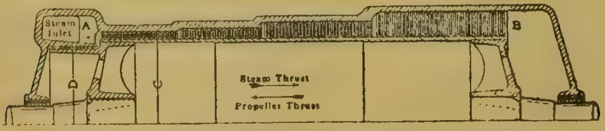


FIG. 2.—High-pressure Cylinder of Parsons Turbine.

It is obvious that the speed ratio between jet and vane must affect the number of stages, and that with a given turbine velocity the greater the ratio of V_t to V_s the greater will be the required number of rows. To obtain a small value for V_s necessary to produce a large value for $\frac{V_t}{V_s}$, a small pressure drop per row is necessary.

The mean diameter is a dimension capable of wide variation without affecting the efficiency, provided that the number of rows is correct.

Calling this mean diameter in inches d, the blade velocity in feet per second will be

$$V_t = \frac{d \times \pi \times \text{r.p.m.}}{12 \times 60};$$

and assuming a blade velocity from experience the diameter can be determined.

$$d = \frac{12 \times 60 \times V_t}{\pi \times \text{r.p.m.}} = \frac{229 \times V_t}{\text{r.p.m.}}$$

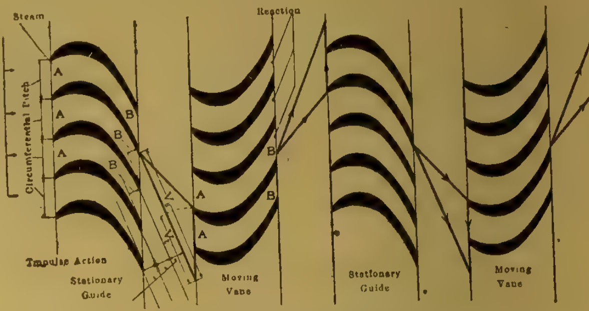


FIG. 3.—Action of the Steam in the Parsons Turbine.
V_t = blade velocity at mean diameter,
V_s = steam speed due to expansion between A and B.

Therefore to find the mean diameter of the rows of buckets, multiply the bucket velocity in feet per second by 229 and divide by the revolutions per minute.

To arrive at the corresponding number of rows, the revolutions being given, the ratio of V_t to V_s must be settled, from which the steam speed can be obtained. It is a convenient assumption at the beginning of any design to consider the turbine as parallel throughout and of constant efficiency, and to design on this basis. The number of rows N on one diameter can be found by working out the British thermal units necessary to give a certain steam speed at each row; see fig. 4. The available energy divided by the energy it is desired to abstract at each row will give the number of rows required. This result may be arrived at by various ways, but the principle involved is the same in each case. Numerous empirical coefficients for approximating steam speeds and the corresponding number of rows are obtainable from experience. To put all the rows on one diameter would involve an excessive length of turbine and also inconvenient blade height. It is therefore usual to divide the rotor into three or more stages, which has the advantage of shortening the turbine and reducing the number of rows. If $\frac{1}{n}$ = the fraction of power developed in the first cylinder or barrel, $\frac{N}{n}$ = the number of rows in the first barrel, and with the change of diameter and increase of blade velocity in the succeeding shafts, the number of rows on other barrels is so altered as to keep, for equal powers and efficiencies, $(\text{Blade Vel.})^2 \times$ number of rows = constant.

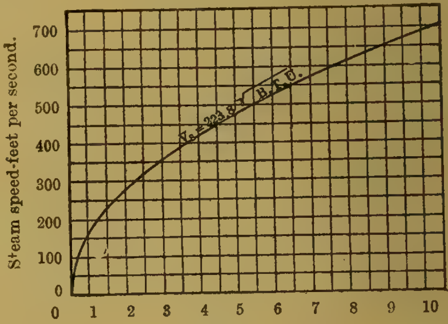


FIG. 4.—Velocity Diagram.

The vane speeds adopted in practice vary considerably; for some time 100 ft. per second was regarded as a standard for the first row, and the author suggests that the Westinghouse Co., at Pittsburg, was the first to make a radical departure in this respect and adopt higher speeds. The maximum vane speed used for Parsons blading is, as far as the author is aware, about 375 ft. per second in the low-pressure blades and 17 ft. in the high-pressure blades for turbines driving electric generators. To some extent the blade speed is governed by blade height. The speed should be so modified that this may be at least 3 per cent of the mean diameter to reduce the proportion of clearance losses. Leakage over the tips of the blades is perhaps not so detrimental on account of actual loss as in its superheating effect on the steam between the row past which it leaks and the last row, because the reheating effect upsets calculations regarding openings by increasing fluid efficiency. This leakage over the tips must be taken into account in designing reacting turbines. Temperature and diameter influence the clearance, and the stiffer the cylinder is made to resist distortion due to heat, the less may be the clearance. A clearance diagram based upon measurements of a large number of machines is given in fig. 5.

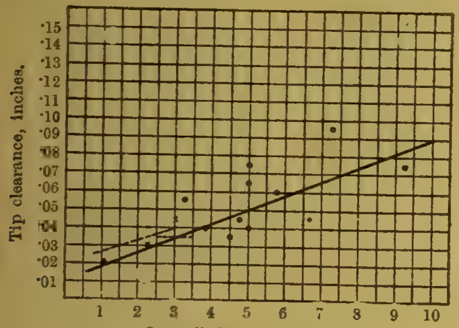


FIG. 5.—Clearance Diagram.

TABLE I.—VARIOUS VANE SPEEDS.

Nominal output of turbine.	Peripheral vane speed.		No. of rows.	Revolutions per minute.
	First expansion.	Last expansion.		
Kw. 5000	135	330	70	750
3500	138	280	75	1200
2500	125	300	84	1360
1500	125	240	72	1500
1000	125	250	80	1800
750	125	260	77	2000
500	120	285	60	3000
250	100	210	72	3000
75	100	200	48	4000

Replying to the discussion on his paper before the Institute of Naval Architects in 1903, Mr. Parsons said that "for all practical purposes, while the steam is traversing each set of blades it behaves like an incompressible fluid, just as water would do, the expansion being very small at each set of blades, it behaves like an incompressible fluid, are practically identical, within small limits, with that of water, and the actual forces are in proportion to the density of the medium. In the turbine blades themselves the efficiency is between 70 and 80 per cent."

This hydraulic analogy enables us to calculate the number of stages required in a different manner. The "equivalent head" due to the steam pressure, together with that at each row necessary to give the required velocity, may be found, and from these both the number of stages and the coefficient of expansion at each stage may be worked out.

In all types of turbines, Parsons, Rateau, Curtis, etc., a certain ratio must be maintained between the blade velocity and steam velocity, and as steam acquires very high velocities by expansion, the blade velocity must be maintained either by a high rotary speed or by large diameters, or both. As the weight increases very rapidly with the diameter, and especially with a reduction in rotative speed, it is preferable to increase, if possible, the revolutions or the number of stages rather than the diameter. This should be done in cases where the weight increases more rapidly in inverse proportion to the rotative speed and the diameter, as in the Rateau and Zoelly types.

Having obtained the number of rows and the diameter, the blading arrangement can be worked out in detail. The height of blade depends upon the volume of steam and the speed at which it is to flow, also upon the ratio of the area of exit openings between the blades to that of the annulus between spindle and cylinder, which is about $\frac{1}{3}$ in. normal blades. The necessary clear area for the steam to pass through being equal to volume divided by velocity, and knowing this annular factor, say, 3 for a ratio of one-third (or 2 for $\frac{1}{2}$, etc.), then height of blade in inches

$$= \frac{\text{clear area in square inches} \times 3}{\text{mean circumference in inches}}.$$

The ratio of blade height to mean diameter should not be less than 3 per cent, or more than 15 per cent, because in the former the percentage of leakage will be excessive, and in the latter the bending moment and the radial divergence of the blades become too great. The width of blade, the shape of section adopted, and the circumferential pitch are standard considerations, and effect the factor 3 given above. It is not proposed to enlarge upon them in this paper. It may, however, be remarked that for $\frac{V_t}{V_s}$, greater than 0·6, the usual shape of Parsons section, as shown in fig. 2, should be modified to a somewhat different form of blade with a sharper entrance edge. This section is not to be recommended, as, owing to the necessity of sufficiently strengthening the blade, the metal must be placed nearer the exit edge, thus increasing the angle between the face and the back of the exit blades, and giving an inferior shape of opening compared with that obtainable with a blade section adapted to ratios under 0·6.

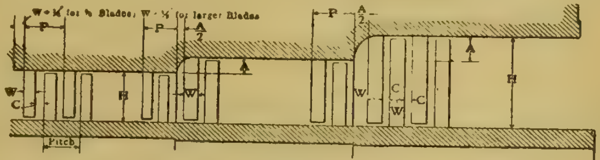


TABLE II.

Height (H)	in. 1	in. 2	in. 3	in. 4	in. 6	in. 8	in. 10	in. 12	in. 15	in. 18	in. 21	in. 24	in. 30
Width (W)	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{3}{4}$	1	1	$1\frac{1}{8}$	$1\frac{1}{4}$
Pitch (P)	$1\frac{1}{8}$	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$	$1\frac{3}{8}$	$2\frac{1}{8}$	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{5}{8}$	$3\frac{1}{8}$	$3\frac{1}{4}$	$3\frac{3}{8}$	4
Axial Clearance (C)	$\frac{3}{16}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{3}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$

In Table II. can be found a list of approximate widths for a given height, and axial spacing of the rows. While this must be kept down to reduce the length of drum, it must be sufficient to allow for some play in overhauling, and sufficient clearance can be allowed here without affecting the economy. The openings between the blades to allow for the passage of the steam are very important, and must be carefully designed. The actual volume of the steam, not the volume per pound as found in steam tables, or the volume due to adiabatic expansion, but the exact volume per pound at any point along the turbine, must be determined in order to arrive at the desired adjustment of velocities. It is extremely doubtful whether the present blading arrangements give the best results. Greater accuracy of calculation and, consequently, improved pressure distribution and efficiency seem likely to follow the use of a more mechanical blading construction.

Fig. 6 shows the percentage of error involved in using either the dry volume or that due to adiabatic expansion, compared with the correct volume corresponding to the actual expansion in a large turbine using dry saturated steam at the first row of blades and 27 in. vacuum. Attention must be paid to the effect of approximate adiabatic expansion and the consequent moisture in the steam.

For convenience in manufacturing, as well as to allow for the expansion of the steam, the blade heights are stepped up, but no rule exists for this. The blades might be of 1 or of 65 heights, provided the blade openings were correct. It is, however, convenient to step them, as in fig. 2, say, in 8 steps of 8 rows each, or 4 steps of 16 rows; even 9 steps of 7 rows would do to avoid any great variation from the annular area factor 3, as shown above. To obtain heights and areas, it is best to plot graphically volumes, steam speed, and the clear areas required. The use of standard blade heights will then enable the number of stages and rows per stage to be determined, and wide differences can be made in any arrangement without materially affecting the economy. The best arrangement is largely a matter of convenience and experience.

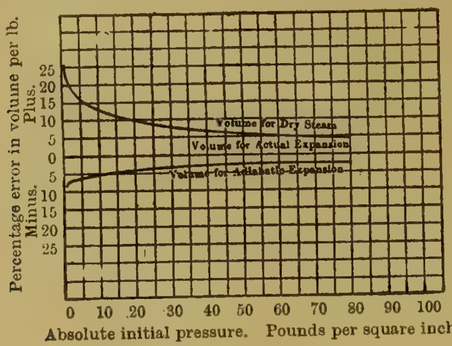


Fig. 6.

The material of which blades are usually made is a mixture of cheap brass containing about 16 parts of copper and three parts of tin. Alloys containing zinc are extremely unreliable for high temperatures, but blades blades containing about 98 per cent of copper have been found very satisfactory for use with high superheats. More recently a material containing about 80 per cent of copper and 20 per cent of nickel has been adopted, and this is undoubtedly the best blading material in existence. Steel blading, drawn in the same way as the usual brass section, has been used in the United States with fairly good results. The process of drawing turbine blades gives an extremely tough skin to the metal, not only increasing the tensile strength, but greatly decreasing the chances of erosion.

It seems probable that the usual caulking piece now adopted will be discarded in favour of a machine divided strip into which the blades may be fitted, and instead of the slotting, wiring, lacing, and soldering process at the tip, a similar machine-divided shroud will be used, giving a far stronger construction, and enabling finer clearances and better workmanship to be obtained, at the same time considerably reducing the cost of manufacture and the risk of blade stripping

The chief causes of the latter may be set down to bad workmanship in setting the blades, defective blade material, excessive cylinder distortion (this is probably the most fruitful cause, and is a serious one, being due to bad design), whipping turbine spindles (which is also due to bad design, or bad balancing), wear of bearings (which is very remote), and the introduction of extraneous substances, such as water or grit. In fact, blade stripping may be said to occur generally from preventable causes. Small vibrations of very high frequency occasionally set up an action in certain rows of responsive length and fatigue in the blade material, causing the loss of blades without any fouling at all.

In turbines driving electric generators, where the end thrust must be eliminated by the use of balancing pistons, the spindle is in tension when the cylinder is balanced. The shafts between the turbine bearings and the drum must be made amply stiff, as well as strong enough, as any sag in the spindle will destroy the clearance. As will be seen from fig. 7, the stresses due to centrifugal force are very low in the Parsons turbine, and, except in occasional low-pressure barrels, they do not exceed 7,500 lbs. per square inch, while at the high-pressure end they are usually under 2,000 lbs.

The pressure on the bearings in a turbine is due only to the weight of the spindle. It may be taken from 80 lbs. to 90 lbs. per square inch as long as the rubbing velocity does not exceed 30 ft. per second. If it does, the pressure must be reduced so that the product of pressure and velocity does not exceed 2,500 to 2,700. In land work 50 lbs. multiplied by 50 ft. is very common. The friction heat of the bearings added to that due to conduction through the pedestals necessitates the use of large oil coolers, and, in the case of very high temperatures, of special kinds of oil. If possible, the bearing temperatures should not exceed 140 to 150 deg. Fah., though the writer has known of 190 deg. being used without trouble.

Space does not admit of more than passing reference to cylinders, but it would be difficult to exaggerate the importance of very careful design in this connection. Cylinders, with heavy flanges on the centre line, distort in a very curious fashion when heated with their axes horizontal, and measurements taken of a hot cylinder on a surface plate with micrometer gauges reveal some very remarkable facts. When working, the temperature along the cylinder falls from 400 to 100 deg. Fah. in a distance of 6 ft. or 8 ft., and, unlike the reciprocating engine, this remains constant. The radial expansion is consequently more at one end than the other, while at any point along the turbine the tendency is to expand less at the flanges than at the top and bottom. For this reason ample clearance must be allowed; exactly what this will be when the spindle and cylinder are hot is hard to say, but it seems most likely that the total clearance area will differ but little from what it is when cold.

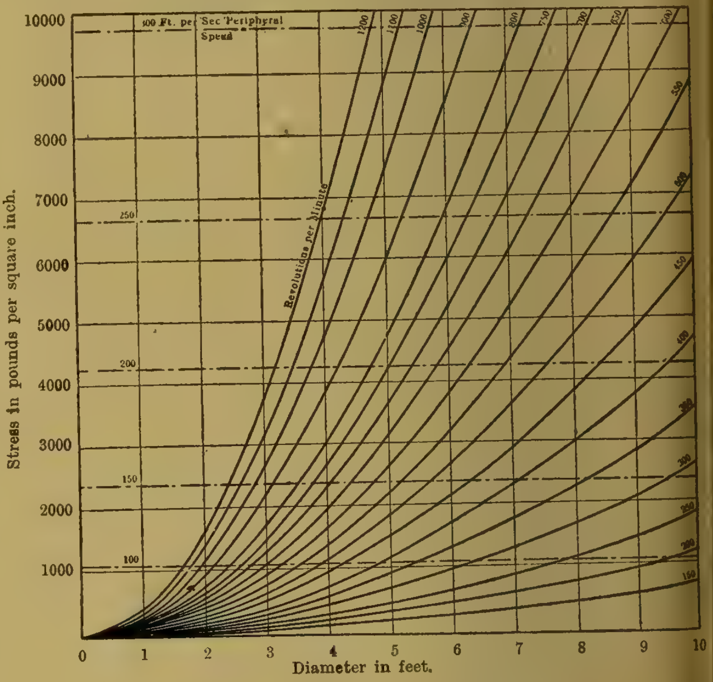


Fig. 7.—Stress due to Various Speeds.

The longitudinal expansion when hot is often very marked, and in all turbines necessitates provision for the resultant movement at one end.

In the course of operation, where no superheaters are used, there is a distinct tendency for the turbine to be supplied with wet steam, the effect of which is very marked on the economy. Experiments that have been made show that the percentage increase in consumption is about twice that of the moisture in the steam. With 2 per cent of moisture in the steam at the first row, the consumption is increased about 4 per cent.

For the above instructive article we are indebted to *Power and the Engineer*, by C. A. Edmonds.

STEERING MECHANISM FOR FLYING MACHINES.

A STEERING mechanism for flying machines of the type in which a single steering pillar is employed to control, say, three independent elements, such as vertical and horizontal rudders, and planes, separately or together as desired, and applicable to machines either of the aeroplane type or dirigible, is shown in figs. 1, 2, and 3. The device is the invention of Mr. T. T. Lovelace, and has been patented in this country by the inventor, in conjunction with Humber Ltd. It has a single steering pillar so arranged that it can slide endwise, rotate about its longitudinal axis, and swing about an axis transverse to its length for effecting three distinct classes of control by movements communicated, for example, to the wings, vertical rudder and horizontal rudder respectively.

The steering pillar comprises two parts A A^1 respectively. The part A is connected to the part A^1 by a cardan or like universal joint A^2, and carries at its free end the hand-wheel A^3. The part A^1 of the steering pillar is supported in a mount B that is rigidly secured to the footboard C or other part of the fuselage or framework of the aeroplane. The mount is provided with ball bearings B^1 B^2 so arranged that the pillar can freely rotate in them and also move endwise through them. At the bottom of the pillar is a swivel joint A^4, by which connection is made to an arm D, fast on a rocking shaft D^1 that carries two other arms D^2 D^3. The arms D^2 D^3 are connected by wire cables D^4 D^5 to a horizontal rudder E. The mount B is shaped to provide a chamber to enclose a drum F. This drum is carried by the part A^1 of the steering pillar, and has in it a feather that engages a key-way A^5. The drum thus allows the steering pillar to slide through it, but if the pillar is turned the drum also turns. Round the drum is passed a wire cable F^1 that has connection with the vertical rudder G. On the upper portion A of the steering pillar is a sleeve H that has in it a ball bearing H^1 to allow of its freely turning and sliding through the sleeve. Extending from opposite sides of this sleeve are wire cables H^2 that extend down to arms H^3 on a spindle J rotatably mounted in a depending bracket K. The spindle J carries a chain-wheel J^1 that is in engagement with a chain J^2, and opposite ends of the latter are connected by wire cables J^3 to the wings L for the purpose of deflecting them when required.

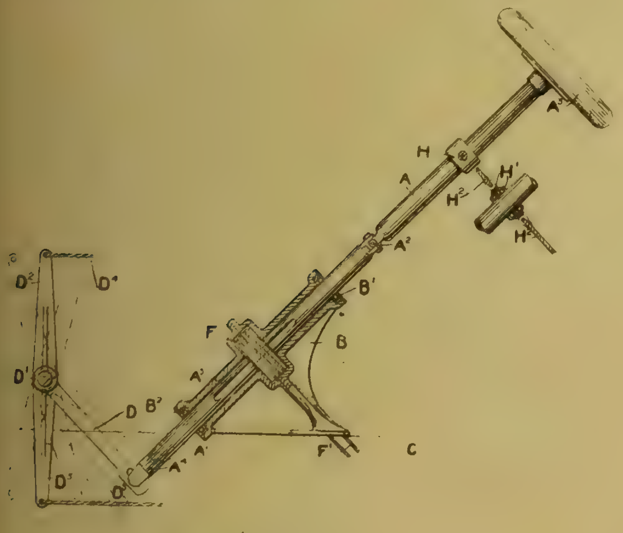


FIG. 1.

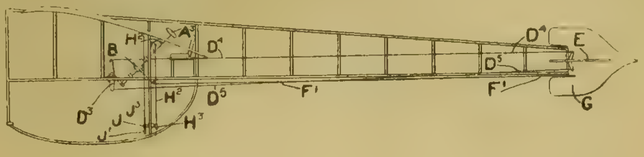


FIG. 2.

To operate the horizontal rudder, the whole steering pillar is raised or depressed, the rocking shaft D^1 being thereby operated and the front edge of the horizontal rudder correspondingly depressed or elevated. To turn the vertical rudder to the right or left, the steering pillar is correspondingly turned, but to deflect the wings the upper portion of the pillar is swung to right or left, as shown dotted in fig. 3, and the wire cables H^2 are carried over guide pulleys H^4 on opposite sides of the steering pillar, so that the swinging movement may give an approximately direct pull upon the cables. The movement of the upper portion A of the pillar is freely permitted by the universal joint A^2, and if moved to the right of fig. 3 the chain-wheel J^1 will be rotated clockwise, so that the right-hand wing will be depressed and the left-hand one allowed to rise.

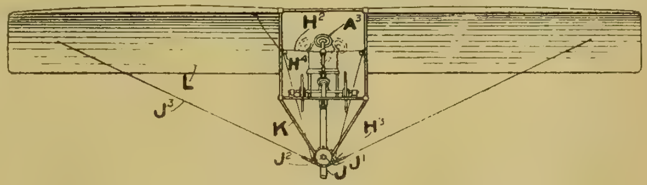


FIG. 3.

Each of the movements of the steering pillar can be operated from the hand wheel A^3 separately, so that the three distinct classes of control effected by the deflection of the wings, the vertical rudder, and the horizontal rudder, may each be carried out separately, or, if desired, any two or more of these three steering elements may be deflected simultaneously.

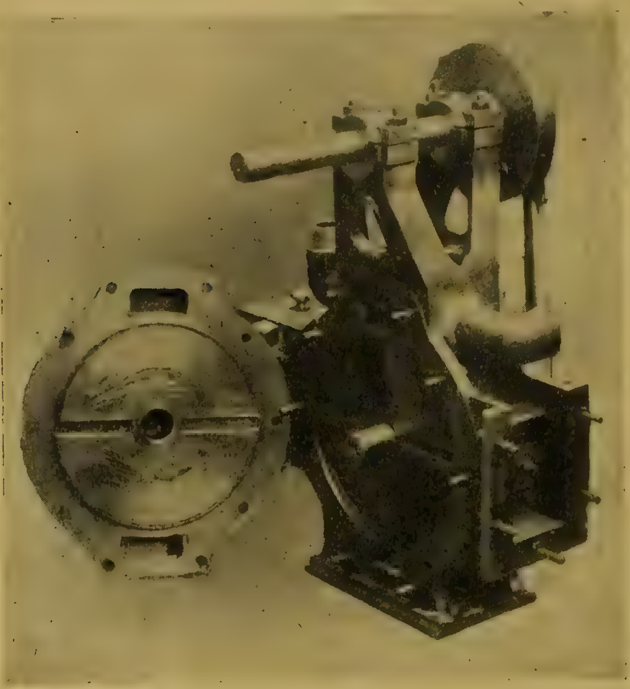
NOTICE OF MEETING, &c.

August 26th.—THE ABERDEEN MECHANICAL SOCIETY. Excursion to Mr. Lewis Morrison's, Spey Boot Works, Leadside Road.

INFLUENCE OF TITANIUM ON STEEL.—In a paper presented before the American Society for Testing Materials, dealing with the influence of titanium on Bessemer rail steel, a series of tests were described which dealt with ingots of ordinary rail steel and ingots of similar steel to which 0·25 per cent of titanium had been added during the pouring. There was no trace of the titanium in the steel with which it was used, but there was a marked increase in the soundness of the steel on account of the concentration of the blowholes in the pipe cavity. A great number of drillings were taken from the ingots, and analyses of them showed the effect of the titanium was to reduce the segregation of the sulphur, phosphorus, and carbon; the results of the silicon and manganese determinations were not given on account of their erratic character, but they did not show segregation. Tests of rails from ordinary and titanium steels were also made and showed the same result.

IMPROVED AIR PUMP AND CONDENSER FOR STEAM ENGINES.

A NEW design of combined air pump and condenser has recently been brought out by Mr. J. H. Burton, of Haslingden. The object in view has been to provide a semi-rotary pump adapted to give two complete discharges each half revolution of the crankshaft, and thereby reduce the pressure to about one-half of that obtaining in the same capacity of ordinary plunger or bucket pump, whilst at the same time effecting a more uniform suction and discharge than is possible in the old type of apparatus.



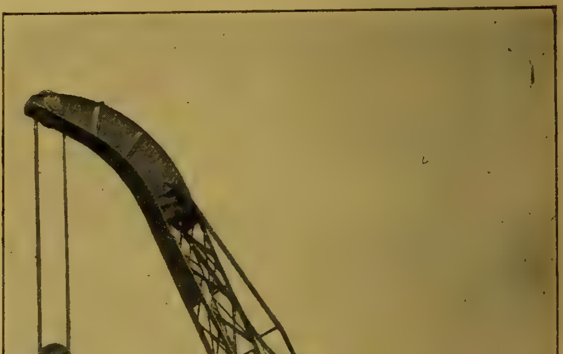
Air Pump Condenser for Steam Engines.

Referring to the illustration, a casing or cylinder is provided adapted to support a central shaft running horizontally through it and oscillated by any suitable means to the extent of a half revolution. This shaft has securely fixed to it a pump bucket having two portions, each of segmental form, or so that the transverse section of the bucket resembles roughly a letter X, with the shaft at the centre where the two bars of the latter cross, the periphery of the segments making a tight joint with the bore of the cylinder or chamber, and also a similar joint at the ends either directly with the sides of the chamber or with special facings arranged in the interior of the chamber. Running horizontally across the chamber is a partition designed to divide it into two parts, discharge ports being arranged at the edges of the plate parallel with the operating shaft, one set of ports being located above the plate and another set below at each side. These ports are controlled by an ordinary rubber valve, and by the usual curved valve guards which are kept in position by bolts, set-screws, or studs, the curvature of the guards allowing the rubber valves to bend outwardly for purposes of discharge. The cylinder is also provided with ports at the top and bottom, each communicating with opposite segmental chambers formed by the bucket and by the division plate previously described. The upper port communicates with a chamber provided with an inlet for the injection water at one part and an inlet for the exhaust steam at another, such chamber communicating by a suitable passage or pipe, or pipes, with the bottom port in the cylinder. The chamber is provided at its upper portion with a number of bars, pipes, or grids adapted to cause the injection water to descend in sheets, so that the exhaust steam meets the water and becomes efficiently condensed. The water and vapour then pass through the top port into the upper segmental chamber, water and vapour also passing through the pipe or passage in the injection chamber to the bottom port in the air pump chamber, and thence into the opposite segmental chamber. As the bucket is oscillated in one direction, the contents of each of the segmental chambers are discharged, one through an upper port above the division plate and the other through the lower port below the division plate at the opposite side of the pump chamber. Both these ports are in communication with the hot well. When the bucket has oscillated in one direction to the fullest extent, the top and bottom ports communicating with the injection chamber are put in communication with the two segmental chambers previously occupied by the bucket, the contents of these chambers being discharged in a similar way through the ports at the top and bottom of the division plate respectively, both these ports being also in communication with the hot well. The division plate is made removable, and is arranged to make a tight joint between the hub of the bucket and the sides of the air-pump barrel.

As already stated, the air pump can be worked by any suitable means. These may consist of levers operated from an engine by means of ropes or belts, rods, or other suitable connections, or by means of motors and wheels or other suitable gearing. The construction very considerably reduces the shock on the working parts, since the design of the bucket causes it to meet the water gradually.

36-TON STEAM BREAKDOWN CRANE.

THE illustration shows a 36-ton steam breakdown crane manufactured by Messrs. Stothert and Pitt Ltd., Bath, for the Gt. Westery Ry. Co. The maximum working capacity of the crane is 36 tons at 20 ft. radius, lighter loads being lifted at increased radii. It is fitted with a curved lattice jib. The motions for lifting, slewing, jib-derricking, and self-propulsion are operated by a pair of double, inclined cylinder engines, 10 in. diameter by 12 in. stroke, whilst the travelling motion is driven by means of a shaft



36-Ton Steam Breakdown Crane.

passing through the centre of the crane post operating a horizontal shaft coupled to two of the axles by sprocket wheels and chains. The boiler is of the "Hopwood" type, 4 ft. 6 in. by 7 ft. 6 in. high; working pressure, 100 lbs. per square inch. A heavy forged-steel post and a ring of live-steel rollers carry the superstructure, and the top of the post is fitted with ball bearings. Steel wire ropes are employed for derricking and lifting, and to admit of the clearing of the load gauge the chimney is hinged. A removable balance weight is provided, which can be racked in and out. Mounted upon five pairs of wheels, 3 ft. 2 in. in diameter, and axles (one four-wheeled bogie and three fixed axles), the crane is capable of negotiating a five-chain radius curve. The wheels and axles, axle boxes, buffers, etc., were supplied by the Great Western Railway Co. Clutches are provided, so that the travelling gear can be entirely disconnected when the crane is being hauled by train. In accordance with Great Western standard practice, the crane has been subjected to, and has successfully passed, a test load of 25 per cent above the working load.

ENGINEERING EXHIBITION AT OLYMPIA.

Preliminary Notice of Exhibits.

In connection with the Naval, Mercantile, Marine, and General Engineering Machinery Exhibition to be held at Olympia, London, W., from the 1st to 26th September inclusive, we are glad to note that it will be representative of almost every class of machinery used in the engineering and allied industries. As we propose during the period stated to devote several pages of our journal, *The Practical Engineer*, to descriptions and illustrations of the various exhibits, we will just refer to a few well-known firms who are sending samples of their specialities.

Messrs. Babcock and Wilcox Ltd., of London and Renfrew, N.B., are installing one of their portable boilers for the supply of steam for running their machinery, and will be complete with all their standard mountings. With the boiler will also be supplied one of their steel-stayed chimneys. This firm also have taken space in the building for exhibiting models of their boilers, samples of their wrought-steel piping, also a model of the Lassen and Hjort water softener, which they are handling under licence from the patentees.

Messrs. H. W. Ward and Co. Ltd., of Birmingham, will be showing several high-class machine tools in operation, including a 9 in. centre combination bar and chucking lathe, a 2¼ in. by 30 in. flat-turret lathe with full equipment of tools, one 7½ in. centre friction geared capstan lathe, and several others of smaller size; also a collection of milling, grinding, and drilling machines.

Messrs. The Crosby Steam Gauge and Valve Co's. exhibit will comprise the following:—A gauge-testing machine; the Crosby patent feed-water regulator, which will be shown in operation on a steam boiler; the Crosby patent water arrester for steam whistles; also a patented electrical timing device for steam whistles.

Messrs. Robert S. Allan and Co., of Gateshead-on-Tyne, who are exhibiting at the Japan-British Exhibition, will be represented at Olympia by one of their patent comprehensive wood-working machines for pattern making and general joinery.

Messrs The Colchester Lathe Co. are sending a new model 6 in. lathe which they have recently placed upon the market. They are also showing a 3½ in. centre screw-cutting and boring lathe, together with one of their drilling machines.

Messrs. The Combination Metallic Packing Co. Ltd., of Gateshead-on-Tyne, will be showing on their stands a number of new and interesting marine specialities, and included will be noticed specimens of their metallic packing, automatic drain valves for steam whistles, syrens, etc., metal jointing rings and metal sheeting, with sample rings for all known joints.

The Lea Recorder Co., of 28, Deansgate, Manchester, will be showing on their stands specimens in operation of their patent combined indicating, recording, and integrating instruments of the latest pattern; patent self-contained recording sets, comprising recorder, float chamber, and notch tank complete; also an assortment of fittings and parts of Lea recorders, together with photographic enlargements, etc., of installations carried out.

Messrs. Reginald Krall and Co. (The Patent Castings Syndicate Ltd.), of Balfour House, Finsbury Pavement, will have an interesting exhibit, comprising specimens of die casting and small machine component parts produced at their works at Willesden under a patent process. Various alloys are used in the process of manufacture to suit the functions and working surroundings of the castings required. No machining of parts is required after casting, and screw threads, holes, etc., are cast equal to tapping or reaming, while interchangeability is secured with much more certainty than by machining the part, as all parts are cast exactly alike, and being absolutely accurate the time saved in assembling is considerable. The economic value of the process consists in the fact that once the tools are made, thousands of pieces and small intricate parts can be made and delivered within a few days of the receipt of order, thus obviating delays in the assembling and putting together of small pieces of mechanism. We would recommend engineers to call and inspect this useful and interesting exhibit.

Other well-known firms exhibiting include Messrs. William Beardmore and Co. Ltd., of Glasgow; Messrs. Cammell, Laird and Co. Ltd.; Messrs. Kynoch Ltd.; Messrs. The Patent File and Tool Co., and others. Shipping interests will also be well represented by leading lines and steamship companies. Full information required by intending exhibitors can be obtained from Mr. F. W. Bridges, organising secretary and manager, 119-125, Finsbury Pavement, London.

(To be continued.)

ELECTRIFICATION OF SUBURBAN RAILWAYS.*

By F. W. Carter.

The shrinkage of suburban traffic has for several years past proved a source of lachrymose complaint at many of the general meetings of our railway companies. The extensive tramway systems that radiate from most of our large cities provide a convenient, cheap, and comparatively rapid means of transport with which the railways are ill-adapted to compete. Where a tramway runs directly parallel to a railway, it may be expected to secure the greater portion of the purely short-distance traffic, and it would seem that the distances over which its competition is effective are greater than might at first be supposed. At the general meeting of the London and North-Western Railway, held on 19th February, 1909, the chairman in discussing this point said that "he would be unwilling to say what the distance was—it might be 10 or 12 miles—but after such a distance the railway was the more punctual and the more certain way for a man to get to his destination. Within the 10 or 12 miles the tramway competition was very severe, but beyond that distance the railways were not so much touched by the tramways." The advent of the motor omnibus has also affected suburban railway traffics adversely, particularly in the neighbourhood of London, the flexibility of its route, its speed, and general convenience giving it a great advantage in ministering to the needs of comparatively short-distance passengers.

With the main routes of street traffic worked by tramcars and auxiliary routes by motor omnibuses, the railways as at present operated are at a great disadvantage, and bid fair to lose most of their suburban passenger traffic. The second report of the

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* Abstract of a paper read before the Institution of Mechanical Engineers and the American Society of Engineers, July, 1910.

London Traffic Branch of the Board of Trade gives the loss of passengers by five railways as upwards of 12 millions in 1908 as compared with 1907, and of 47 millions in 1908 as compared with 1902, both figures being exclusive of season-ticket holders, and taking no account of the increase in the number of long-distance passengers indicated by the receipts.

The railway companies affected appear for the most part undecided between allowing their short-distance traffic to go, employing their energies in fostering the longer distance traffic, and endeavouring to reduce the effective range of tramway competition by electrification of their suburban lines. The latter alternative, wherever it has been tried, has invariably succeeded in recovering a portion of the lost traffic, besides creating a more desirable traffic for longer distances by the improvement of facilities. Whilst it is by no means certain that local electrification would prove the best commercial policy in the case of all railways handling suburban traffic, it is the author's opinion that there is considerable scope for well-considered electrification schemes in this country.

Where a suburban railway is regularly used to near the limit of its capacity and there is still possibility of increased traffic, there is every reason to expect a commercial advantage from electrification. Both here and abroad the improved service has always been the means of largely increasing the traffic, whilst the capital cost is further justified by the greater use that can be made of existing lines and terminals under electrical operation. The cost of electrification should, in fact, be set against the cost of widening and improving the railway to accommodate the traffic in view.

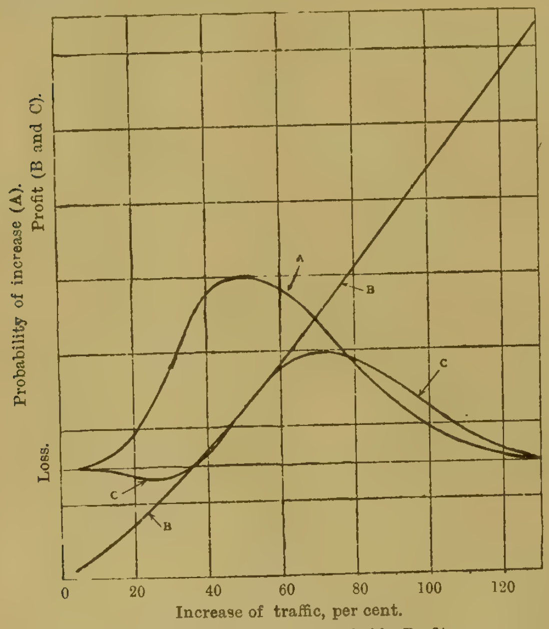


Fig. 1.—Estimation of Probable Profit.

In the more usual case, however, the management of a railway are compelled to estimate the chances of success from far less certain data. Consider, for instance, the line from Birmingham (New Street) to Sutton Coldfield and Four Oaks. It passes through a populous and growing residential district, feeding also one of the most beautiful pleasure resorts of Birmingham people. The present trains, of which there are about 30 per day in each direction, make a schedule speed, including stops a little over a mile apart, of approximately 18 miles per hour, the grades being rather severe. As the whole distance in question is little more than eight miles, it is small wonder that the tramway, which now parallels the line for a considerable distance and offers a frequent service at low fares, takes the greater part of the traffic so far as it extends. Although the population served has largely increased in recent years, the passenger traffic on the railway appears to have decreased considerably since the opening of the tramway, and will doubtless decrease still further as the tramway is further extended. If this section of the railway were electrified, the schedule speed might be increased 30 per cent or 50 per cent and trains run every 15 minutes or so throughout the day, say, two-coach trains during hours of light traffic and six-coach trains during the busy hours. The capital cost of electrification and the expense of such electrical working could be very closely estimated. The real difficulty which confronts the management is in estimating the increase in receipts which would accrue from the improved facilities. This is an economic problem to which no certain answer is possible. So many considerations enter into the matter that experience in one locality is no sure guide in making an estimate for another.

The appropriate method of treatment for any such problem in estimation is provided by the theory of probability. If from the experience of other electrified lines, and from knowledge of the particular district, such a curve as A, fig. 1, can be improvised, the abscissæ of which represent the increase of passenger traffic resulting from a certain improvement in facilities, whilst the ordinates are proportional to the probability of such increase—the probable value of the advantage of providing the improved facilities can be deduced. Let the increase of profit above the old method of operation be represented by curve B and deduce curve C, whose ordinate is the product of the ordinates of curves A and B. Then the area of curve C, as compared with that of the probability curve A, gives the probable value of the advantage of providing the improved facilities. While the probability curve may be subject to considerable uncertainty, the result of such calculation as indicated above, if properly interpreted, is likely to be of much greater value than a figure derived from a simple estimate of the increase of traffic.

It has generally been found hitherto that the increase in traffic due to electrification has exceeded the estimates formed of it. Thus at the February (1905) meeting of the Lancashire and Yorkshire Railway Co. the chairman stated, concerning the electrified Liverpool-Southport line, that "the increase in the traffic had exceeded their most sanguine expectations." At the February (1906) meeting of the North-Eastern Railway Co. the deputy chairman, referring to the Tynemouth electrification, said that "in the last half of 1903, with steam traction, they had 2,844,000 bookings, and in the last half of 1905, with electric traction, they had 3,548,000, an increase of, in round figures, 25 per cent. In 1903 the gross amount of money earned with steam traction was £129,000, and in 1905 with electric traction the gross amount of money earned was £151,000, and they had run in 1905 twice as many trains as in 1903. In 1903, to earn the £129,000, the running expenses amounted to £42,761, while to earn the £151,000 it cost £47,799, which was only £5,000 more to do twice the work in 1905 that they did in 1903. He would give the figures in another way, as many persons were interested in train mileage cost. In the electric traction on the 31 miles of suburban railway in the Newcastle district, they had practically doubled the train mileage and doubled the accommodation of the public, and the running cost per train mile, allowing for depreciation of stock, etc., had been with electric traction about 9d. per train mile, as compared with 1s. 5½d. per train mile under steam conditions. They had run smaller trains, but there were more of them. They were thus able to serve the public better and at the same time to make a better profit for themselves." At the February (1907) meeting of the North-Eastern Railway Co. the deputy chairman explained that in the last half of 1906 they had carried 4,195,339 passengers on the electrified lines, as against 3,548,206 in the corresponding half of 1905—a further increase of 18 per cent, making a total increase of 47½ per cent as compared with the last half year that steam operation was exclusively employed. At the last February meeting of the London, Brighton, and South Coast Railway Co. the chairman announced that the increase in passengers on the elevated electric line between Victoria and London Bridge for the two months (December, 1909, and January, 1910) during which the line had been open was, as compared with the corresponding period of 1908-9, 440,536, or 63 per cent.

It has been stated above that the capital outlay and operating expenses can be closely approximated in any particular case. The amount will depend largely on the difficulty of the proposed schedule. It is in the power of electricity to improve very greatly on the performance of steam trains, but the greater the improvement the higher the capital and operating costs, and the greater the attractiveness of the line. It is a matter of nice estimation and computation to determine what improvement of service will result in the greatest commercial advantage to the railway. The Tynemouth lines and the Liverpool-Southport line do not differ greatly in the distance between stops. The schedule speed is, however, considerably higher on the Liverpool-Southport line, and the effect of this on operating expenses is to some extent revealed in the above extract from the statement of the North-Eastern chairman as compared with that of the Lancashire and Yorkshire chairman at the February (1906) meeting: "They found after a full year's experience that the cost of electric working, as they had expected, was, when proper allowances were made for the depreciation of the more costly plant, slightly higher per train mile run" (than that of a steam working). Other features doubtless affect the comparison, but the greater portion of the difference in running cost can probably be ascribed to the difference in the schedule speeds.

The electrification of a steam railway can, of course, be considered commercially expedient only when the estimated net profit under electrical operation exceeds that under steam operation by more than the interest on the extra capital involved. It is chiefly the burden of capitalisation which limits electrification to lines of heavy traffic. The extent of the burden is in practice very variable. The total capital involved in the Tynemouth electrification to date is approximately £244,000, and the annual electrical train mileage 1,215,000; taking the interest at 4 per cent, which appears to be about the average value of railway investments here, the capital burden is seen to be about 1·93d. per train mile. Again, the capital involved in the electrification of the South London elevated line has been given as approximately a quarter of a million sterling, and the yearly train mileage is at present some 375,000, to be eventually increased to approximately 585,000 miles. The burden of the capital is therefore about 6·4d. per train mile at present, decreasing to 4·1d. if the improved service can be realised without adding to the capital expense. The capital burden in the case of the Mersey Railway has been given as 4·3d. per train mile, and in the case of the Lancashire and Yorkshire electrified lines as about 2d. per train mile. These two cases, of course, include generating station, which is absent in the first two.

An indispensable requirement to the success of any system for working suburban traffic is immunity from all forms of breakdown competent to delay the service. In this respect modern electric railway apparatus, the design and construction of which has been developed by arduous experience, if chosen with reference to the nature of the service and maintained with care, leaves litte to be desired. Even when first installed the troubles are usually of a minor character, and the consequent delays unimportant, whilst ordinary operation is exceedingly reliable so far as the electrical plant is concerned. The author is indebted to Mr. James R. Chapman, late chief engineer of the Underground Electric Railways Co. of London, for the following figures, giving particulars of all delays on lines under the company's control for the month of December, 1909, Table I. The much greater loss of time on the Metropolitan District Railway, as compared with the tube lines, is almost entirely due to the fact that district trains operate to a considerable extent over foreign lines worked for the most part in the interests of steam trains.

TABLE I.—TRAIN DELAYS, DECEMBER, 1909.

	District.	"Tubes."*
Total number of train-miles	401,295	499,908
Total number of delays (all causes)	303	44
Total time lost by delays ... mins.	1,186	107
Train-miles per delay	1,324·4	11,361
Train-miles per minute lost	338	4,672
Total number of delays due to electrical troubles on the trains	54	21
Time lost due to electrical troubles on the trains .. mins.	135½	75
Train-miles per electrical delay	7,431	23,805
Train-miles per minute delay on account of electrical troubles	2,961	6,665
Average mileage per train per day	185	194·85
Average delay per train per day due to electrical troubles on the trains ... mins.	0·062	0·029
Average delay per train per day due to all causes .. mins.	0·548	0·042

* Baker Street and Waterloo Railway; Great Northern, Piccadilly, and Brompton Railway; Charing Cross, Euston, and Hampstead Railway.

The comparative immunity from breakdown is duly reflected in the low maintenance costs of the train equipments. Mr. Chapman dealt with this subject at a valedictory dinner given in his honour on 7th February, 1910, on the occasion of his retirement from the position of chief engineer to the Underground Co. He said that they (the Underground Railways Co.) "owned over 800 motors, and that every one was the same throughout, no matter whether it was working on the district or a "tube," under a car or on a locomotive, all were interchangeable; and to-day, several years after the original purchase, they were negotiating for some more of the same motors to meet the increased traffic requirements of the district railway. On no one of their properties did the cost of rolling stock maintenance and repairs exceed 0·6d. per car mile. The 10 district railway electric locomotives, now five years old, made 1,300 miles per day at a cost of ½d. per mile for all maintenance and repairs. Two of them coupled handled a London and North-Western Railway nine-coach train to Mansion House far better than a steam locomotive had ever done. The maintenance cost was 1d. per train mile. The North-Western costs for maintaining a steam locomotive were 4d. per mile; the average cost for all English railways was 3½d. per mile. Five years after this system had been designed the Pennsylvania Railway had experimented for two years at a cost of $200,000 to determine the electric system to be adopted for bringing their trains through the Hudson River Tunnel into their magnificent New York terminal, and had decided in favour of the same system as they (the Underground Railways Co.) had to-day."

The railways in this country operated wholly or in part electrically are 18 in number, working over a total of approximately 200 miles of route and 410 miles of track. The trains are worked by 87 locomotives and 821 motor coaches. The aggregate nominal power of the driving motors is approximately 360,000 H.P., of which 184,000 H.P. is provided by one type of motor alone, namely, that used exclusively by the railways operated by or in conjunction with the Underground Electric Railways Co., London, and partly by the Metropolitan Railway.

Of the 18 electric lines 13 are in the London area (including seven tube lines), three in the neighbourhood of Liverpool, one at and near Newcastle, and one between Heysham, Morecambe, and Lancaster. As full details of all the lines have been published, there is no necessity to give more than a brief comparative summary here.

The oldest of the London lines is the City and South London Railway, which was not only the first tube railway, but one of the first electric railways to be constructed, having been opened for traffic in 1890. It extends for eight miles, from Clapham Common to Euston, and is carried in a 10-ft. 6-in. tube. It is unique among electric railways in transmitting high potential continuous current (2,000 volts) and distributing to the trains by the three-wire system, the up and down track conductors being of opposite polarity, whilst the track rails form the middle conductor. The traffic is still worked exclusively by electric locomotives.

The Waterloo and City line of the London and South-Western Railway is also comparatively old as electric railways go. It is 1½ miles long, and is carried in a 12-ft. tube. The trains are worked by motor coaches, mounting for the most part gearless motors, directly controlled. The track rails are used as return conductors.

The Central London Railway was the first to employ polyphase transmission of power and conversion to continuous current at sub-stations. The line is 6½ miles long, and is carried in an 11-ft. 8-in. tube. The traffic was originally worked by locomotives, but is now handled entirely by multiple-unit trains, using the electro-magnetic system of control, this railway having been the first to employ the multiple-unit system of operation. Power is supplied to the trains by a third rail, and the track rails are used as return conductors.

The Great Northern and City Railway is the only tube sufficiently large to accommodate main line rolling stock, the minimum internal diameter being 16 ft. It is 3½ miles long, and is supplied with power from a central power station, which feeds directly to positive and negative conductor rails. The trains are of the multiple-unit type, using the electro-magnetic system of control.

The Underground Electric Railways Co. of London operate three tube lines, namely, the Baker Street and Waterloo Railway (4½ miles), the Great Northern, Piccadilly, and Brompton Railway (9 miles), and the Charing Cross, Euston, and Hampstead Railway (8 miles). These are all run in tubes of 11 ft. 8 in. minimum diameter. Power, which is generated at the company's great power station at Lots Road, Chelsea, is supplied to the railways through 12 sub-stations, being distributed to the trains by positive and negative conductor rails. The traffic is worked exclusively by multiple-unit trains using the electro-magnetic system of control.

The Metropolitan District Railway comprises 25 miles of route, but, including running powers, operates over 56 miles in all. Of this, 41 miles is supplied with power from Lots Road power station through 15 sub-stations, it being distributed to the trains by positive and negative conductor rails. The district trains are of the multiple-unit type, using the electro-magnetic system of control. A number of foreign trains are brought to the company's lines at Addison Road Station, whence they are hauled by electric locomotives. The Whitechapel and Bow Railway and the electrified portions of the London, Tilbury, and Southend, and the London and South-Western Railways are worked in conjunction with the district, using the same or similar rolling stock, and their route mileage is included in the 41 miles given above.

The Metropolitan Railway has some 26 miles of its lines electrified. It employs the same system of operation and the same location of conductor rails as the Metropolitan District Railway, the Inner Circle being, in fact, jointly worked by the two companies. The Metropolitan Co. generate power at their own power station at Neasden, which feeds their lines through nine sub-stations. The trains are, for the most part, of the multiple-unit type, both the electro-magnetic and the electro-pneumatic systems of control being used. A number of trains are made up of the old steam stock and hauled by electric locomotives, which also handle the goods traffic over the electrified lines.

(To be continued.)

LAUNCHES AND TRIAL TRIPS.

Castle Stuart.—On August 9th this steam drifter was launched from the Thornbush Slipway, Inverness, to the order of the Inverness Drifter Co. Ltd. She is 82 ft. long and 18 ft. beam. This is the second drifter that has been constructed by the Rose Street Foundry Co., Inverness.

Chindwin.—Messrs. William Denny and Brothers, Dumbarton, launched on August 10th the steamer Chindwin, which they have built for Messrs. P. Henderson and Co., Glasgow. The Chindwin has been built to the highest class of the British Corporation. Her principal dimensions are: Length between perpendiculars, 445 ft.; breadth moulded, 55 ft.; and depth moulded, 31 ft. 4 in. The vessel will have 13 derricks, each having an outreach of fully 8 ft. over the side and the lifts ranging up to 30 tons, so that cargo of practically any weight or bulk may be conveniently handled. The propelling machinery will be supplied by Messrs. Denny and Co.

Lucistan.—Messrs. Robert Duncan and Co., Port Glasgow, launched on August 10th a single-deck steel screw steamer of 5,000 tons, which they have built for Messrs. W. S. Miller and Co., Glasgow. The holds of the vessel fore and aft are fitted with divisions, in order that grain in bulk may be safely and conveniently carried. Machinery will be supplied by Messrs. David Rowan and Co., Glasgow.

Victoria.—Messrs. Lobnitz and Co., Renfrew, launched on August 10th this self-propelling bucket dredger. The vessel, which has been designed to dredge to a depth of 14 metres below water, has been built for the Leopoldina Railway Co., under the direction of Messrs. Livesey, Son, and Henderson, London. She was inspected during construction by Messrs. Thomas Nash and Son, Sheffield. After completing trials on the Clyde she will steam to Port Victoria, Brazil. Messrs. Lobnitz and Co. have just completed two hopper barges for the same owners to be used in conjunction with this dredger.

Eros.—Messrs. MacLaren Bros., Dumbarton, launched on August 10th the Eros, a vessel built by them to the order of Baron Rothschild. The Eros is 54 ft. long, of 10 ft. 6 in. beam, and has a moulded depth of 6 ft. 6 in. She has a 90 H.P. Mercedes motor, with a MacLaren patent reversible propeller.

Thomas Holt.—Messrs. William Hamilton and Co., Port Glasgow, launched on August 9th the passenger and cargo steamer Thomas Holt, which they have built to the order of Messrs. John Holt and Co., Liverpool. The vessel, which is intended for the West African trade, is rigged as fore and aft schooner. Special attention has been given to ventilation, electric fans being introduced. The machinery, which will be supplied by Messrs. David Rowan and Co., Glasgow, will consist of triple-expansion engines and two single-ended boilers. The vessel has been built on the Isherwood system of longitudinal framing to Lloyd's highest class special survey.

Usworth.—The new screw steamer Usworth, built by Messrs. John Readhead and Sons Ltd., West Docks, South Shields, to the order of the Gordon Steam Shipping Co. Ltd., London, was on August 13th taken to sea on her official trial trip. The vessel is of the following dimensions: Length overall 333 ft. by 48 ft. beam by 23 ft. 10 in. depth moulded, and carries a large cargo on a light draught of water. The vessel is fitted with triple-expansion engines by the builders, having cylinders 23½ in., 39 in., and 64 in. diameter, by 42 in. stroke, steam being obtained from two large boilers of 180 lbs pressure. The vessel is built to Lloyd's highest class and to their special survey. The trial was in every way satisfactory.

Messrs. William Hamilton and Co., Port Glasgow, launched recently a steel self-docking pontoon floating dock for South American owners. The dock, which was placed through the agency of Messrs. J. M. Campbell and Son, Glasgow, has a lifting power of 1,300 tons, and is arranged to dock vessels up to 250 ft. in length. The structure is made up of five separate pontoons connected by two continuous side walls. The pumping machinery consists of two large horizontal centrifugal pumps placed direct on the main drain, actuated through vertical shafting by steam engines. The various compartments into which the dock is divided are connected to the main drain, and the arrangement is such that either pump can pump out any compartment in any pontoon. There are self-indicating floats showing the water level in each compartment. Mechanical shores and capstans, keel blocks, and portable bilge blocks have been provided for handling the vessel to be docked, and at one end a bridge has been fitted, which when shut enables the dock crew to get from one side wall to another. Either part of the bridge can be used as a crane, and is capable of taking weights weighing six to eight tons from the centre line of dock. The material and workmanship has been carried out under Lloyd's survey. This is the fourth floating dock which has been built by Messrs. Hamilton.

Brentham.—Messrs. Mackie and Thomson Ltd., Govan, launched on August 9th the steamer Brentham, which they have built for Messrs. Paton and Hendry, Glasgow. The dimensions of the vessel are: Length, 199 ft. 10 in.; breadth, 30 ft.; depth, 14 ft. 3 in.; and gross tonnage, 800. Triple-expansion engines of 750 I.H.P. will be supplied by Mr. W. V. V. Lidgerwood, Coatbridge. The vessel, which will have a speed of 10 knots, is intended for the coasting trade. She has large hatches and self-trimming holds to enable her to carry heavy machinery and boilers.

Thistletor.—The steamship Thistletor, built to the order of Messrs. Allan, Black, and Co. (Messrs. The Albyn Line Ltd.), Sunderland, by Messrs. Irvine's Shipbuilding and Dry Docks Co. Ltd., West Hartlepool, proceeded on her official trial trip in Hartlepool Bay on August 13th. The vessel is 382 ft. 6 in. in length by 51 ft. 4½ in. beam by 26 ft. 6 in. depth moulded, carrying 7,550 tons on a light draught, and she takes Lloyd's highest class. The whole of the main and auxiliary machinery worked efficiently throughout the trials, a speed of 12 knots being obtained. The engines and boilers have been supplied by Messrs. Richardson, Westgarth, and Co. Ltd., Hartlepool, the sizes of cylinders being 25 in., 40 in., 68 in., by 48 in. stroke, with two large single-ended boilers working at a pressure of 180 lbs.

Benpark.—On Saturday, the 13th inst., the steel screw steamer Benpark, built by Messrs. Craig, Taylor, and Co. Ltd., Stockton-on-Tees, to the order of Joseph Hoult, Esq., of Liverpool, underwent her trial, which proved highly satisfactory. The steamer will carry about 7,000 tons dead weight on a light draught of water, and the engines, which have been constructed by the North-Eastern Marine Engineering Co. Ltd., Sunderland, give a speed of 10 knots, loaded. A light trial trip speed of 12¼ knots was averaged running each way over a six-mile course.

Joseph Chamberlain.—On Saturday, 13th inst., the steel screw steamer Joseph Chamberlain, built by Messrs. Wm. Gray and Co. Ltd. for Messrs. J. and R. O. Sanderson, of West Hartlepool and Cardiff, was taken for her trial trip. The vessel has been built to Lloyd's highest class, and is of the following dimensions: Length overall, 361 ft. 6 in.; breadth, 50 ft.; and depth, 25 ft. 11 in. The hull is built with deep frames, cellular double bottom, and large aft peak ballast tank. Seven steam winches, steam steering gear amidships, hand screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead, and all the requirements of a first-class cargo steamer have been fitted. Triple-expansion engines have been supplied from the Central Marine Engine Works of the builders having cylinders 25 in., 40½ in., and 67 in. diameter, with a piston stroke of 45 in., and two large steel boilers adapted for a working pressure of 180 lbs. per square inch. The trial was a highly satisfactory one, a mean speed of 11½ knots being registered.

Loch Assater.—A steam trawler, built by the John Duthie Torry Shipbuilding Co., Aberdeen, to the order of Mr. Andrew Smith, Aberdeen, was launched from the yard of the builders on the 19th inst. The dimensions of the vessel are: Length, 126 ft.; breadth, 22 ft. 6 in.; and depth, 13 ft. 6 in. She is to be fitted with triple-expansion engines by Messrs. James Abernethy and Co., Aberdeen.

Barshaw.—This new steamer, built by the Greenock and Grangemouth Dockyard Co. for Messrs. Paton and Hendry, Glasgow, ran trials on the Clyde on August 17th. A speed o 11 knots, loaded, was attained, which was in excess of the requirements of the contract. The stipulations in respect of carrying capacity on a specified draught and trim and speed on a specified consumption of coal were also satisfactorily fulfilled.

Anglo-Patagonian.—On August 17th this vessel, lately launched by Mesrs. Short Brothers Ltd., Sunderland, left the Tyne for fully loaded trials. The vessel, which has been built to the order of Messrs. Lawther, Latta, and Co., London, for the Nitrate Producers Steamship Co. Ltd., London, is the first vessel of the "Isherwood" type to be built on the Wear. Her leading dimensions are: Length, 419 ft.; beam, 52 ft. 4 in.; and depth moulded, 29 ft. 1½ in.; and she will carry a dead weight of 8,737 tons on a moderate draught. The machinery has been supplied by Messrs. The North-Eastern Marine Engineering Co. Ltd., Wallsend-on-Tyne, and consists of quadruple engines balanced on the Yarrow-Schlick-Tweedy balanced system, with cylinders 24 in., 34½ in., 49 in., and 71 in. diameter, and a stroke of 48 in., taking steam from three multitubular boilers of 220 lbs. pressure, and fitted with Howden's system of forced draught. Every attention has been given by the engine builders to the question of economy, and it is expected she will average a speed of 10½ knots on about 28 tons per day. Several trial runs were taken, during which the machinery worked to the satisfaction of all on board, and a mean speed of 11 knots was maintained.

NAVAL NOTE.

Rainbow.—The cruiser Rainbow, purchased by the Canadian Government from the British Admiralty, as one of the vessels to form a nucleus of the Dominion Navy, left Portsmouth recently for Esquimault. The vessel, which has been refitted for use as a training ship, and is manned by a volunteer crew and staff of instructors, lent by the Admiralty, carries a piece of plate presented by Lord Strathcona. The Rainbow was built at Palmer's Shipyard, Jarrow, in 1891.

TRADE CATALOGUES.

We have received a catalogue from **Messrs. The Patent Castings Syndicate Ltd.,** Finsbury Pavement, London, E.C., describing a patent method of casting suitable for Babbitt bearings, toothed wheels, internal, external, and irregular gears, meter parts, automatic machine parts, and any other kind of work where repetition is required. The principal feature of the process consists in using special dies, and this renders tapping of holes reaming machining unnecessary, and, moreover, parts can be cast very accurately. Many illustrations are given which demonstrate the efficacy of the process.

We have received from **Messrs. The St. Helens Cable and Rubber Co. Ltd.,** Warrington, a booklet dealing in an attractive manner with various requirements of engineers. The back page is devoted to items which will be of occasional use to electricians. This company will forward a copy of above to any of our readers interested in same.

We have received from **Messrs. The Imperial Lamp Works (Brimsdown) Ltd.,** of Kingsway, London, a leaflet giving particulars and prices of their colloid-tungsten metallic filament lamps of various voltages. It is claimed for the lamps that 40 hours' light can be obtained at the cost of one penny.

We have received a catalogue from **Messrs. The Reflector Syndicate Ltd.,** Victoria Street, Westminster, who operate the Cowper-Coles' patents for the production of gold and metallic mirrors for searchlights, motor car headlights, and also translucent gold glass, giving particulars of their various specialities. The firm have been awarded under various sections of the Brussels Exhibition one grand prix, four gold medals, and two silver medals.

We have received from **Messrs. Babcock and Wilcox** a handy little catalogue containing description and illustrations of their well-known water-tube boilers, both for land and marine use. Two pamphlets are also to hand from the same firm, one being devoted to boilers and the other to their steel chimneys.

Messrs. Donovan and Co., Barwick Street, Birmingham, have sent us their list No. 65 giving particulars and prices of various types of switches, fuses, etc.

TRADE NOTES.

Messrs. Clarke, Chapman, and Co. Ltd., of Gates-on-Tyne, have recently received some large and important orders for their Woodeson patent water-tube boilers, amongst them being the following: Large installation of boilers for extensions to the generating station at Devonport Dockyard, this being a repeat order for this type of boiler received from the Government during the last 12 months; two large boilers for Messrs. W. Sommerville and Sons for their paper works; four boilers for utilising the waste gases from coke ovens for Messrs. Nunnery Colliery Co.; four boilers for utilising waste heat from re-heating furnaces for Messrs. Wm. Cooke and Sons; four large boilers for Sir B. Samuelson and Sons, Middlesbrough, to work in connection with blast-furnace gases; one boiler to utilise the waste heat from re-heating furnaces for Messrs. Brown, Bayley, and Co.; one large boiler for Luton Corporation; one boiler for Whitehaven Colliery, this being the third repeat order for this company. It will be noticed that all the above orders are for this country, but there are several large orders in hand for Continental and other foreign countries.

Messrs. John Reid and Co., naval architects, Glasgow, have placed an order for a tug boat on behalf of colonial owners with **Messrs. George Brown and Co.,** shipbuilders, Greenock.

We understand that **Messrs. Scott's Shipbuilding and Engineering Co.,** Greenock, have received an order to build and engine a large steamer for foreign owners. The vessel will be fitted for passenger and cargo service, and her construction will give considerable employment to workmen during the coming winter.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 18th August, 1910.

Barrow.—*Second class :* J. D. Greenfield.

Belfast.—*Extra first class :* W. A. Hackney.

Cardiff.—*First class :* H. Bullen, O. H. Jelley, P. H. Seys. *Second class :* R. P. Clargo, A. E. Giles, J. Nison, C. F. D. Wakeford.

Glasgow.—*First class :* W. Frame, D. H. Nairne, D. Martin. *Second class :* R. Geddes, R. H. Jacobsen, J. E. Rothwell, R. MacDonald.

Leith.—*First class :* A. Forsyth, A. P. Hood, J. L. Chapman. *Second class :* S. Bates, J. A. Law, J. Paterson, W. S. Tod.

Liverpool.—*First class :* J. Wilson, R. Forbes, W. Neild. *Second class :* A. Ankers, H. Armstrong, P. Howard, A. Johnston, C. E. Nimmo, J. W. Wright.

London.—*First class :* F. E. Buttrum, J. N. Cotter, M. R. Henry, R. G. Sibun. *Second class :* A. Montador, J. S. Scotland.

North Shields.—*First class :* J. Teasdale, R. H. Hindman, A. E. Green, C. F. R. Fell, J. Y. McDonald. *Second class :* J. W. Tulip, B. Bennett, T. M. Humble.

Southampton.—*First class :* R. Kingdom, A. D. McLarty. *Second class :* J. E. Jopling, S. H. Burton.

West Hartlepool.—*First class :* J. R. Wilson, E. W. Elliott, G. L. W. Speck, T. H. Wrightson, A. H. Docherty. *Second class :* T. S. McCarthy.

CORRESPONDENCE.

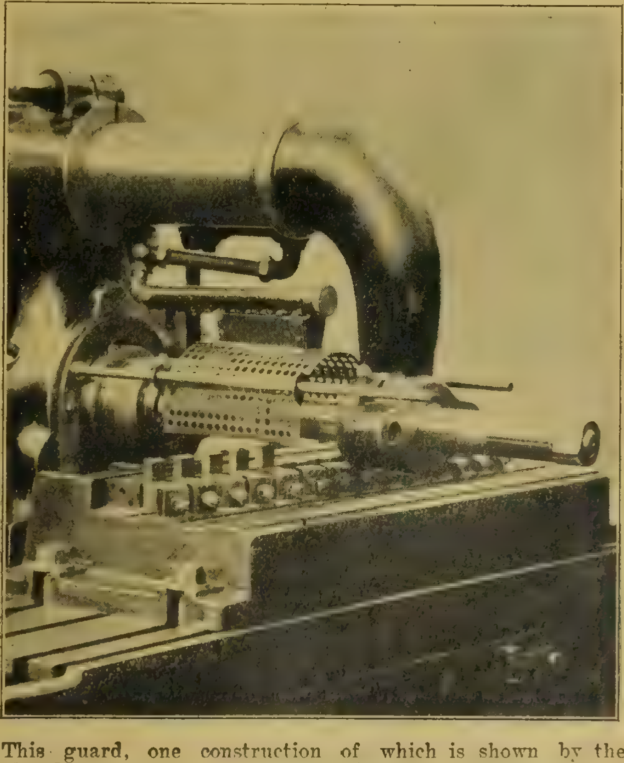
Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only; and if accompanied by sketches, these should be neatly drawn, and forwarded on a roll, to prevent creasing. We cannot undertake to return rejected communications, or to reply to inquiries by letter. In all cases letters must be accompanied with the name and address of the writer.

We do not hold ourselves responsible for the opinions of our Correspondents.

MILLING CUTTER GUARDS.

To the Editor of "The Practical Engineer."

Sir,—We are in possession of a patent, No. 22392, dated October 10th, 1906, for a type of milling cutter guard, which has been used extensively in our own works and by a number of other engineers under licence.



This guard, one construction of which is shown by the enclosed photograph, has been found quite satisfactory in use and has had the approval of H.M. Inspectors of Factories, having, in fact, been the subject of a special Home Office illustrated circular of recommendation.

Believing that it is in the public interest that such protective devices should be freely available by all users of machinery, we have decided to give up our rights under the above patent for the free use of the public.

In view of the agitation which has been in progress for some time on the subject of the guarding of milling cutters, we shall be obliged if you will favour this letter with the publicity of your columns.—Yours, etc.,

Alfred Herbert Ltd.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2271. **Gas Explosion in Cylinder.**—I should be glad if any reader could answer the following questions at the earliest convenience: If gas mixture in explosive proportions were forced into a cylinder and exploded, and fresh explosive charge forced in, would incoming charge explode? if so, would its force be equal to that of two explosions? If it would not "gradually" explode, would it increase the pressure against the walls of cylinder; or what effect would exploding charge have on fresh charge entering? The cylinder would not allow any to escape, being enclosed.—B. A.

2272. **Young's Modulus.**—Having some steel and brass wire, of which I wish to know Young's modulus, should be glad to hear of simple method of finding same. State precautions to be observed, and give any hints, data, etc., likely to help to accurate result.—Modulus.

2273. **Grindstone Formula.**—Please explain how the (0·031 $w v^2$) grindstone formula is obtained from first principles. Is the formula reliable? What speeds and stresses can I allow in millstones? Show how to calculate the energy stored in same.—K. T.

MISCELLANEA.

A formal investigation into a boiler explosion which took place at Ardwick, Manchester, will be held in the Lord Mayor's Parlour, Town Hall, Manchester, on 30th August next at 11 a.m.

Internal-combustion Engines for Marine Use.—Messrs. Yarrow and Co. Ltd., Glasgow, are building two fast gunboats to be propelled by internal-combustion engines for the Governor-General of Bagdad.

The Fire at Brussels.—Messrs. Hans Renold Ltd., the chain manufacturers, of Manchester, inform us that their exhibit, being located in the large machinery hall, was not injured in the conflagration.

Forthcoming Publication.—"Our Home Railways: How they Began and how they are Worked" is the title of a serial publication being issued by Messrs. F. Warne and Co. It is written by Mr. W. J. Gordon, and the complete work contains 500 pages, with a large number of illustrations.

Export of Metals.—During the six months ending June 30th Great Britain exported iron and steel and manufactures thereof to the value of nearly 21 millions; other metals, five millions; cutlery, hardware, etc., three millions; electrical goods, over 1½ millions; machinery, 14 millions; and ships, over 4½ millions. This represents an increase of about six millions over the corresponding period of last year.

New Submarine Telephone Cable.—A submarine telephone was laid recently across the Channel from Dover to Cape Grisnez by the British Post Office to improve telephonic communication between Great Britain and France. This is the first cable of the kind laid in tidal waters and across the open sea, although a similar cable had been previously laid in Lake Constance.

Clyde Iron and Steel.—The inquiries in the Glasgow market for manufactured iron and steel goods for abroad have materially improved recently. The demand is specially urgent for steel manufacturers. Good orders have been placed for tubes for South Africa and elsewhere, and an order has been booked for 1,000 tons of boiler plates for New South Wales. Canada and Australia are urgently asking for various kinds of steel goods. The demand for black and galvanised sheets is also very active.

Belgian Blast Furnaces.—The number of furnaces in blast in Belgium at the commencement of July was 40, while four furnaces were out of blast. At the commencement of July, 1909, the corresponding position was: In blast, 36 furnaces; out of blast, eight furnaces. The output of pig in Belgium in the first half of this year is returned at 907,220 tons, as compared with 739,480 tons in the first half of 1909, showing an increase of 167,740 tons. The total of 907,220 tons was made up as follows: Puddling pig, 100,840 tons; casting pig, 45,040 tons; and steel pig, 761,340 tons.

Memorial to Late Hon. C. S. Rolls.—At a joint meeting of representatives of the Royal Automobile Club and the Royal Aero Club a resolution was unanimously passed that the two clubs be recommended to erect suitable memorials to the late Hon. Charles Stuart Rolls at their respective clubs. It was decided that the memorial should take the form of a bas-relief plaque, and that any surplus money should be devoted to the funds of the Royal Aero Club for the establishment of an aeronautical library, to be called "the Rolls' Memorial Library."

Labour Statistics.—As compared with last year, the state of the labour market shows a satisfactory improvement. In a memorandum prepared by the Labour Department of the Board of Trade for the *Board of Trade Labour Gazette*, it is shown that in the 416 trade unions, with a net membership of 698,888, making returns for July, 26,664, or 3·8 per cent, were reported as unemployed, whereas at the end of July, 1909, the percentage was 7·9. Engineering trade unions reported 4·5 per cent unemployed, as compared with 12·1 per cent last year. In shipbuilding trades the reported unemployment was 8·5 per cent, as against 23·9 a year ago.

The Engineering and Machinery Exhibition.—The Marquis of Graham, C.V.O., will formally open the Naval, Mercantile Marine, and General Engineering and Machinery Exhibition at Olympia, London, on September 1st. The show promises to be one of exceptional interest to naval architects, shipbuilders, engineers, and machinists generally. The programme of events includes the following special meetings: September 6th, Junior Institution of Engineers; September 14th, Institute of Metals; September 15th, Institute of Sanitary Engineers; September 17th, Institute of Marine Engineers; September 21st, Society of Engineers; September 24th, Association of Engineers-in-Charge. Provision has been made for the admission of workshop parties, etc., at reduced rates.

New North-Eastern Railway Locomotives.—There is now being completed at the North-Eastern Railway Co.'s works at Darlington the first batch of ten powerful "Atlantic" type locomotives which have been specially built for hauling the heaviest and fastest-timed trains on the East Coast Scottish express route. These locomotives, which have been constructed from the designs of Mr. Wilson Worsdell, the consulting mechanical engineer of the North-Eastern Railway, are provided with four driving and coupled wheels, each 6 ft. 10 in. in diameter, four bogie wheels, 3 ft. 7¼ in. in diameter, and a pair of trailing wheels, 4 ft. in diameter. The boiler is of abnormal dimensions, the barrel having a diameter of 5 ft. 6 in. and a length of 15 ft. 10½ in. The total heating surface amounts to 2,456 square feet, and the firegrate area to 27 square feet. The cylinders are 19½ in., and the piston stroke 28 in. The tender is carried upon six 3 ft. 9¼ in. diameter wheels, and has a tank and well capacity of 4,125 gallons of water, and a fuel space for 5 tons of coal. It is provided with a patent scoop arrangement, permitting of a further supply of water being taken up from the track troughs whilst travelling. Exclusive of the tender, each of these engines weighs 76 tons 4 cwt., of which 40 tons 1 cwt. rest on the coupled wheels, whilst the tender has a weight of 43½ tons, so that the engines in working order have an aggregate weight on metals of 119 tons 14 cwt., constituting them as the heaviest locomotives ever built for the East Coast Scottish express services.

Copper-clad Steel.—A paper on the subject, presented at the convention of the American Society for Testing Materials, made clear that this steel is made by casing a steel bar in copper. This compound bar is then rolled and drawn down, the areas of the two materials being reduced proportionally so that if the original cross section of the bar comprises one-third copper and two-thirds steel the wire made from it will have a section of one-third copper and two-thirds steel. There is no definite surface of junction between the two metals, but, on the contrary, an alloy is formed which has been found to possess unusual resistance to corrosion. The wire made in this way has high conductivity and high strength.

PATENTEES' CHRONICLE

OF

Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

AUGUST 15th, 1910.

19104 *Coke ovens. Fabry.
19105 Wheat drying, etc., machinery. Swales.
19106 Combing machinery. Nasmith.
19107 Dust extractors. Webb.
19108 Coin freed mechanism. Howard.
19109 Hairpin. Williams.
19110 Tyre. Artuso.
19111 Fire alarm. Mills.
19112 Telescope reflectors. Volk.
19113 Milk canisters. Johnson.
19114 Boot protectors. Alderson.
19115 Windows. Phillips.
19116 Puzzle. Leese.
19117 Dyed fabric discharge. Knecht.
19118 Carburetter. Bruce.
19119 Secondary battery. Karavodine.
19120 Pneumatic lock. Haworth.
19121 Hatpin. Barnes.
19122 Wheels. Probert.
19123 Milk, etc., blending machine. Edwards.
19124 Motor siren. Evans.
19125 Electric switch. Scott.
19126 Picture postcards. Laban.
19127 *Chain casting moulds. Schürhoff.
19128 Printing press. Walker.
19129 Gas furnaces. Zahr.
19130 *Bottle. Morris.
19131 Boiler fire bars. Morgan.
19132 Cigar, etc., holder. Morgan.
19133 *Carbonised fabrics. Horton.
19134 Carriage door locks. Daly.
19135 *Boot manf. Hadaway.
19136 *Screw thread cutting device. Bilhartz..
19137 Pneumatic tyres. Stone.
19138 Fountain pens. Wainwright.
19139 Extincteur. Squire.
19140 Rowing, etc., boats. Roessler.
19141 Ammonia nitrate, etc., manf. Henry.
19142 *Obtaining delivery machine. Taylor.
19143 *Automatic delivery machine. Taylor.
19144 *Talking machine. Reddie.
19145 Furnaces. McIntyre.
19146 *Door handle manf. Christophery.
19147 Tyres. Thomas.
19148 *Cinematographs. Gassner.
19149 Flour milling. Rollason.
19150 Soap manf. Newton.
19151 Relating to airships, etc. McKinney.
19152 *Washing machine. Delmage.
19153 Treating iron, etc., containing liquors. Thwaites.
19154 Steam boiler. Fowler.
19155 *Treating distillation gases. Otto.
19156 *Sensitive prints. Ioreny,
19157 Tyre. Howard.
19158 Wall paper. Wankelmuth.
19159 Teaching of writing. Blanchard.
19160 Railway chairs. Philbey.
19161 *Exciting liquids.
19162 *Wheels for vehicles. Gruss.
19163 Water cooling device. Geoghegan.
19164 *Dynamo. Siemens.
19165 *Mangle, etc. Murdock.
19166 Artificial silk finishing. Huliner.
19167 Amusement device. Hine.
19168 Dress, etc., hangers. Watson.
19169 Change gear device. Edington.
19170 Yarn winding device. Asbly.
19171 Internal-combustion engine. Roots.
19172 *Process for impregnating wood. Marks.
19173 Trawl nets. Brompton.
19174 *Advertising device. Mackenzie.
19175 *Gas turbine. Patschke.
19176 *Engine starters. Barley.
19177 *Sieve brushes. Keller.
19178 *Friction transmission device. Becker.
19179 *Musical instrument. Lake.
19180 *Relating to aeroplanes. Detable.
19181 *Gas production. Schachtel.

AUGUST 16th, 1910.

19182 Electric switch. Collins.
19183 *Drying device. Rosenberg.
19184 Lubricator spring lids. Bolton.
19185 Ferrule. Howewood.
19186 Skirt manf. Frost.
19187 *Type holder. Reed.
19188 Lubricator. Mackay.
19189 Talking machine. Harrington.
19190 Relating to coal. Phillips.
19191 Sprinkler installation. Kirke.
19192 Letter box. Cook.
19193 Colour screen. Potter.
19194 Basket handle. Wardle.
19195 Bonnet frame. Bowen.
19196 Structural beam. Willis.
19197 Coke conveyor. Williams.
19198 Steam traps. Wilson.
19199 Electric bell. Herrde.
19200 Tyres. Hellier.
19201 *Artificial gem setting. Keidecker.
19202 *Firearms. Schulz.
19203 *Tilting bottles. Tusk.
19204 *Flying machine. Wallace.
19205 *Press. Riemana.
19206 *Line casting machine. Drewell.
19207 Gas apparatus. Chandler.
19208 Dentures for artificial teeth. Thomlinson.
19209 Course recorder. Seaton.
19210 Indicating floating bodies. Strong.
19211 Calculating machine. Harris.
19212 *Stuffing boxes. Short.
19213 *Rapid service counter. Gray.
19214 *Knitting machine. Beale.
19215 Tyres. Rowland.
19216 *Milk jugs.
19217 *Cigarette manf.
19218 *Pipe unions. Kelly.
19219 Can lids. Waller.
19220 Stool. Smith.
19221 *Fliping machine. Materne.
19222 Theatrical stage. Siviter.
19223 *Ships' recorded. Anschutz and Co.
19224 *Ships' compasses. Anschutz and Co.
19225 *Spring hooks. Chittenden.
19226 Sample wrappers. Scott.
19227 Ventilation device. Epstein.
19228 Fishing bait. Wadham.
19229 Waist belts. Mortin.
19230 *Collar stiffening supports. Hyslop.
19231 *Camera. Walaschek.
19232 *Bait. Klich.
19233 *Metal enamelling. Sonntag.
19234 Screw wrench. Molden.
19235 Pocket knives. Merton.
19236 Galvanic apparatus. Blasberg.
19237 Chair silencing pads. McLean.
19238 Railway coupling. Ganstone.
19239 Bottle stoppering. Tringwell.
19240 Capsuling bottles. Lumley.
19241 *Internal-combustion engine. Bosch.
19242 *Internal-combustion engine. Bosch.
19243 *Barrel hauling device. Metallwaaren.
19244 *Breech pieces for guns. Metallwaaren.
19245 *Skates. Eckart.
19246 Bunsen burner. Zechnall.
19247 *Ball bearings. Woffen.
19248 *Cot, bed, etc. Riddiford.
19249 Ammonia manf. Johnson.
19250 Ammonia manf. Johnson.
19251 Ammonia manf. Johnson.
19252 Inhaler. Martin.
19253 Photo colouring. Mitchell.
19254 *Inkstands. Smith.
19255 *Anchors. Bateman.
19256 *Ore concentrators. Deister.
19257 *Piano actions. Clark.
19258 *Label affixing device. Maynes.
19259 *Trucks. Droster.
19260 Saucepan. Poole.
19261 Flying machine. Blondin.
19262 Gas ring. Drabble.
19263 Clutching device for scaling poles. Rimmer.
19264 *Net lifting mechanism. Atwood.
19265 *Safety device for railways. Unverricht.
19266 Fur beating machine. Herpich.
19267 *Submarine mine. Bichel.
19268 *Submarine mines. Bichel.
19269 *Whip holder. Kauser.
19270 *Closets. Tickell.
19271 *Forge. Altrichet.
19272 *Cutting out device. Tauber.
19273 *Hand stamps. Bosworth.
19274 Fuel briquette manf. Grimshaw.
19275 *Treatment of ores. Scott.
19276 *Filling device for corners of rooms. Wade.
19277 Axes, etc. Garnier.
19278 Smelting device. Kern.
19279 Cylinder capacity meter. Resche.

AUGUST 17th, 1910.

19280 Bread toasting device. Murray.
19281 Water heating. Hyland.
19282 *Electric signalling. Herlick.
19283 Tyre. Vaughan.
19284 Wheels. Gray.
19285 Engine. Woodhead.
19286 Ships. Micallef.
19287 Tyre. Legh.
19288 Tyre. Turner.
19289 Photo plates. Turnbull.
19290 Calendering machine. Milligan.
19291 Overhead wire fittings. Walmsley.
19292 Gas mantle. Coventry.
19293 Window fastening. Bullock.

19294 Nut locking device. Hamilton.
19295 Flower holder. Jones.
19296 Timber scribes. Oliver.
19297 *Braces. Grundy.
19298 Stone, etc., etching device. Learoyd.
19299 Brick block for pipes. Cambell.
19300 Tobacco pipe. Bennett.
19301 Lathes. Rush.
19302 Lathe tool rest. Rush.
19303 Boiler. Barker.
19304 Fabric shrinking. Ross.
19305 Tea, etc., canisters. Page.
19306 Strip maps. Jones.
19307 Screw cutting machine. Greenway.
19308 Carding engine. Hulme.
19309 Indicating device for motors. Punt.
19310 Swing doors. Elliott.
19311 Photography apparatus. Elsy.
19312 Ring. Blomley.
19313 Stove. Maclausen.
19314 Knitting machine. Wildt.
19315 *Knitting machine. Stebbe.
19316 *Valve. Schrode.
19317 *Hollow rubber articles. Farman.
19318 *Aeroplanes. Field.
19319 *Buckles. Stevens.
19320 *Musical instrument. Alexander.
19321 Airships. Brown.
19322 *Drawing device. Brown, Boveri, and Co.
19323 Amusement device. Foulis.
19324 Valve gear. Biggs.
19325 *Deodorisation of smoke. Kindermann.
19326 Compass. Reisshaner.
19327 *Spraying rose. Kotschau.
19328 *Wear resisting material. Metcalfe.
19329 Horse shoe. Sagel.
19330 *Ignitor for smokers' use. Allday.
19331 *Cooking stoves. Beyer.
19332 Tyres. Skew.
19333 Advertising signs. Spurin.
19334 Ordnance sight. Dawson.
19335 *Inflammable liquid. Lange.
19336 *Liquefying carbonic acid. Hildebrand.
19337 Stamping device. Boult.
19338 Locomotive wheels. Stirling.
19339 *Scoring board. Bellgrove.
19340 *Nitrogen compounds. Johnson.
19341 *Oxidation of acenaphthene.
19342 *Calculating machine. Guricke.
19343 Internal-combustion engine. Gresswell.
19344 Ordnance sight. Dawson.
19345 Purification of crude rubber. Fleet.
19346 Artificial marble manf. Aocettola.
19347 *Hand tool. Blanchard.
19348 *Steam superheater. Pilling.
19349 *Flying machine. Pelterie.
19350 *Acid manf.
19351 Feed water heaters. Schreiber.
19352 Runways. Morris.
19353 *Torpedoes. Whitehead.
19354 *Firearms. Haeghan.
19355 Bottle neck. Fleming.
19356 *Wheels. Stuart.
19357 Tyres. Mort.
19358 Poster printing. Wright.
19359 Alternating current motors. B. T.-H. Co.
19360 *Ventilating railway carriages. Gain.
19361 *Firearms. Haeghan.

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19362 Power transmission. Brown.
19363 Can openers. Alderson.
19364 Tyres. Wetherell.
19365 Valve. Stanmore.
19366 Internal-combustion engine. Macleod.
19367 Facing machine. Mathewson.
19368 High speed engine. Watson.
19369 Loom shuttles. Ireland.
19370 Aeroplanes. Neale.
19371 Goods lifting device. Turner.
19372 Raising sunken vessels. James.
19373 Vehicles. Crutchley.
19374 Dado radiators. Fisher.
19375 Gasometers. Jackson.
19376 Screw cutting tool. Shaw.
19377 Water carts. Brownlow.
19378 *Advertising apparatus. Seigle.
19379 Tooth brush. Levy.
19380 Improved distemper. Buckley.
19381 Wood, etc., smoothing device. Buckley.
19382 Gas purification. Sadle.
19383 Strap buckles. Coaigen.
19384 Petrol tanks. Jackson.
19385 Window opening, etc. Jones.
19386 Vegetable cutters, etc. Leah.
19387 Horse shoe. Ward.
19388 Flying machine. Placek.
19389 Cycle pedal. Dickinson.
19390 Advertising showcard. Petitjean.
19391 Looms. Simpson.
19392 Fireproof partition, etc. Ward.
19393 Tube connecting device. Fellows.
19394 Skirt support, etc. Woodbridge.
19395 Coat front pad. Tanenbaum.
19396 Propeller. Treweek.
19397 *Projectiles. Krupp.
19398 *Guns. Krupp.
19399 *Percussion fuses. Krupp.
19400 Kneeling mats. Träger.
19401 Hinges. Barclay.
19402 Chimney cowls. Rathbone.
19403 Paper mounting, etc. North.
19404 Machine packing. Beldam.
19405 Calendar. Fingerhut.
19406 * Collapsible trunks, etc. Frank.
19407 *Back-pedalling brake. Sacks.
19408 *Mineral separating device. Schiechel.
19409 Toy. Yates.
19410 Reservoir pens. O'Malley.
19411 *Advertising devices. Bertrand.
19412 Valve gear. Redrup.
19413 *Door closing device.
19414 Gas burners. Hands.
19415 *Beds. Biro.
19416 *Valves. Mason.
19417 Furniture castors. Gostick.
19418 *Ticket printing. Wronker.
19419 Gas controller. Anderson.
19420 Gas lamp. Anderson.
19421 Gas cocks. Anderson.
19422 Artificial fuel manf. Piggot.
19423 Ice manf. Brückner.
19424 *Cycle spring forks. Schafmayer.
19425 *Filters. Made
19426 Aeroplanes. Sanders.
19427 *Aeroplane. Sanders.
19428 Kilns. Woodall.
19429 *Pipe connectors. Sprott.
19430 Wind sails. Anderson.
19431 *Lacework, etc., trimming. Sander.
19432 *Boot heel protector. Wilmshofer.
19433 *Wall plug. Walder.
19434 *Supplement inserting device.
19435 *Press strainer. Eisen.
19436 Ventilation. Epstein.
19437 Bottle packing device. Vangel.
19438 Advertising sign. Vangel.
19439 *Shoe heels. Prante.
19440 *Airship propulsion. Colebrook.
19441 Valves. Peacock.

AUGUST 19th, 1910.

19442 Milk churn. Porter.
19443 Pipe joints. Koenig.
19444 Condenser tubes. Thompson.
19445 Collar fastening device. Emmett.
19446 Tyres. Williams.
19447 Pressing machinery safety guard. Adams.
19448 Railway signals. Garton.
19449 Separation device. Mastin.
19450 Fireguard. Macnamara.
19451 Bedsteads. Parr.
19452 Reversing gear. Lanchester.
19453 Drying apparatus. Bamber.
19454 Air pumps. Davies.
19455 Turbine. Fearon.
19456 Internal-combustion engine. Corah.
19457 Harness. Millard.
19458 Pin point protector. Bardell.
19459 Internal-combustion engine lubrication. Glen.
19460 Wire drawing machine. Bond.
19461 Fuel economiser. Rothwell.
19462 Drilling machine. Hewit.
19463 Furniture leg attachment. Kopeliowiz.
19464 Motor car. Nagel.
19465 Pedal cycles. Ernest.
19466 *Electric stoves. Hawkes.
19467 Fire bracket support. Galick.
19468 Finger rings, etc. Saunion.
19469 Ladies' hat fastener. Felton.
19470 *Embroidery cutting. Boult.
19471 Trouser stretcher. Watts.
19472 Leather skiving. Bates.
19473 *Textile fibre protection device. Gaide.
19474 Chaff riddle. Johnson.
19475 Ladies' veil fastener. Scott.
19476 *Ear ring. Schölch.
19477 Hinges. Allen.
19478 Bobbin manf. Bull.
19479 Guide pulley spindle bearings. Musgrave.
19480 Hat boxes. Squires.
19481 Boot stretching. Taylor.
19482 Syphon valves. Fletcher.
19483 Instrument for therapeutical treatment. James.
19484 *Armour plates. Schaumann.
19485 *Reinforced wells. Stolte.
19486 Motor car wind screen. Crump.
19487 Dye manf. Newton.
19488 Gas stoves. Flory.
19489 Type casting machine. Stubbs.
19490 Chocolate, etc., wrapping device. Rose.
19491 Railway, etc., couplings. Allen.
19492 Rotary engine. Peet.
19493 *Sad iron. Feldmeyer.
19494 *Soaps. Wolffenstein.
19495 *Shearing machine.
19496 *Surface cleaning device.
19497 Pistonless diaphragm engine. Silvain.
19498 *Wearing apparel. Schulhöfer.
19499 Internal-combustion engine. Pulman.
19500 *Fluid regulator. Sandross.
19501 *Tin opener. Dossegger.
19502 Artificial rubber manf. Bradley.
19503 *Line casting machine.

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19504 *Life saving jacket. Carroll.
19505 *Advertising device. Jacob.
19506 *Pencil case. Cox.
19507 Motor car wheels. Symes.
19508 Vacuum cleaner. Jones.
19509 Tobacco cases. Withers.
19510 Bobbins. Wilson.
19511 Artificial flagstone. Kelly.
19512 Pneumatic tyre cover. Little.
19513 Flexible counter drive. Tagg.
19514 Stocking holder. Fletcher.
19515 Self-raising flour. Thomson.
19516 Wire winding machine. Dickson.
19517 Telephone receivers. Conner.
19518 Metal alloy. Gabriel.
19519 Valve extracting tool. Austin.
19520 Bedsteads. Whitefield.
19521 Cigar, etc., holders. Twiss.
19522 Sewing machine. Stevens.
19523 Embroidery machine. Birks.
19524 Gas burner. Blakey.
19525 Internal-combustion engine. Brooks.
19526 Launching missiles from aeroplanes. Murray.
19527 Timing clocks. Waddington.
19528 Steam generators. Hilton.
19529 Furnace fire bars. Hilton.
19530 Vacuum casting machine. Wright.
19531 Cooking inset. Dahl.
19532 Electric lamp. Esser.
19533 Haulage clip. Smallman.
19534 *Manhole channel for sewage. Brooke.
19535 Spinning machine. Bettini.
19536 Looms. Mattausch.
19537 *Rotary engine. Barrière.
19538 *Imitation antelope skin. Marchand.
19539 *Dynamo. Siemens.
19540 *Percussion tool. Siemens.
19541 *Boy scout poles. Jewson.
19542 Roller skates. Walbrum.
19543 *Drill holders. Knight.
19544 Type casting device. Duncan.
19545 Dye manf. Newton.
19546 Tiles. Wooding.
19547 *Runner cutters. Garwood.
19548 Fluid carrying conduits. Burgess.
19549 Ribbed hosiery manf. Hill.
19550 *Steering device for aeroplanes, etc. Zens.
19551 Cigarette manf. Macdonald.
19552 *Device for obtaining ammonia. Otto.
19553 *Plate glass manf. Bicheroux.
19554 *Colour photography. Ruth.
19555 *Combustible mixture. Laliberte.
19556 Tyres. Goudge.
19557 *Electric apparatus. Krizik.
19558 Pedestal gun mountings. Dawson.
19559 Moving picture effect production. Bower.
19560 Guns. Dawson.
19561 Driving belts. Pollin.
19562 *Process for dehydrating perborates. Byk.
19563 *Lamps. Heraeus.
19564 Specific gravity ascertaining. Savory.
19565 *Ladders. Cosnett.
19566 *Firearms. Guindon.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to September 26th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

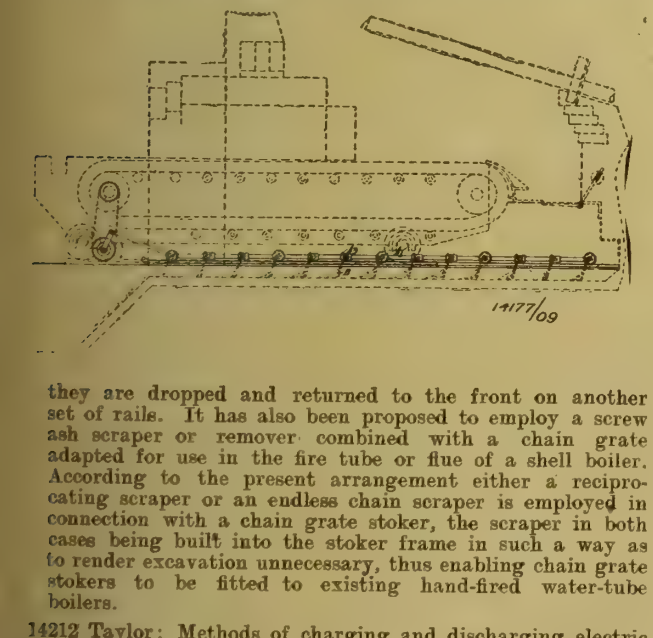
Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

1977 Maude: Apparatus for utilising water power. [Post-dated July 27th, 1909.] 3244 George and Natkiel: Photographic show cards, window tickets, price tickets, and the like. [Post-dated August 10th, 1909.] 9066 Garde and Adams: Electrodes of secondary batteries. 9163 Simpson and Oviatt: Direct production of iron and steel from oxide iron ores. [Cognate Applications. 10790, 1909, and 25152, 1909.] 10790. *See* 9163, 1909. 11515 Berry, Russell, and Jung: Automatic and autographic distance, speed, or operation-recording apparatus. 11526 Pope: Method of and means for making lead oxide. [Cognate Applications. 24768, 1909, and 25203, 1909.] 11858 Pealing: Portable drill. [Application for Patent of Addition to 24733, 1908.] 12382 Wearing: Fore carriages of four-wheeled road vehicles. [Post-dated December 28th, 1909.] 14024 Michaelis: Centrifugal separators. 14102 Moore and Marshall: Chairs (furniture) and fittings therefor. [Cognate Application. 24035, 1909.] 14121 Fairweather (Mergenthaler Linotype Co.): Type-line casting machines.

14177 Henry: Mechanical stokers.

Relates to chain grate stokers, and has been designed with the object of automatically removing ashes, clinker, and riddlings. It has previously been proposed to employ for this purpose a reciprocating scraper in connection with a furnace having a travelling grate formed of transverse firebars, which are moved on rails to the fire bridge, where they are dropped and returned to the front on another set of rails. It has also been proposed to employ a screw ash scraper or remover combined with a chain grate adapted for use in the fire tube or flue of a shell boiler. According to the present arrangement either a reciprocating scraper or an endless chain scraper is employed in connection with a chain grate stoker, the scraper in both cases being built into the stoker frame in such a way as to render excavation unnecessary, thus enabling chain grate stokers to be fitted to existing hand-fired water-tube boilers.

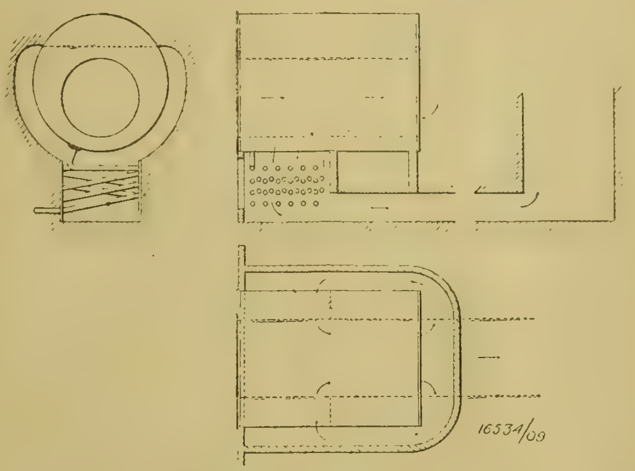


14177/09

14212 Taylor: Methods of charging and discharging electric accumulators or secondary batteries. [Cognate Application. 16522, 1909.] 14506 Humphris: Toothed driving gear. 15474 Appleby: Means for preventing the fall of colliery cages and the like when the hauling rope breaks. [Post-dated February 1st, 1910.] 15634 Moon: Soles, waists, and heels of boots and shoes. 16099 Ellard and Ellard: Means for use in riveting together parts of certain light metal structures. [Post-dated January 10th, 1910.] 16355 Wilton: Treatment of gas obtained in the distillation of carbonaceous materials for the recovery of useful products and apparatus therefor. 16405 Burks: Combined massaging and magneto electric machine. 16406 Bennett: Tool for bending tubes and for like purposes. 16411 Ede and Kempton: Street lantern for inverted incandescent gas burner. 16430 Vollbrecht: Supporting body for airships. [Date applied for under International Convention, September 2nd, 1908.] 16492 Hague: Locking devices for use in connection with carding engines. 16522. *See* 14212, 1909. 16528 Wray: Weft feeler for the shuttles of looms for operating the shuttle-changing mechanism.

16534 Cook: Feed-water heaters.

This invention relates to feed-water heaters for steam generators of the type in which the feed-water is arranged in the downtake of the flue communicating with the chimney, the flow of water through the apparatus being in a direction opposite to that of the flue gases. In carrying out the invention as in the application to a boiler of the Cornish type, a bank of tubes is arranged in the downtake beneath the boiler so that the tubes are in layers. Some tubes are inclined towards one side, some towards the other, whilst others may be in horizontal layers. The tubes may be connected to two large headers arranged one on each side of the flue. The feed water is forced in by means of a pump (not shown) through the pipe at the lowermost part of the heater and flows through the tubes from the bottom upwards, entering the boiler through a connection at or near the bottom thereof. A sufficient number of tubes are used to abstract practically the whole of the waste heat of the flue gases, in which case forced or induced draught or both are employed to compel the furnace gases to pass through the various flues and through the heater, there being no natural draught since the heat is abstracted from the gases.

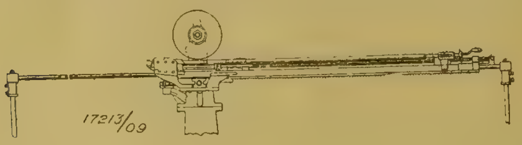


16534/09

16594 Nickells: Screens for use with open stoves or fireplaces for preventing dust and for other purposes. 16612 Hughes and Partington: Means for waxing sewing cotton, thread, and the like. 16620 Evans: Apparatus for burning atomised liquid fuel and utilising the heat derived therefrom. 16621 Rennie: Electric measuring instrument chiefly designed for use in indicating the speed of vehicles. 16645 Dalziel's Constant Voltage Patents Ltd., and Dalziel: Electric distribution systems. 16655 Murdoch: Shoeing of horses. 16660 Matthijssen: Machines for punching cards for use in weaving looms. 16692 Dunton: Ball and socket joint for steam pipes. [Post-dated January 6th, 1910.] 16699 Rayburn: Inverted incandescent gas burners. 16707 Watson: Aerial craft. 16721 Zimmermann (Chemische Fabrik auf Actien, vorm. E. Schering): Manf. of acetyl derivatives of the alkylated iminopyrimidines and of the alkylbarbituric acids derived therefrom. 16726 Edwards: Registering, timing, and indicating apparatus for games and other operations. 16729 Schuster: Calculating machine. 16737 Jansen: Devices for ironing clothes. 16738 Schafer: Screw and nut mechanism applicable to vices and the like. 16740 Rose, and Rose Brothers (Gainsborough) Ltd.: Apparatus for applying bands, wrappers, or labels to boxes, blocks, or packages. 16749 Brabbins: Fuelless engine. 16763 Rose: Elastic wheel tyres for road vehicles, velocipedes, and other wheels. 16766 Dodd: Combustion product engines. 16773 Hartley: Nailless horseshoe. 16804 Walkup: Printing presses and the like. 16822 Specker: Rubber overshoes or goloshes for preventing slipping on ice or snow. 16824 Soc. Anon. Raffinerie Moderne Procede Natta: Apparatus for the concentration of the juices of refinery syrups. [Date applied for under International Convention, July 22nd, 1908.] 16832 Mathieu: Automatic fishing hook. 16849 Machlet: Combined temperature indicating and regulating apparatus for gaseous fuel furnaces. [Application for Patent of Addition to 11840, 1909.] 16853 Hettmann and Katzmayr: Process for manufacturing a paste for grinding in valves and like operations. 16875 Akester and MacLeod: Transference of designs or outlines to stone, zinc, aluminium, or other substances for lithographic and like processes. 16881 Parr, and W. H. Dorman and Co.: Machinery for labelling packets, boxes, or similar articles. 16925 Gibbons and Masters: Vertical gas retorts. 16934 Sage: Vessels such as kettles and the like adapted to promote and accelerate the boiling of liquids therein. 16935 Martin: Treatment of clays for the manf. of pottery and other articles. 16936 Holman, Holman, and Coad: Apparatus for the treatment of metalliferous slimes. 16941 Thormeyer: Devices for controlling the operation of two or more reproducing apparatus. 16956 Buchel: Method of obtaining soluble slag in the alumino-thermic reducing process for the production of metals. 17014 Dymond (Hudson): Apparatus for taking soundings, more particularly for use at sea. 17019 Coffin: Valves of internal-combustion engines. 17031 British Thomson-Houston Co., and Wedmore: Protective devices for electrical transmission and distribution systems. 17043 Boult (Deutsche Elektro Sparlicht Ges.): Small electric transformers. 17051 Draper and Grundy: Carding engines. 17064 Jackson: Cooking ranges and the like. 17152 Standerwick: Machines for slotting, stamping, and bending blanks for collapsible cardboard boxes and the like. 17201 Briggs, and British United Shoe Machinery Co.: Nailing or slugging machines which comprise a puncturing or nail-driving tool. 17211 Farquhar and Hill: Automatic firearms. [Application for Patent of Addition to 28587, 1907.]

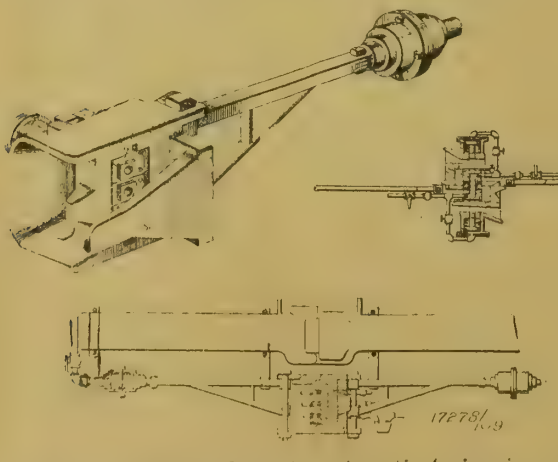
17213 Lake (Gail): Machines for buffing or polishing metallic articles.

This invention relates to machines for buffing the surfaces of hollow metallic tubes either with a bright or satin polish, and the object is to render the machine entirely automatic in its action with exception of insertion and removal of the article. The tube is reciprocated while being subjected to the action of a rotating buffing wheel, and is turned step by step automatically to bring new portions under the buffer, the tube during the turning being unacted upon by the wheel. This reciprocation and turning continues uninterruptedly for a certain length of time, at the end of which the entire mechanism, except the revolution of the buffing wheel, ceases its operation and warns the operator that the finished tube may be replaced by another. In order that the surface of the wheel may wear evenly and that the buffing or polishing may be more satisfactorily and evenly done, the wheel is preferably moved laterally or transversely of the tube during its action thereon.


17213/09

17235 Hirst: Coal-cutting machine. 17248 Bentley: Bread, cake, biscuits, and like food preparations. 17267 Internationale Taxameter-Ges. and Hornig: Fare indicators.

17278 Cary: Automatic train pipe couplers. [Date applied for under International Convention, July 25th, 1908.]

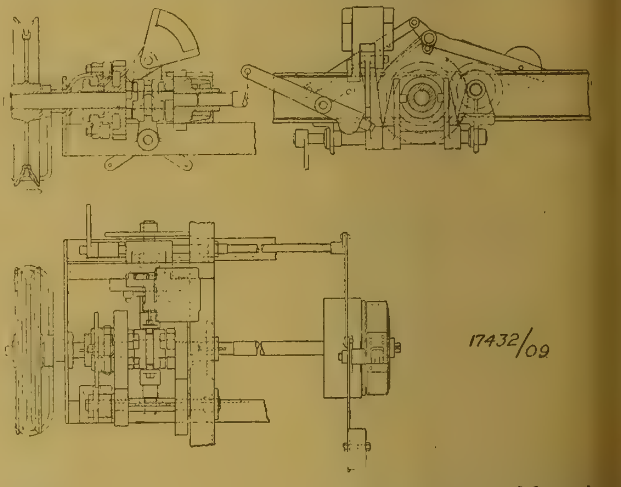

17278/09

This invention relates to automatic train pipe couplers. The head on each member of the couplings is constructed in a similar manner, and the connection between the pipes is effected by the movement in each head of a block having a port or ports therein for the passage of the pressure fluid. Each such block is provided with gaskets and is adapted to be slidden by fluid pressure in a transverse guide in its head, so that the contacting faces of the gaskets extend in a plane longitudinally of the car, whereby a side engagement is obtained, such arrangement being especially desirable when the cars are rounding curves. Amongst other features are improvements in the construction of the coupler heads in order to ensure the correct engagement of the co-acting members of the coupling. While principally designed for coupling the air pipes, the invention can be employed for coupling the steam and signal pipes, one coupling, in fact, for all the pipes being employed.

17279 Thomson: Process for the treatment of waste liquors. 17280 Johnson and Rignall: Apparatus for the delivery of liquid from a bottle or other receptacle. 17282 Lake (Gail): Machines for buffing or polishing metallic articles. 17284 Boggiano: Voting machines. 17307 Garsed: Regulators. 17313 Williams: Cranks for cycles, motor cycles, and the like. 17334 Bour: Devices for warning off traffic automatically on railroads at level crossings. 17343 Brown-Ekins: Aeroplanes, flying machines, and the like. 17376 Bonnesen and Engblom: Stapling and like machines. 17377 Pink and Petty: Temporary binders or loose-sheet holders. 17378 Lake (Gail): Machines for buffing or polishing metallic articles. 17384 Fallenius: Submarine broadside torpedo tubes. 17414 Whipple: Tyre pumps.

17432 Morris: Lifting apparatus.

This invention relates to lifting apparatus, wherein means are provided for automatically sustaining the load at any point when the lifting power ceases to act, and in which on releasing the brake or apparatus for sustaining the load the latter runs down by its own weight. The invention is more particularly applicable to that form of lifting apparatus in which the load is lifted by means of a chain working over a pocketed load-wheel, or by means of a rope working over a drum, and is intended to be used in conjunction with a band brake and centrifugally expanding automatic brake as described in the Specification of Patent No. 20390 of 1908. The present improvements are in connection with the means whereby, first, the wheel or handle by means of which the gear is operated when lifting the load is put out of action during the operation of lowering the load—*i.e.*, is caused to remain stationary instead of revolving at a dangerous speed during this operation, and second, the operation of lowering, when there is no load on the gear, can be performed by means of the wheel or handle without the necessity of carrying a permanent weight on the outer end of the load chain or rope for the purpose of overcoming the inertia of the moving parts of the hoisting mechanism and causing them to revolve in the direction for lowering. The apparatus consists essentially of a disengaging lever provided with rollers contained in a split casing operating in combination with a sliding collar or double cam, and a sleeve and clutch for the purpose of relieving and rendering stationary the operating hand wheel or handle during the time that the load is running down by its own weight.

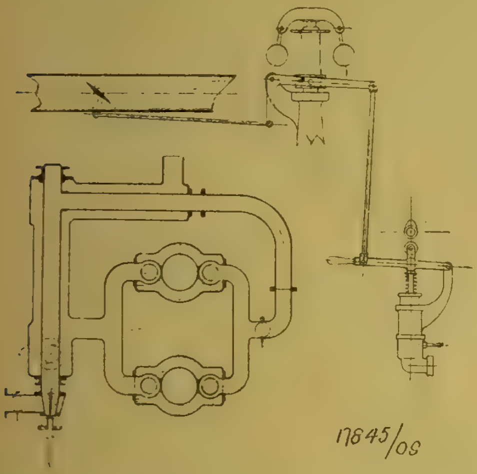

17432/09

17444 Stableford: Multiple copying machines. 17468 Twiss: Stretchers for boots and shoes. 17478 Lannmark: Corking machines. 17480 Greenberg: Vehicle lamps. 17569 Boult (Tapscott): Aeroplanes. 17571 Tippetts and Hankins: Revolving heel pad for boots and shoes and the like. 17681

Hunt: Spring clips for holding buttonhole flowers and like purposes. 17683 Wedgwood: Variable-speed gear. 17728 Briggs: Steam-jacketed pan for boiling brewers' worts and other liquids. 17777 Edwards: Rotary printing machines.

17845 Roberts and Young: Means for vaporising petroleum and other liquid fuels.

This invention relates to liquid fuel vaporisers for use in internal-combustion engines in which an exhaust jacketed induction pipe is employed through which the fuel is axially injected by means of a spraying nozzle surrounded by air inlets and the supply of air or explosive mixture independently controlled, and is especially applicable to the type of engine in which the interior of the vaporiser is not always in direct communication with the working cylinder of the engine. The vaporiser comprises an induction pipe which is enclosed in a jacket and heated by the exhaust gases from the motor in the usual way and a charge of fuel is injected axially along the induction pipe, this being effected by a pump driven by the engine. The whole or a part of the air supply which is necessary to form the explosive mixture is induced through a series of holes, or slots surrounding the oil spray, and in order that the proper proportion of oil shall be constantly maintained a throttle valve or the equivalent is provided for controlling either the air supply or the explosive mixture prior to its admission to the cylinder or cylinders of the engine, the throttle valve being arranged in conjunction with a device for regulating the stroke of the fuel pump. The device for regulating the quantity of fuel may be controlled either manually or by a governor. In order that the heat of the vaporiser may be adapted to the power which is being developed at any time by the engine, a bye-pass valve is provided to control the quantity of exhaust gases which enters the jacket surrounding the induction pipe, and in some cases this bye-pass valve may be arranged in conjunction with the device for controlling the stroke of the pump and the air or mixture throttle valve, and any one or all of these three regulating devices may be arranged to be disconnected when required. The initial heating of the vaporiser for starting the engine may be effected either by first running the engine on petrol or by the flame of a blow lamp applied to the induction pipe.


17845/09

17944 Wanklyn: Holder for erasers. 18151 Phipps: Incubators. 18259 Kershaw, and Edmund Whittaker and Sons Ltd.: Cop tubes, pirns, or bobbins for use in spinning, doubling, winding, and like machines.

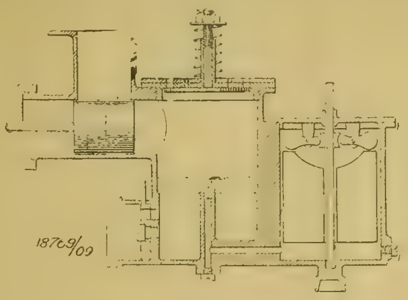
18345 McGray: Hatches.

This invention relates to hatches for steamships and other vessels, and comprises a device in which the hatch cover, which may consist of one or more sections, is movably supported upon hatch coamings, so that it can be rolled bodily aside and then tilted into a substantially perpendicular and inoperative position, means being provided for suitably holding the cover in the inoperative position, together with means for clamping the hatch cover in a closed or battened position upon the coaming edges. Specifically, the hatch cover is supported upon wheels arranged to roll upon trackways carried by the fore and aft or longitudinal coamings of the hatchway, the trackways having adjustable sections which permit the hatch cover to be lowered into engagement with the hatch coamings when the wheels supporting the cover are located at these sections.

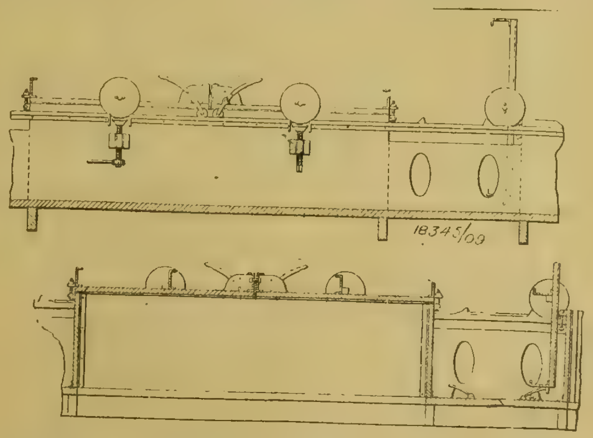
18418 Johnson: Amusement apparatus. 18499 Pink: Electric traction systems. 18595 Sargeant: Method of manufacturing driving belts.

18769 Fisher and Levy: Carburetters for internal-combustion engines.

This invention relates to carburetters, and has for its object to simplify and improve the working of a particular type of this apparatus. The type referred to has heretofore comprised a liquid fuel spray nozzle or jet upstanding within a tubular chamber of a diameter of about half its height to the lower end of which, in some cases, warmed air has been admitted and allowed to flow upwards past the nozzle or jet. Cold air from the atmosphere has been admitted from an automatic suction valve arranged above the nozzle or jet and in axial alignment therewith, so that a downward cold stream has, when the speed of the engine has been high enough to create sufficient suction to open the suction valve, been directed against the ascending stream of warm air charged with petrol and the resultant mixture has been drawn off laterally through the suction or feed pipe located at the upper end of the spraying chamber and directed at about right angles to the axis of the suction valve. Now the present invention consists in particular arrangements and improvements of detail of such an apparatus, the result of which is a carburetter of extreme simplicity and efficiency. The chief features of the improved carburetter of this type are the making of the spray chamber of a considerable diameter compared with its height, as, for instance, a diameter of a little more than half its height, and the use of a suction air valve of the disc variety and of large diameter immediately above the spray jet nozzle so that a small opening of the valve admits a large thin film of air.


18769/09

18860 Flower: Bottle-labelling machines. 18877 Gusterson: Taps and tapping appliances for beer and other casks. 19004 Court and Harris: Kettles and other like hollow ware used as cooking utensils. 19248 Atkins and Pridmore: Back rests for use on cycles, motor cycles, and the like. 19401 Marshall: Means for locking nuts and the like on bolts and the like. 19477 Magee and McGhee: Valves and gear of internal-combustion motor engines. 19556 Kenny: Construction of device for fixing to windows and upon which to stand when cleaning or repairing such windows. 19585 Bennett and Dutchman: Grinding tools. 19623 Thompson (Hamburger Elektritzitats Ges.): Illuminated signs. 19696 Talmadge: Article-coating process. 19792 Beaton: Pneumatic tyre for the road wheels of vehicles and aeroplanes. 19843 Fairweather (Wilcox and White Co.): Auto-pneumatic music playing instruments. 20000 Parker: Carburetters for internal-combustion engines. 20027 French: Sand driers. 20029 Bloxam (Akt.-Ges. fur Anilin Fabrikation): Manf. of new dyestuffs of the safranine series. 20030 Tolton: Frying pans and like cooking utensils. 20106 Beaver and Claremont: Electric joints. 20233 Baines: Pencil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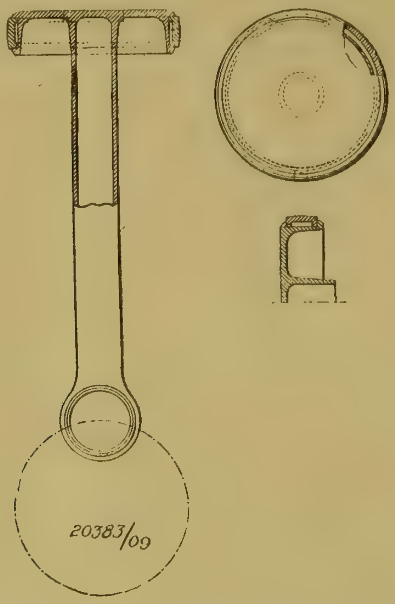
sharpeners. [Request under Section 19 of the Act not granted.]

20383 Simms: Pistons of reciprocating engines, pumps, and the like.

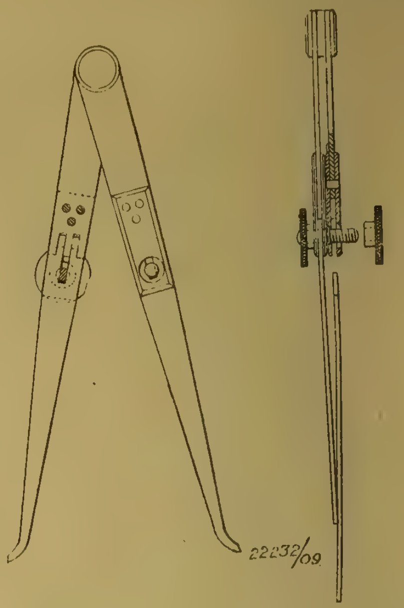
This invention relates to the pistons of reciprocating engines, pumps, and the like. A piston constructed according to this invention has rigidly attached to it a rod which is also adapted to be connected to the crank and the surface of the piston in contact with the cylinder, or of the ring or rings upon the piston conforms or substantially conforms to that of a sphere having the same diameter as the cylinder, so that as the piston reciprocates it will be capable of oscillating in the cylinder to an extent corresponding to the length of stroke and the throw of the crank. By the use of this arrangement a piston of the kind wherein the connecting rod is united directly to the piston can be made shorter than heretofore, so that the length of the cylinder is correspondingly reduced, whilst at the same time, as the usual pivotal connection is dispensed with, the cost of manufacture of these parts is reduced and the weight diminished. When the piston is provided with rings, recesses are provided to allow of the pressure of the gases or fluid in the cylinder passing behind the rings and so expanding them slightly into contact with the cylinder surface. Instead of making the surface of the piston truly spherical, it may be constructed so that the parts which have the greatest oscillation have the greatest convexity gradually diminishing towards the axis of oscillation where the amount of movement is small and where the convexity of the surface may be somewhat less.


20383/09

20635 Harnett: A new game, and apparatus for playing the same. 20666 Arnold: Shade holders and the like for incandescent electric lights. 20776 Coster: Chalk-holding device for billiard rooms. 20821 Ross: Pumps for aerating liquids. 20894 Lea and Lea: Variable-speed gears. 21056 Rushton: Means for operating the lifting pokers of ring-spinning and doubling frames. 21057 Rushton: Means for operating the lifting pokers of ring-spinning and doubling frames. 21162 Bell and Bell: Means for adding chemicals to water, sewage, and other liquids for the purpose of purifying or softening the same. 21186 Fleming: Aerial toy. 21232 Hollingworth (Crompton and Knowles Loom Works): Terry motions of looms for weaving. 21332 Birmingham Small Arms Co., and Norman: Sights for small arms. 21454 Thomas: Valves for hot-water heating apparatus. 21504 Riley: Automatic stop motion for carding engines. 21651 Marks (Rotary Ring Spinning Co.): Spinning rings and holders therefor. 21891 Messter: Cinematograph films. 22080 Hippisley: Carburetters for internal-combustion engines. 22120 Broom: Means for deflecting the draught in the tubes of marine and other boilers. 22211 Williams, Forgas, and Cosetano: Rotary radiators for cooling liquids, gases, or other substances, and for purifying or perfuming air. 22222 Van Oosterzee: Process for regenerating old rubber. [Date applied for under International Convention, September 30th, 1908.]

22232 Knott: Callipers, dividers, scribers, compasses, and other analogous tools or instruments.

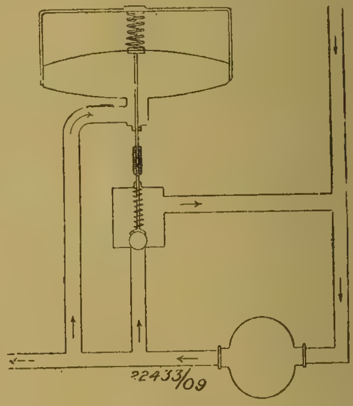
This invention relates to callipers, dividers, scribers, compasses, and other analogous tools or instruments of the class in which the operative portions of such tools or instruments are detachable from the shanks, which latter are hinged together at one end. The chief object of the invention is to provide an improved joint for attaching the operative portions to the shanks, a resulting advantage being that rigidity is imparted to the joint. According to the invention the shank and operative portions are joined together by means of a fork on one portion sliding into a suitable housing in the other portion, with or without additional fastening means.


22232/09

22378 Knight: Electric fire alarm apparatus and the like
[Cognate Application. 5641, 1910.]

22433 Stubbs: Pressure regulators for use more especially with suction gas plant.

Relates to systems in which the suction gas plant provides gas for two distinct purposes, viz., a main supply for driving an engine and a secondary supply for heating purposes. As hitherto arranged, a pipe from the scrubber was connected to the engine and another pipe was connected to the burners and exhauster to feed the gas to the burners. Owing to the variable pressure, it has been customary to provide a return pipe, one end of which is in advance of the exhauster and the other end behind it, and in this pipe a return valve is located so that if the pressure at the burner side of the exhauster was excessive the return valve lifted and eased it. Various means have been suggested for delicately adjusting this return valve so that at the burners as constant a pressure as possible could be maintained. According to the present invention a pressure regulator comprising a flexible diaphragm that expands whenever the pressure in the branch supply becomes excessive, and a valve connected to it which allows surplus of gas under pressure to escape and rejoin the suction supply, is employed.

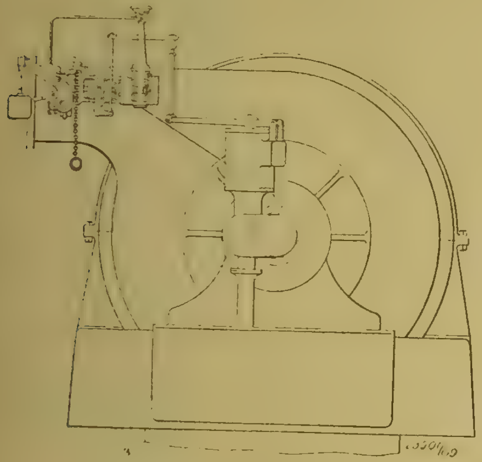

22433/09

22643 Fish, Phillips, and Parker: Apparatus for lapping, creasing, folding, doubling, or similarly treating cloth and other fabrics. 22757 Caldwell, Oldham, Clayton, and Jones:

Pipe connections. 22847 Stevenson: Apparatus for submarine signalling. 23000 Williams: Corking machines. 23116 Shirley Bros. Ltd., and Kay: Soothers or comforters for infants, and the treatment of indiarubber therefor, and for other purposes. 23275 Parkyn and Mitton: Releasing gear for operating the admission or other valves of the cylinder of a steam or gas engine. 23306 Murphy: Process for covering golf and other like balls and apparatus employed therein. 23328 Lake (Electric Press Bulletin Co.): Telegraph transmitting and receiving apparatus. 23372 Waugh: Portable shed or cover for ricks, stacks, and other purposes.

23501 Warwick Machinery Co. (General Electric Co.): Governing mechanism for elastic-fluid turbines.

This invention relates to the governing of low-pressure turbines which receive and are driven by the exhaust steam from one or more high-pressure reciprocating engines or other low-pressure source of supply. In such an arrangement it is undesirable to permit the steam entering the turbine to fall below atmospheric pressure because the air admitted to the system by leakage under such conditions will impair the vacuum due to the condenser which is connected to the low-pressure turbine. To effect this purpose governing mechanism is provided comprising a speed governor adapted to control the supply of fluid to a motor which operates the fluid admission valve of the turbine under normal conditions and a pressure responsive device which under certain conditions overpowers the governor and causes the motor to close the admission valve.



23527 Jensen: Folding apparatus to be used in connection with machines for making flat-bottomed and other paper bags, envelopes, and the like, or for folding newspapers and the like. 23542 Heeley: Cutting devices for cutting loaves, bacon, tobacco, vegetables, and other substances into slices. 23577 Haighton, Midgley, and Midgley: Border or heading motion for looms for weaving shawls, scarves, and the like.

23618 Burstinghaus and Schroeder: Compound for preventing the formation of scale, corrosion, and pitting in steam generators.

This invention relates to a new or improved compound for the prevention of incrustation, corrosion, and pitting in steam generators and the like, and consists essentially of barium tannate in the liquid or solid form and (with or without) the admixture of free tannic acid, or any other suitable organic or inorganic compound, such as sodium thiosulphate or sodium phosphate, hydrochloric acid excepted, to be mixed with the feed water before this enters the steam generator, or to be fed into the steam generator at suitable intervals.

23666 Ruthenberg: Airships and the like. 23700 Fawcett: Buttons. 23978 Tixier: Filters for liquids. [Date applied for under International Convention, April 27th, 1909.] 24015 Perraud: Safety device for automatically stopping trains in the case of the breaking of a coupling. [Date applied for under International Convention, April 27th, 1909.] 24032 Rainforth: Riddling apparatus for separating straw, cavings, chaff, and the like from grain and seeds. [Post-dated April 5th, 1910.] 24035. *See* 14102, 1909. 24077 Smithurst: Devices for opening and closing the window sashes or blinds of carriages and the like. [Cognate Application. 25977, 1909.] 24131 Hall and Saborne: Line-throwing apparatus. 24200 King: Lawn tennis courts, cricket pitches, fives courts, and the like. 24269 Siemens Bros. Dynamo Works Ltd. (Siemens-Schuckertwerke Ges.): Driving and operation of electric frequency transformers having commutators. 24336 Elson: Chain wheels. 24412 Stockall and Merrick: Mechanical appliance or apparatus for cutting uniform lengths from a web or roll of paper, cloth, or similar material, and transferring or feeding the lengths to printing, packing, or paper-bag making machines. 24441 Bunn: Wire cutters for cheese, butter, and the like. 24530 Beeching, Beeching, and Kynoch Ltd.: Internal-combustion engines. 24768. *See* 11526, 1909. 24818 Thom: Couch roll mechanism for paper machines. 25152. *See* 9163, 1909. 25203. *See* 11526, 1909. 25258 Peck, and H. O. Peck: Automobile Wheel Co.: Resilient spoke or shock absorber. 25367 Wood: Manf. of yarn. [Date applied for under International Convention, February 26th, 1909.] 25538 Blanch and Stevens: Sighting of firearms from cover. 25550 Osborn and Carnegie: Crushing machines and appliances connected therewith. [Application for Patent of Addition to 9454, 1909.] 25564 Beech: Construction of apparatus for holding and positioning wheel blanks whilst cutting teeth therein, and for dividing other work. 25870 Heizer: Air brakes and whittle signals for railway and like cars. 25977. *See* 24077, 1909. 26020 McClean: Vehicle wheels. [Date applied for under International Convention, November 12th, 1908.] 26094 Whiteway, and Chas. Macintosh and Co.: Pneumatic and other resilient tyres. 26316 Orr: Ventilator for use in railway, tramway, and other moving vehicles, ships, and in the walls of houses or elsewhere and means for operating same. [Cognate Application. 1375, 1910.] 26448 Osenberg: Method of cutting files. 26549 L. Dutheil, R. Chalmers, and Co.: Motors especially applicable to aviation and aerostation purposes. [Date applied for under International Convention, November 23rd, 1908.] 26601 Rossel: Aeroplanes. [Date applied for under International Convention, February 12th, 1909.] 26688 Medcraft and Ensom: Tooth brushes and the like. [Post-dated February 3rd, 1910.] 26914 Beck: Rotary explosion motors. 27195 Blake and Smart: Distributing apparatus of kilns for the revivification of animal charcoal. 27351 Lamplough: Rotary blower, exhauster, or the like. 27362 Reck: Appliances for smokeless combustion. 27402 Smith, Whittington, and Whittington: Single-trigger double-barrel sporting guns. 27515 Baillie: Fixing for chimney cowls. 27682 Axien: Process and apparatus for the separation of lubricating oil in rotary vane pumps and the like. [Date applied for under International Convention, January 18th, 1909.] 27736 MacLaren, MacLaren, and MacLaren: Motor boats. 27931 Jones and Andrew: Ship tables. 28006 Whitrow: Cattle or sheep feeding trough. 28019 Siemens Bros. Dynamo Works (Siemens-Schuckertwerke Ges.): Flexible couplings for the transmission of power. 28102 Smith: Cigarette case or card case with movable slide. 28186 Tomlinson and Tomlinson: Clamps or holding devices for use with butchers' blocks. 28328 Blanchford: Tube connections. 28536 Balsley and Balsley: Machines for forming flower pots and other articles from plastic materials. 28615 Le Page: Air heaters 28642 Droitcour: Process of making printing plates from plastic material. 28717 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new azo dyestuffs. 28750 Greville: Clutches. [Date applied for under Rule 13, October 2nd, 1909.] 29016 Haire: Fluid compressors. [Date applied for under International Convention, December 11th, 1908.] 29128 Adams: Dining tables. 29304 Fowden: Blow-off valve or cock. 29325 Ward: Apparatus for feeding calves. 29341 Fairweather (Mergenthaler Linotype Co.): Type-line composing and casting machines. 29416 Peacock and Peacock: Protectors for boots and shoes. [Application for Patent of Addition to 27828, 1908.] 29458 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of a new azo dyestuff. 29763 Wheless: Railway rails. 29984 Prieto: Decorticating machines. 30043 Pieper: Apparatus for generating and filtering hydrogen for balloons. 30197 Johnson (Badische Anilin and Soda Fabrik): Manf. and production of stable indigo-white preparations. 30246 Ashworth: Packing cases. 30307 McElvain: Adjustable flue collars and pipe supports. [Date applied for under International Convention, December 30th, 1908.] 30421 Topping: Railway rail-fastening devices. 30424 Popow: Device for automatically weighing pulverised material. [Application for Patent of Addition to 4597, 1909.] 30578 Dunstan: Boring bits.

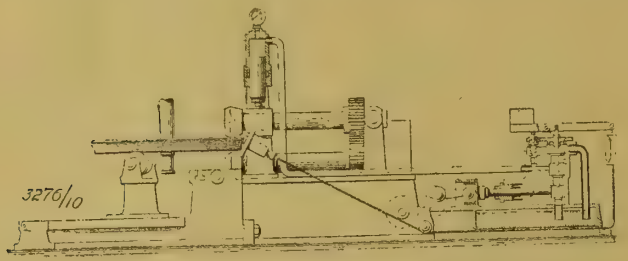
1910.

375 Burger: Marine vessels. [Date applied for under International Convention, November 30th, 1909.] 473 Wunderlich: Motor flying machines. [Application for Patent of Addition 1307, 1908.] 560 Anderson, and "X" Chair Patents Co.: Folding shelf racks. 937 Jacques: Percussion boring machines. [Date applied for under International Convention, June 17th, 1909.] 1340 Lake (Soc. Anon. Fides Fabrica di Automobili Brevetti Enrico): Joint or coupling for transmitting the movement of rotation between two shafts. 1375. *See* 26316, 1909.

1580 **Atkinson**: Circulation of water for heating and cooling purposes, more particularly for cooling the cylinders of internal-combustion engines. 1589 **Goldenstein**: Dental instrument. [Date applied for under International Convention, August 2nd, 1909.] 1706 **Roscheisen**: Process and device for producing bandages of tissues of any kind ravelled out at the edges and provided with a fur-like cut. 1802 **Hilgers**: Rolling mill shears. 1840 **Russell**: Quick adjusting micrometer gauge. 2012 **Jenkins**: Spirally-wound paper or like cases or receptacles. [Date applied for under Rule 13, October 29th, 1909.] 2013 **Jenkins**: Spirally-wound paper and like receptacles. [Date applied for under Rule 13, October 29th, 1909.] 2014 **Jenkins**: Spirally-wound paper and like receptacles. [Date applied for under Rule 13, October 29th, 1909.] 2015 **Jenkins**: Receptacles of paper or like material. [Date applied for under Rule 13, October 29th, 1909.] 2024 **Carrier, and John Broadwood and Sons Ltd.**: Means for adjusting the tension of diaphragms. 2203 **Hall**: Flying machines. 2238 **Wrissenberg**: Method of forming ferro-concrete ribbed floors and like structures. [Date applied for under International Convention, February 6th, 1909.] 2380 **Twine**: Non-vibrating valve. 2386 **Tellerson**: Dispensing receptacles. 2433 **Berryman**: Apparatus and process for the manf. of artificial ice. [Date applied for under Rule 13, August 16th, 1909.] 2641 **Schmitt**: Sounding board for pianos. 2865 **Howlett, Howlett, and Howlett**: Reversible windows and the like. 2950 **Fried. Krupp Akt.-Ges.**: Flushing pipes for mine gobbing. [Date applied for under International Convention, March 6th, 1909.] 3087 **Lake (Goss Printing Press Co.)**: Folding mechanism for printing presses.

3276 **Beche**: Machines employed in the manf. of railway and other wheels.

The object of the present invention is to provide an improved construction of machine whereby the amount of pressure applied in the rolling process can be observed and can be either increased or diminished at will, and whereby it is not only impossible to apply a pressure in excess of a predetermined maximum, but an equal pressure will be applied to the tyre, although the width of the tyre may slightly vary. To these ends the pressure given to the rolls acting upon the tyre being operated upon is transmitted by hydraulically-operated mechanism, whereby the actual pressure at any time so transmitted can be read off upon a pressure gauge, and whereby the amount of pressure applied within a predetermined maximum pressure, which is governed by a safety valve, can be easily and quickly varied through the medium of hydraulic relief valves controlled by springs, the tension of which can be adjusted through mechanism within easy reach of the operator, and by which mechanism also a uniform pressure upon the tyre throughout the rolling operation is assured, whether the tyre has elevations or depressions around its side periphery—that is, whether or not the tyre is wider across its tread at one part than at another.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3403 **White**: Wind shields for automobiles. 3412 **Sears**: Internal-combustion engines. [Date applied for under Rule 13, November 3rd, 1909. Application for Patent of Addition to 28265, 1908.] 3438 **Lovelace, and Humber Ltd.**: Steering mechanism of flying machines. 3606 **Merritt**: Shock absorbers. [Date applied for under International Convention, February 13th, 1909.] 3730 **Adair, Cameron, and Ainsworth**: Governing mechanism for machines for hemming handkerchiefs and the like. [Date applied for under International Convention, July 25th, 1908. Originally included in 16923, 1909.] 3754 **Flersheim**: Clutches. [Date applied for under International Convention, May 24th, 1909.] 3758 **Munger**: Car couplers. 3764 **Adolphs and Co. Ges.**: Fireproof sliding shutters for safes and doors of all kinds. [Date applied for under International Convention, February 15th, 1909.] 3981 **British Thomson-Houston Co. Ltd. (General Electric Co.)**: Treatment of metals of the chromium group. 4198 **Du Pont**: Railway cars. [Date applied for under International Convention, April 7th, 1909.] 4277 **Schurhoff**: Machine for making moulds for cast chain. 4390 **Dawson**: Loose-sheet holders. 4527 **Musil**: Roller skates. 4532 **Alldridge**: Skates. 4762 **Roberts**: Tramway rail joints. 4994 **Midland Railway Carriage and Wagon Co., and Pedley**: Means for securing buffer plungers. 5001 **Graaff**: Diffusers for coating the interior surface of hollow bodies. 5043 **Schlick**: Magneto electric machine for velocipede lamps and holder therefor. 5376 **Fairburn-Hart (Electric Renovator Manufacturing Co.)**: Centrifugal fans. [Date applied for under Rule 13, October 28th, 1909.] 5641. *See* 22378, 1909 5755 **Pratt**: Machines for making link mesh. [Date applied for under International Convention, March 10th, 1909.] 5781 **Walsh and Kay**: Means for sealing air filled teats for infants. 5788 **Dawson**: Loose-leaf binders. 5801 **Adams Manufacturing Co. (Cutler Hammer Manufacturing Co.)**: Electro-magnetically actuated electric switches. 5848 **Schwade**: Centrifugal pumps. [Date applied for under International Convention, March 12th, 1909.] 5921 **Lindstrom**: Talking machines. [Date applied for under International Convention, February 16th, 1910.] 5987 **Jelfs**: Blackboard or slate-like appliance. 6464 **Kennedy**: Combined ball and tube mills. 6620 **Ross and Holton**: Amusement devices. [Date applied for under International Convention, November 15th, 1909.] 7078 **Melville**: Steam turbine. 7292 **Siemens Bros. Dynamo Works (Siemens Schuckertwerke Ges.)**: Electric frequency converters. 7343 **Scheie**: Extension rims for traction engine wheels. 7398 **Adlam**: Apparatus for sparging brewers' wort. 7651 **Williams**: Gas regulator. 7708 **Worcester (Turner and Co.)**: Guard or protecting device for use in connection with the chain wheels of velocipedes and the like. 7814 **Dusterloh**: Dirigible aerial vessels. [Date applied for under International Convention, January 10th, 1910.] 7819 **Evans and Innes-Baillie**: Method of tanning hides and skins. 7939 **Oakes**: Knives of grass mowers, reapers, and combined reapers and binders. 8127 **Kalle and Co. Akt.-Ges.**: Manf. and production of azo-dyes. [Date applied for under International Convention, April 13th, 1909.] 8713 **Marks (Badische Maschinenfabrik and Eisengiesserei)**: Separation and the pulverisation of materials. 8790 **Quinn**: Non-refillable bottles. 8976 **Maschinenfabrik Grovenbroich**: Apparatus for filling sugar plate moulds, more particularly those constructed according to the Adant system. [Date applied for under International Convention, June 23rd, 1909.] 9122 **Carl Zeiss**: Stands composed of a head, and three legs hinged to the head. [Date applied for under International Convention, April 19th, 1909.] 9216 **Horswill**: Stands or supports for cycles, motor cycles, and the like. 9248 **Hosking**: Packing confectionery and fragile articles. 9348 **Brandell**: Tamping machines especially applicable for tamping concrete into moulds to form building blocks or the like. 9497 **Farbwerke vorm. Meister, Lucius, and Bruning**: Process of manufacturing a monoazo dyestuff. [Date applied for under International Convention, April 27th, 1909.] 9543 **Freise**: Device for indicating the presence of fire-damp by means of a selenium cell and a safety lamp. [Date applied for under International Convention, April 27th, 1909.] 9628 **Grumer and Grimberg Ges.**: Apparatus for storage and delivery of inflammable liquids. [Date applied for under International Convention, May 10th, 1909.] 9845 **Wigzell**: Navigational sounding instruments. 9938 **Williamson**: Non-refillable bottle. 9984 **Harsanyi**: Fans and air propellers driven by internal-combustion engines. [Date applied for under International Convention, October 17th, 1908. Originally included in 23658, 1909.] 10100 **British Loose Leaf Manufacturers Ltd. (Sieber and Trussell Manufacturing Co.)**: Loose-leaf binders. 10519 **Kay**: Drop doors for sanitary dry closets. 10703 **Thompson (Firm L. and C. Arnold)**: Apparatus for making multiple-threaded wood screws. [Date applied for under Rule 13, November 22nd, 1909. Application for Patent of Addition to 7016, 1910.] 10802 **Palmer**: Prepayment meters. 11358 **Societa In Accomandita Per l'Utilizzazione Delle Invenzioni Ing. Beer**: Railway signals. [Date applied for under International Convention, November 17th, 1908. Originally included in 26487, 1909.] 11366 **Haselbauer**: Machines for cutting out wrappers for cigars or the like from tobacco leaves. [Date applied for under International Convention, May 26th, 1909.] 12584 **Hoffmann Manufacturing Co., and Mair**: Bearings of internal-combustion engines. 12589 **Belgian Pneumatic Tool Co. (Soc. Anon.)**: Valve mechanism for pneumatic tool engines. [Date applied for under International Convention, July 5th, 1909.] 12841 **Bates, and British United Shoe Machinery Co.**: Holders for knives, forms, and the like that are used in machines for the manf. of boots and shoes. [Date applied for under Rule 13, July 24th, 1909.] 15559 **Rose, and Rose Bros. (Gainsborough) Ltd.**: Mechanism for feeding and cementing bands, wrappers, or labels in connection with machines for applying such bands, wrappers, or labels to boxes, blocks, or packages. [Date applied for under Rule 13, July 17th, 1909.] 15882 **Walter's Electrical Manufacturing Co., and Moore**: Method of and apparatus for giving warning of the approach of a train on railways. [Date applied for under Rule 13, February 23rd, 1910.] 15956 **Hill**: Mail delivery appliances for railway trains. [Date applied for under International Convention, July 12th, 1909.]

HOW THE WORLD OBTAINS HER PROGRESSIVE MECHANIC.

The Modern Practical Engineer's View-point—A Fallacy Exploded.

A Demonstration of the Best Method of Technical Training.

MR. S. BROWN, of Sheffield, has for some time past been studying the Mechanical Engineering Course. He is one of our young English engineers who not only means to get on, but whose future is assured, for he is building his success upon a firm foundation of sound knowledge and hard work. He served his seven years' apprenticeship with the world renowned firm of Hugh Bell, of Middlesbrough. When he was out of his time he obtained a post in the engineering drawing-office at the firm of Dorman. It was then that he became an I.C.S. student.

"I had been attending the Technical Schools," Mr. Brown said in a special interview recently, "but was led to give them up for many reasons, chiefly because of the difficulty of fitting in the times of attendance with my other work. I tried studying alone, but that was a failure. A man must be pretty far advanced to study engineering alone. In an engineering paper which I took I often read an advertisement of the International Correspondence Schools, and one day I sent for a prospectus out of curiosity, though I must say I had little faith in tuition by correspondence. I looked through the prospectus and put it aside; it struck me as being far too expensive. Then for several months more I tried working alone. One night I took paper and pencil, and jotted down all the items of the technical school expenses—fees, new books, car fees, etc., and then, on the assumption that it would take me five years to get through the Complete Mechanical Engineer Course with the I.C.S., I compared the two. I saw then that instead of being dearer, it is much cheaper. It certainly has been so for me, for, because of the benefit I am persuaded an I.C.S. course confers, I have already been instrumental in persuading twelve other students to join. By the time I am through my course I expect I shall earn the whole of my fees—practically get my course for nothing. After I had been studying with the I.C.S. for a year, it occurred to me that I was worth more than at the beginning. so I applied for a post in the drawing office at Hadfield's Steel Foundry, Newhall Road, Sheffield. The head men of the firm are quite alive to the fact that the I.C.S. turns out well-trained men. An application from an I.C.S. student is always considered more carefully than that of other applicants.

"Working out each scheme on paper, I found the I.C.S. system far cheaper and better in every way."

Mr. Morgans, our manager, is studying an I.C.S. language course. I attributed my success in obtaining the post at Hadfield's entirely to my connection with the I.C.S.; of course, I backed up my application with specimens of my drawings that had been corrected by the schools. And I must say this, that never in all my experience of technical schools, or of other men's work have I seen drawings corrected in such a thorough manner; nothing is overlooked. An I.C.S. pupil would be ashamed to do slip-shod work.

"As a result of my studies with the I.C.S., I am glad to report that I was successful in obtaining a situation at an increased salary of about 50 per cent.

"There is one thing I specially enjoyed about the I.C.S." he continued, "apart from the benefit the tuition confers, and that is the feeling that one belongs to a big international fraternity. Let me give you an instance. I was strolling one day along the dock-side at Middlesborough, when I was seized by a Japanese naval officer. I was puzzled for the moment to know what he wanted with me, but it was soon explained. I was wearing my I.C.S. button; he was wearing his. I went with him on board his ship, and discovered we were taking the same Course—Mechanical Engineering—and were about equally advanced. His English was not too good, and my Japanese nil, but we managed to have a good talk."

Securing berth at 50 per cent increase in salary.

Readers of *The Practical Engineer* are assured that the foregoing is a fair example of the reports that Rosamund Kendall is gathering throughout Great Britain. Big cities. small villages, are penetrated by the International Correspondence Schools; wherever the post goes, there can the advantages of the world's greatest technical and commercial training centre be obtained. A postcard will bring you particulars wherever you live.

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THE
PRACTICAL ENGINEER
AND ENGINEERS' GAZETTE.

VOL. 42. FRIDAY, SEPTEMBER 2, 1910. No. 1,227.

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DREAM BATTLESHIPS.

A VERY great number of these crafts have been launched from the imaginations of various people since the recent announcement in the evening paper of a dockyard town as to the intentions of the Admiralty. Right at the zenith of the holiday season—just when we are accustomed to anticipate sensational pronouncements—we were informed by the enterprising journal above indicated, that the Admiralty have decided to forthwith build a motor-driven battleship. Nothing could have been more fortunate for the newspapers of the country during the slack, not to say "silly," season, when the junior members of editorial staffs are left to make bricks without straw, whilst their seniors are enjoying their vacation. And they all made very good use of it. The following description of the battleship of the future, as given in one journal, of the more staid and sober sort, will suffice to illustrate their treatment of the theme:—

"The battleship of the future," says the writer of the thesis, will be able with the same displacement "to carry more guns because of the saving of weight in engines, boilers, and fuel." He proceeds: "These guns will have a wider sweep, because no funnels will restrict their action. Between decks she will be vastly more roomy, affording better accommodation for the crew. When she is moving, in place of an army of toiling stokers and engineers, there will be a tiny company of the latter and their attendant greasers. The inferno of the stokehold will be unknown. Half as many men again will be available for fighting the ship, or crews may be reduced if more gunners and sailors are not required. Oil vapour and electricity will provide the motive power for all the machinery. If an accident comes in battle the number of men doomed to almost certain death will be but a fraction of those who would perish to-day. The battleship as she rides on the water will have no funnels to be shot away, so reducing her efficiency. She will present a smaller mark, while the whole of the machinery will be so low in the ship as to make disablement by a shell a remote event. Instead of coaling in laborious and dirty fashion in harbour and on sea, the fuel will be pumped quietly from the store tanks. The coal lighter will be replaced by an oil-tank steamer carrying sufficient fuel for a whole fleet, and delivering it to our battleship through a hose while steaming ahead at full speed. When the call for urgent action comes, there will be no waste of hours in getting up steam, no lying for weeks under banked fires. The switching on of an electric motor will start the engines within a couple of minutes of the demand for power."

It is all very simple, but very beautiful.

Let us now leave dreams and prophecies and descend to a consideration of that which has already been accomplished, and the nature of the work before engineers engaged upon the development of the internal-combustion engine and its application to marine propulsion.

The centenary of the application of the steam engine to marine propulsion has lately been celebrated. It is not so generally recognised that this year sees the jubilee of the gas engine as a commercial prime mover. A quarter of a century ago, in the first or an early edition of his standard work on the "Gas Engine," Mr. Dugald Clerk said:—"Since 1860, when by the genius and perseverance of M. Lenoir the gas engine first emerged from the purely experimental stage, it has steadily and continually increased in public favour and usefulness. At first more wasteful of heat than the steam engine, it is now more economical; at first delicate and troublesome in the extreme, it is now firmly established as a convenient, safe, and reliable motor; at first only available for small and trifling powers, now really large and powerful motors are used in thousands." But Mr. Clerk also saw and appreciated "the other side of the shield," as will be seen by the following:

"As a piece of mechanism, the steam engine is almost perfect; it is started, stopped, and regulated in a very perfect manner. Its motion is, in good examples, almost perfectly uniform under variation of load, and but little flywheel power is required, because there is little or no negative work. Its motion is perfectly under control. The gas engine requires much improvement in this respect; it is a comparatively inferior machine."

Whilst it must be borne in mind that Mr. Clerk was speaking 25 years ago, and that, in the intervening 25 years, tremendous advances have been made in the internal-combustion engine, it is still true, as a general proposition, that for marine propulsion such a motor is inferior to the steam engine, notwithstanding the very much greater thermal efficiency of the former. Its inferiority, apart from the starting and reversing difficulty, is evidenced by the fact of its great weight for power produced—a fact which is lost sight of by the lay journalist. Mr. J. J Kermode, of Liverpool, well puts it: "What is the use of dispensing with boilers if you are going to concentrate weight that you would get rid of in the boiler room into the massive cylinders, cranks, shafts, and gearing in the engine room?"

As to the starting and reversing difficulties, the adoption of electrical in place of clutch transmission—using a dynamo on the engine shaft and a variable speed reversing electric motor on the propeller shaft—will no doubt overcome such difficulties; but the cost in weight may at present be prohibitive.

As to what has already been accomplished, it should be remembered that Messrs. Thornycroft were the first to propel a sea-going launch and a canal boat in Britain by means of a gas engine driven by gas produced on board. Messrs. Gardner and Sons Ltd., of Patricroft, have solved many difficulties in the application of internal-combustion motors to marine propulsion, and Messrs. Mirlees, Bickerton and Day, of Stockport, have applied their Diesel type oil engine to boats of 1,800 tons displacement.

A few weeks ago it was publicly stated that the Hamburg-American Company had ordered an Atlantic liner of 9,000 tons, which is to be fitted with Diesel type oil engines. These engines will be of 3,000 H.P. It is also announced that a Diesel engine with four cylinders which will develop 10,000 H.P. is now under construction. One newspaper writer observes that "two such engines on twin shafts would at once give the power for a battleship," and that "on four shafts the horse power of the Orion could be obtained." But there is a good deal yet to be done by inventors and constructors before the Orion is displaced by a vessel equipped with any such motors.

Railway Construction in Canada.—The contracts let and engagements entered into with the Dominion and Provincial Governments by the different Canadian railway companies indicate that at least 7,000 miles of new railroads will be built during the next five years. The construction for the present year is 1,500 miles, about the same as last year. The largest increase in mileage will be in British Columbia. The construction of the National trans-continental—better known as the Grand Trunk Pacific—from Moncton, on the Atlantic, to Prince Rupert on the Pacific, 3,550 miles, is more than half completed, and trains are already being run. For the purpose of construction, rails and fastenings are to be admitted duty free, also the material for the construction of rolling stock. The immense amount of railway construction in Canada in proportion to its population will be more fully realised by the fact that during 1909, according to the official returns of the different railway companies, Canada constructed 1,588 miles of new lines, whilst, in the same period, the United States built 3,748 miles.

Heroult Furnace.—In a paper read before the Canadian Mining Institute, Mr. P. M. Bennie gave some account of the working of the Héroult electric furnace at Shasta, California. The furnace smelts a high-grade magnetite containing 68 per cent of iron, and very low in sulphur and phosphorus. The ore costs about 6s. per ton and the limestone 2s. Charcoal and not coke is used as a reducing agent. This is estimated to cost 37s. 6d. per ton. Probably about one-third of a ton of charcoal would be required per ton of pig smelted. Power is obtained at about £3 per horse-power year, and the average consumption of power is stated to be about 0·22 H.P. year per ton of pig. The total cost is estimated at between £3 and £3 5s. per ton, the pig being of very pure quality. In studying the figures it must of course be kept in mind that the raw materials, power, limestone, and ore are very cheap and the ore exceptionally pure. The furnace is a comparatively small one, producing about 20 tons per day. Three-phase current at 60 cycles and 100 volts is employed, the maximum load being 1,500 kilowatts. The furnace generally is of blast-furnace shape, except just above the hearth, where it widens out greatly to accommodate the carbon electrodes, which project into the furnace just above the hearth at a moderate angle to the vertical. The gases leaving the furnace are passed to a reheating chamber and then to a bin containing the ore, which thus receives a preliminary roasting.

Launch of the Orion.—The Orion, launched at Portsmouth on August 27th, is the largest battleship yet constructed in any Government dockyard, and the launching weight was 8,500 tons. She measures 684 ft. in length, will have a displacement of 22,500 tons, and is the first vessel to be armed with ten 13·5 in. guns instead of 12 in. weapons, provided in previous Dreadnoughts. They will be mounted in pairs, and so arranged that all may be fired on either broadside. The guns fire a projectile half as heavy again as those fired by the other Dreadnoughts. Her speed will be 21 knots, to correspond with other ships of her class, turbines engines capable of developing 27,000 H.P. being employed. She will also have three submerged tubes for discharging torpedoes. The new torpedo measures 18 ft. 6 in. in length, is 21 in. in diameter, carries 250 lb. of gun cotton, and, although weighing nearly a ton, can be discharged at a vessel practically four miles away. The Orion represents an improvement on all the Dreadnoughts hitherto launched, according to the Admiralty, of 33 per cent. The first keel plate was laid last November, and the vessel is to be ready for sea within two years from that date.

A 9,000-kilowatt hydraulic power station is at present in course of construction at Cook Falls, which are situated on the Au Sable River, Michigan, U.S. The power station is to be the starting point of a 135,000 volt transmission system, ultimately to extend 190 miles distant. The generating equipment at the station is to include three 3,000-kilowatt 60-cycle alternators, which are to be mounted on horizontal shafts, and are to be driven by water wheels, the available head of water at the water-power site works being 40 ft. Delta connected transformers installed at one extremity of the generator room are to be used for stepping up the voltage of the generators to 135,000 volts. The transmission line is to be a single three-phase circuit of three No. 0 copper wires, carried on insulators of the suspension type, secured to and dependent from bracket arms provided on tripod-pattern steel standards or towers 55 ft. in height. Two of the bracket arms are to be arranged to extend from one side of each standard, and one arm from the other side, all being suitably braced, and the wires will be carried at the angles of an isosceles triangle placed sideways, with a base of 12 ft. and sides of 17 ft. The distance from the lowest wire to the ground will be 40 ft. Suspension insulators will be used having eight discs linked in series, and when complete measuring 52 in. from the tower hook to the live conductor. Each disc will be tested to withstand continuously 75,000 volts, and being subjected to 100,000 volts for a short time. The foundation of the dam and power house are to be of solid concrete, the water passages and draft tubes being moulded during construction. Above the water levels the power house is to be built of brick, and will have a floor space of 40 ft. by 110 ft. The flow of the Au Sable River is a very uniform one, averaging about 1,100 cubic feet per second, and according to a 10 years' record the flood has not at any season been in excess of four times the minimum flow of the river. The reason for this remarkable regularity of flow is that there are only two tributaries to the river—and those only insignificant ones—above the water-power site, the supply being chiefly derived from springs which emerge from a strata of clay which underlies the sandy surface of the peninsula at its northern end. To meet the daily variations in the station load, a 40-ft. dam will be built to impound a lake or reservoir having an area of 2,000 acres. This is said to be the first of a series of four or five similar installations that are to be erected on this river.

STEAM ENGINE DESIGN.—XXVI.

(Continued from page 197.)

Centrifugal Pumps.

An example of a centrifugal pump is given in fig. 137. Water enters at A and passes into the impeller on either side at B B. It will be seen that the impeller consists of two plates C C and a central plate D, the water entering each eye being kept separate until discharge. On many pumps the central plate is stopped at E, allowing the water to mix (and perhaps cause loss in power by eddies and shock). Small pumps sometimes omit the outer plates C C. The impeller casing is of the "Volute" type, increasing in area uniformly from E to G. The pump is driven by a small high-speed steam engine, which is often made enclosed.. A pump having entry on one side only is given in fig. 138, and it will be seen how the impeller has been modified; also in this case the shaft and impeller are cast in one, the left-hand bearing being under water. Both bearings are provided with lignum vitæ bushes. The pipe A is for lubrication.

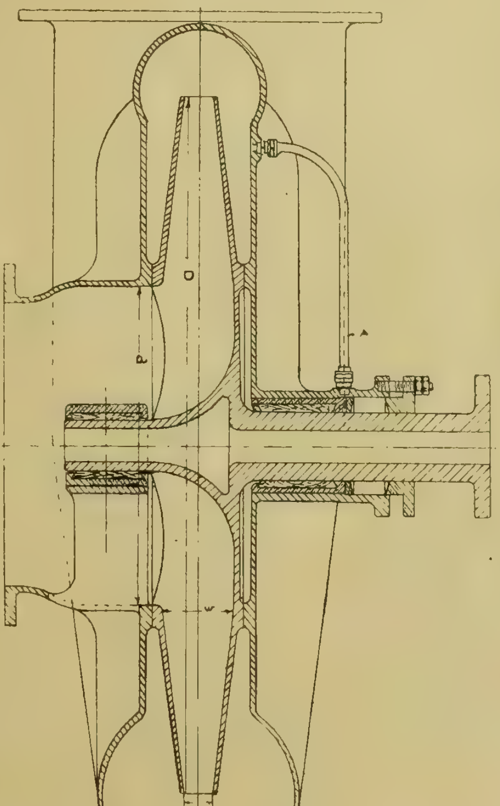


Fig. 138.

In the design of centrifugal pumps, as in most hydraulic calculations, Bernouilli's theorem is the basis:—

$$H = \frac{p}{d} + \frac{V^2}{2g} + h$$

Where H = total energy of 1 lb. of water

h is measured in feet, and represents the potential energy of position

$\frac{V^2}{2g}$ = energy of motion, in which V = velocity in feet per second

$\frac{p}{d}$ = energy due to pressure, in which p = pressure in lbs. per square foot, and d = density of water, $62\frac{1}{2}$.

In centrifugal pumps, $h = o$, and energy of W lbs. in foot lbs.,

$$H\,W = \left(\frac{p}{d} \times \frac{V^2}{2g}\right) \times W.$$

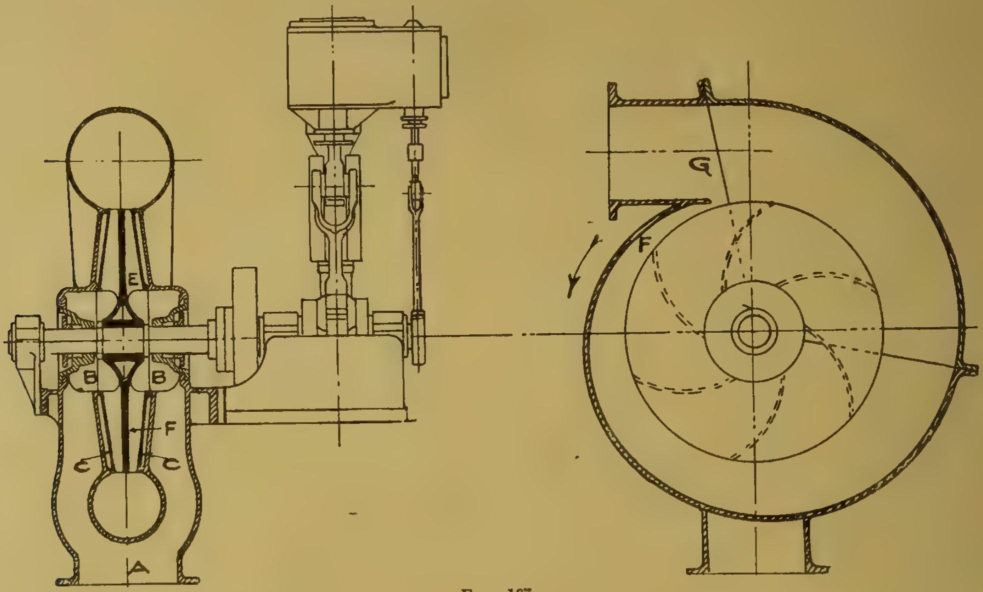
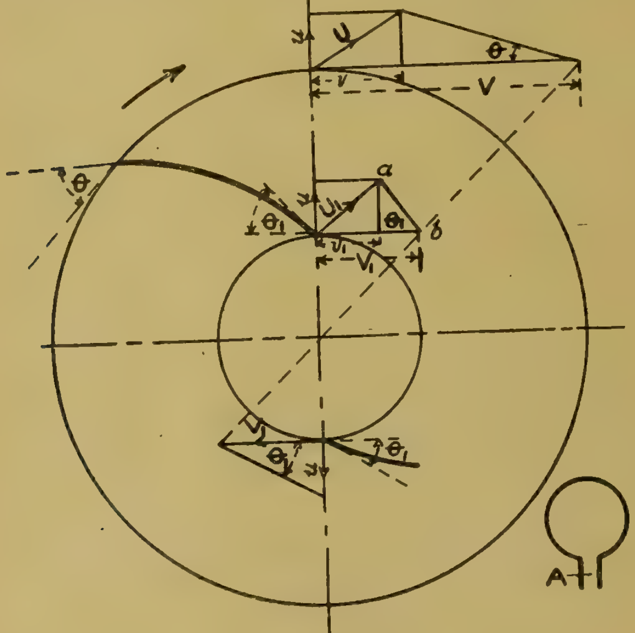


Fig. 137.

Referring to fig. 139, the velocity with which the water is carried from the eye to the periphery of the pump may be resolved into two components—one, radial, by which the



F.G. 139.

water passes through the pump and is called the "velocity of flow" (u); secondly, a component at right angles to the radius, called the "whirling velocity" (v).

The general case for the designs of vanes is given in connection with fig. 139. Water entering the eye of the pump has a radial velocity of flow u and a velocity of whirl v imparted to it by the rotation of the impeller. The absolute velocity and direction of the water at entry is then represented by U_1.

If V_1 = peripheral velocity of the eye, then the velocity of the water relative to the impeller is represented by $a\,b$. In order that the water may enter the pump without shock, the vane, at entry, must be tangential to $a\,b$.

A similar construction may be used for obtaining the vane angle (θ) at the periphery. It can be proved that

$$\frac{V\,v}{g} = \frac{H}{g};$$

where V and v have the same meaning as above, but are for the impeller discharge periphery; H_1 = total head in feet against which the pump works (suction, delivery, and friction).

The effect of vane angle at discharge on the whirling velocity can be seen by drawing diagrams like that in fig. 139 for different values of θ, or by the formula—

$$V - v = c = u \cot \theta.$$

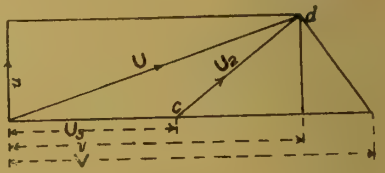


Fig. 140.

For radial vanes $\theta = o$, $V = v$, since $c = o$.

For vanes curved forward to any angle $(90 + \theta)$, since cot $(90 + \theta) = -\tan x$, v is always greater than V.

Water appearing at the impeller periphery has a total energy (H) per pound :

$$H = \frac{p}{d} + \frac{U^2}{2g};$$

where U is the absolute velocity of discharge (figs. 139 and 140),

In the case of centrifugal pumps most of the velocity energy, $\frac{U^2}{2g}$, is lost in shock and eddies, since the directions of the stream lines cannot be changed in such a way that the water is slowed down and the velocity energy changed into pressure energy.

There are many methods of saving as much as possible of this energy, and the usual way is to make the pump casing in the form of a volute (fig. 137), in such a way that the area gradually increases in proportion to the quantity of water passing from point K to the discharge; hence the water gradually slows down and encounters little shock. The following investigation, given by Professor Goodman in his book on "Applied Mechanics," clearly shows the conditions which prevail in a volute pump:—

Referring to fig. 140, and using the previous notation, the absolute velocity of discharge is U, and the velocity of flow round the volute U_3, leaving a component U_2 in the direction *c d*. The object is to change as much as possible of U_2 into pressure energy. If the change in velocity and direction of U to U_2 is abrupt, the loss in head $= \frac{U_2^2}{2g}$; if the change is gradual and without shock, the loss in head

$$= \frac{U^2 - U_3^2}{2g}.$$

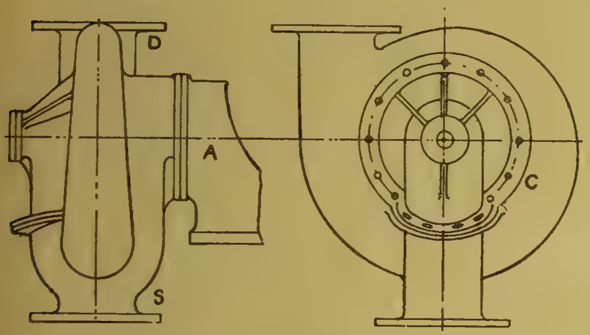


FIG. 141.

It can be shown, from a consideration of the formulæ, that the maximum efficiency of a pump having a volute is:—

$$\eta = \frac{V^2 - u^2 \operatorname{cosec}^2 \theta + 2v}{2 V (V - u \cot \theta)}.$$

For a pump having no volute, but in which the water is discharged at a high velocity into a casing in which no provision is made for slowing it down without shock, practically the whole of *u* and *v* is wasted in eddies. The efficiency then becomes

$$\eta = \frac{V^2 - u^2 \operatorname{cosec}^2 \theta}{2 V (V - u \cot \theta}.$$

The following table gives pump efficiencies, with and without volute, for different vane angles, and for $u = \cdot 25 \sqrt{2 g H}$.

TABLE XXXV.—CENTRIFUGAL PUMP EFFICIENCIES.

	Pump with volute.		Pump without volute.	
θ	η	V	η	V
90 deg.	0·60	$0{\cdot}84 \sqrt{2 g H}$	0·47	$1{\cdot}03 \sqrt{2 g H}$
45 ,,	0·78	$0{\cdot}94 \sqrt{2 g H}$	0·58	$1{\cdot}06 \sqrt{2 g H}$
20 ,,	0·82	$1{\cdot}00 \sqrt{2 g H}$	0·73	$1{\cdot}24 \sqrt{2 g H}$

On some pumps a whirlpool chamber (A in fig. 139) is provided, with the object of gradually changing the water direction by allowing it to form a free vortex. The efficiency is certainly improved, but it is so small that the gain does not pay for the extra expense in making the much larger pump casing which is necessary.

Practical rules: The above formulæ and principles must be used with discretion and regarded largely as guides, and, if used in this way, are of great value in design. By theory, for each head a certain vane angle is needed, but in practice such a large number of patterns would be required that standard pumps are designed to give best average results over a given range of heads. A good average vane angle at discharge is 20 to 30 deg., and 50 to 60 deg. at inlet. The curve of vane may be observed by striking an arc with radius = ·55 to ·60 × diameter of impeller, and making it tangential to the inlet and outlet angles decided on.

If a graphical construction for vane angle at inlet is preferred, it is safe to neglect the initial whirling velocity and find the angle as at *b*, fig. 139. The value of *u* may be taken from

$$u = \tfrac{1}{4} \text{ to } \tfrac{1}{8} \sqrt{2 g H}.$$

In ordinary circulating pumps, u = about 4 ft. per second. The velocity of flow (u) must be kept constant through the pump. Referring to fig. 137,

$$w_1 = \frac{d}{D} w.$$

For the impeller velocity the formula

$$\frac{V_v}{g} = \frac{H^1}{\eta}$$

is modified to

$$V = K \sqrt{H} \text{ feet per second;}$$

where K = 9·75 for ordinary pumps, but may be as high as 14; a good average is 10.

Diameter of impeller (D)
= 4 to 2·5 × suction pipe diameter (for D up to 12 in.)
= 2·5 to 2·0 × suction pipe diameter (for D over 12 in.).

For pumps sucking on either side, the area of the eye may be 1·25 × area of suction pipe.

The suction and discharge pipes should be calculated on a velocity of 7 ft. to 10 ft. per second.

Diameter of suction pipe

$$= \cdot 66 \text{ to } \cdot 55 \sqrt{\text{cubic feet of water per minute}}.$$

The efficiency of centrifugal pumps of the type dealt with in this article ranges from 50 to 55 per cent for medium and larger sizes, but for small pumps it may be as low as 40 per cent. When deciding on the power required, the loss in head due to foot valves and pipe line resistances must be considered; the effect of these often reduces the overall efficiency of the installation to 25 per cent.

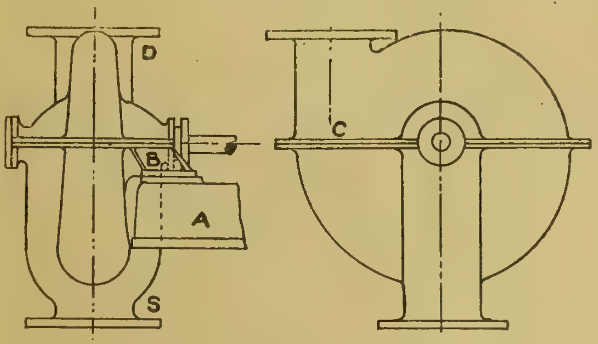


FIG. 142.

The two pumps in figs. 137 and 138 show inlet and outlet construction, and in the former it will be seen that the casing is divided at an obtuse angle in such a way that the impeller can be lifted bodily out, without interfering with the water connections. This construction is especially suited to marine sets.

An arrangement by which the impeller can be withdrawn endways without any more than removing end plate C is shown in fig. 141. The construction in fig. 142, in which the casing is divided diametrically, necessitates breaking the water joints.

The different methods of attaching the pump to the engine or motor bed will be easily seen.

Centrifugal pumps must always be charged with water before starting, as they cannot remove the air from the suction pipes. On pumps up to about 12 in. diameter a foot valve is fitted, and the suction pipe can then be filled by hand. On large pumps some kind of valve is placed on the discharge and the air removed by a steam ejector or by a small vacuum pump, thus inducing the water to flow up into the pump casing.

A centrifugal pump should always be arranged with as short a suction as possible, and the pipes kept straight; the total suction head should not exceed 20 ft., including actual lift and frictional resistance. Care must always be taken to see that all joints in the pipe line, and also the glands, are perfectly air-tight, since centrifugal pumps are very susceptible to air leaks.

For pumping hot liquids, the liquid must run down into the pump—this is usually the case when hot water from condensers is elevated to the top of the cooling towers.

When estimating the total head against which a pump is to work in order to fix the impeller speed, the loss of head h in the pipe line may be calculated from:—

$$h = \frac{1}{200} \cdot \frac{L V^2}{D};$$

L = length of pipe in feet.
V = velocity of water in pipe, in feet per second.
D = diameter of pipe in inches.

The loss in a foot valve is considerable, and should not be taken at less than 1 ft.

Bends, if of a good easy radius, will waste from ¾ ft. to 1 ft. head; if very sarp, or of elbow type, the loss may be double this.

It is usual, for fresh water, to make the pump casing and impeller of cast iron and the shaft of steel; for salt water, the casing may be of cast iron, the impeller of gunmetal, and the shaft of manganese bronze. In naval work, the casing is also of gunmetal.

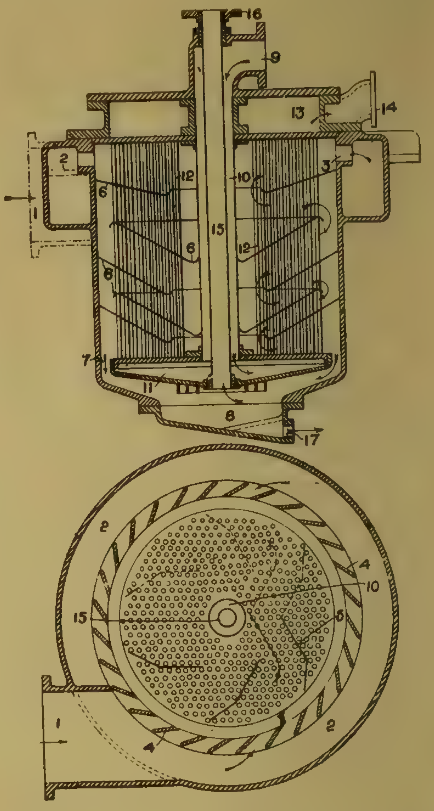
Bearings, when submerged (fig. 138), should be bushed with lignum vitæ, but when like fig. 137 may be of gunmetal, or white metal lined.

(To be continued.)

AN IMPROVED SURFACE CONDENSER.

The surface condenser we are about to describe is of the class working on the counter-current principle, and provided with cooling tubes around which circulates the vapour to be condensed. In the present case the construction is such as to fully utilise the cooling surface, and to obviate the unequal expansion and contraction which is frequently the cause of damage to the parts.

The condenser may be a cylindrical vessel with a vertical axis, as shown by figs. 1, 2, and 3—figs 1 and 3 being sectional elevations and fig. 2 a plan. The steam is admitted to the condenser through the flange 1. This flange communicates with the spiral volute 2, and the steam is led into the interior of the condenser through the slit 3, which is arranged with guide vanes 4, all in order to impart a spiral motion to the exhaust steam in the condenser. This spiral motion is kept up in the apparatus by means of guide vanes 5 placed in amongst the tubes, and baffles 6 are arranged for carrying the steam, first towards the centre of the condenser, then outwards, then towards the centre, and so on. The spiral motion of the steam is kept up all the time by means of guide vanes inserted amongst the tubes, and the height between the baffles is so arranged as to keep the velocity of steam that has not been condensed as much as possible constant. The condensed steam finally flows down through the opening 7 into the bottom 8 of the condenser, and thence it is delivered by means of a hotwell pump (which might be either of the plunger, rotary, or the centrifugal type) connected to the opening 17 to the hotwell of the boiler installation. By this arrangement the steam becomes very effectively condensed, and the condenser obtains practically one and the same temperature in the horizontal regions, thus avoiding as much as possible any warping of the casing of the condenser.



Figs. 1 and 2.

The circulating water is admitted to the condenser through the flange 9, travels down into the centre of the condenser through the pipe 10, into the "cold-water-chest" 11. From this chest the cold water is distributed into the set of tubes 12, and travelling upwards reaches the discharge chest 13, and is allowed to leave the condenser through discharge flange 14. The circulating water may travel only once through the condenser, as in the arrangement shown in fig. 1—if no account is taken of the water

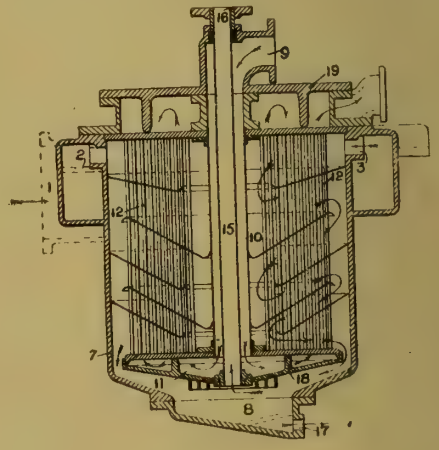


Fig. 3.

passing the central tube 10—or by the introduction of baffles 18 and 19, shown in fig. 3, it may be allowed to travel several times through the condenser. The "cold-water-chest" 11 is only suspended by means of the tube 12 and centre tube 10, and by this arrangement the "cold-water-chest" can take any position in the condenser, depending on the heat; but as on account of the spiral flow of the steam already referred to the condenser obtains practically the same temperature in the horizontal regions there will be very little warping of the "cold-water-chest" and the set of tubes. The tubes might be provided with ferrules in the ordinary way, but otherwise they may be expanded firmly in the tube plates.

In order to utilise the cooling effect of the water passing the tubes, as many spiral strips of metal as possible may be put in the condenser tubes so as to give a spiral motion to the water passing up through these tubes.

The air is withdrawn from the condenser through the central tube 15 through the flange 16. The air is drawn from the coolest part of the condenser, and tube 15 is arranged in the centre of the water pipe, so that the air passing up through the pipe to the air pump will be effectively cooled. Even in this pipe a spiral strip of metal plate might be put in so as to impart a spiral motion to the air travelling up through the pipe, all in order to make the cooling of the air as effective as possible.

The circulating pump used in connection with the condenser may be either of the ordinary centrifugal or of the plunger type, and the air pump may be any ordinary construction of dry-air pump, with or without water seal, or an ejector with or without steam augmentation.

The above improvements are the invention of the late Mr. Arthur Greenwood, of Messrs. Greenwood and Batley, Leeds, in conjunction with Mr. Kourad Andersson.

VENTILATION AND DUST REMOVAL IN COTTON MILLS.—VI.

(Continued from page 234.)

ARRANGEMENTS RELATING TO CARD ROOMS.

In the system covered by Schofield and Stott's patent No. 11,594, of 1908, and illustrated at figs. 41 and 42, the stripping brush is partly enclosed within a casing *a* communicating by a flexible pipe *b* with an exhaustion pipe *c*, in which a high degree of vacuum is maintained by a steam ejector. When the flexible pipe is connected up to *c*, the opening of the valve *d* (see fig. 42) also causes the opening of the steam inlet valve of the ejector by means of the rod *e*.

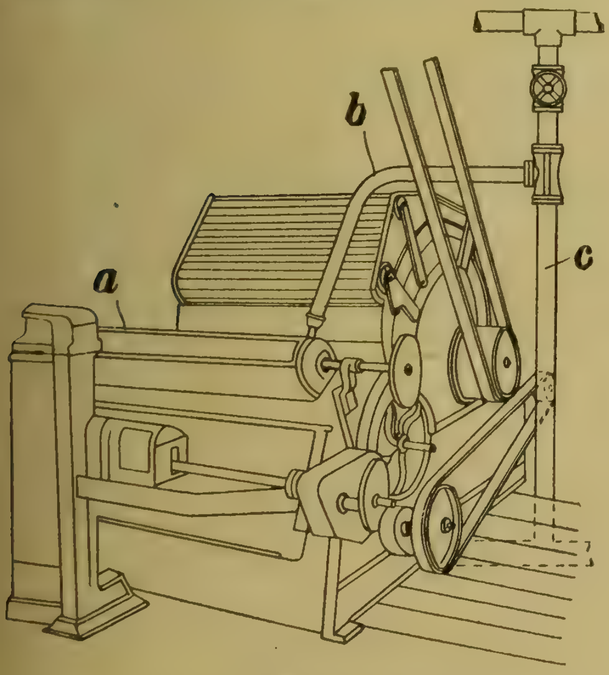


Fig. 41.

Tattersall's specification No. 15,801, of 1908, claims an arrangement in which all the valves of the exhaustion conduit may be opened or closed simultaneously for ventilation purposes as well as for dust removal from the carding engines. In the form illustrated at fig. 43, the inlet branch *a* is connected to a valve plate *b*, so arranged that when the said branch is in use, and therefore in the position shown in full lines, the valve plate is open, and when the inlet is not in use and in the position shown in dotted lines, the valve plate is closed to prevent communication to the exhaustion conduit *c*. A spring *d* normally holds the inlet *a* in its out-of-service position.

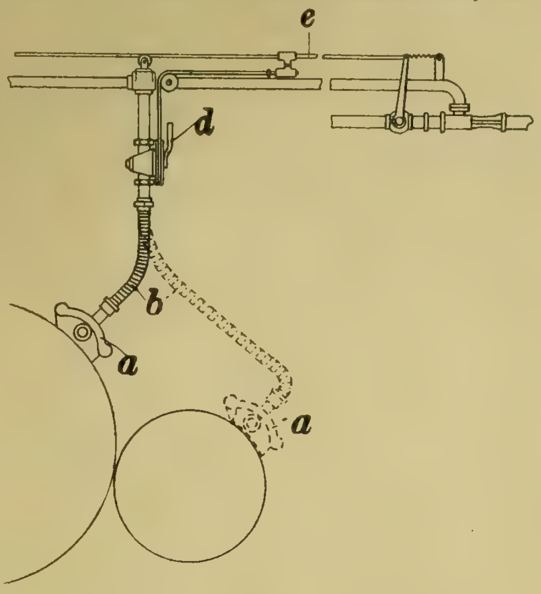


Fig. 42.

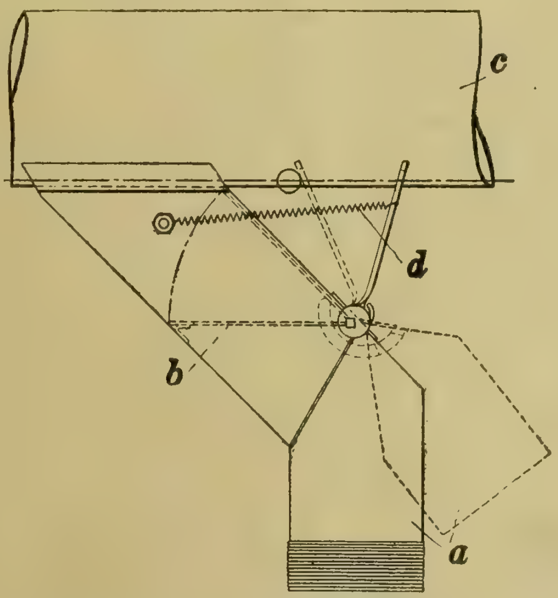
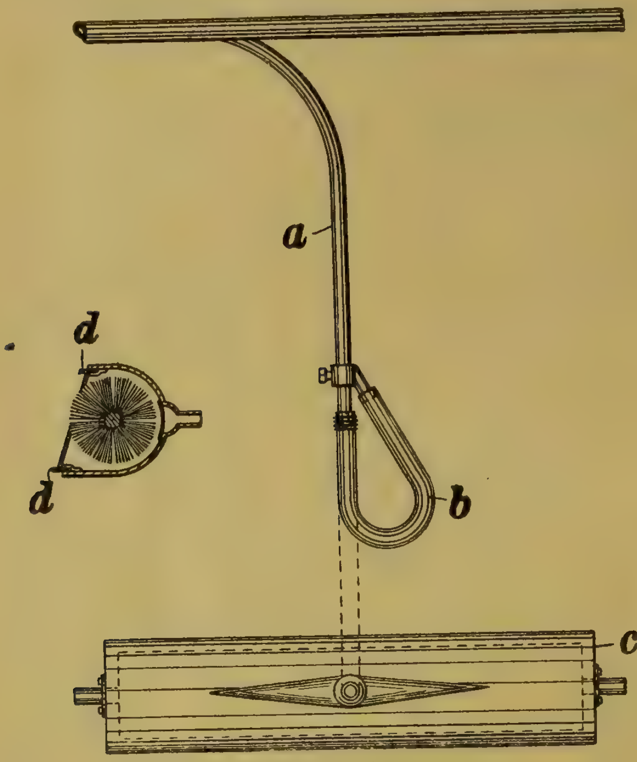


Fig. 43.

In the system fitted by Messrs. George Hargreaves and Sons Limited, of Brookhouse Lane, Blackburn, and covered by patent No. 17,986, of 1908, the exhaust conduits are made of very small diameter, usually from 1¼ in. to 2 in., and a vacuum of about 24 ft. is maintained therein by means of a pump. The arrangement is illustrated at figs. 44 and 45, the latter view being a cross section through the stripping brush and its casing. A branch connection *a* is provided over each carding engine, and a flexible conduit *b* is employed to connect the hood *c* to each connection. A border *d* of felt or other material is provided around the hood to make a joint with the framing of the carding engine.

A portion of a card room in which Hargreaves apparatus is installed is shown at fig. 46. The stripping brush with



Figs. 44 and 45.

its cover is in position on the cylinder of the nearest carding engine. As the exhaustion pipes are of small diameter they do not affect the lighting arrangements of the card room.

In the arrangement at present adopted by Messrs. Hargreaves, one flexible conduit *b* serves for a row of branch pipes *a*, the conduit being securely fastened to the hood *c* instead of to the branch *a*.

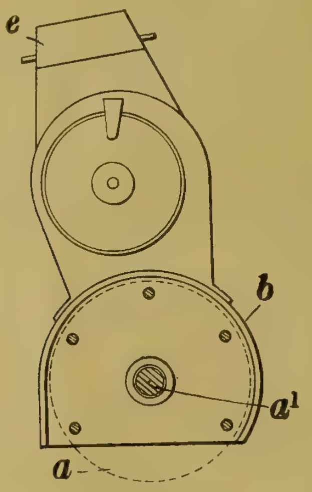


Fig. 49.

For removing the dust which collects about the carding machines and the card room, a nozzle is employed which is connected to the branches *a* by a flexible tube. The use of the apparatus in this manner is shown at fig. 45.

In the system proposed by Fishwick and others in their patent specification No. 1,320, of 1909, the fan or exhausting pump is enclosed within a portion of the hood or canopy which surrounds the stripping brush. The fan is rope driven from the latter. The arrangement is shown in sectional and end elevations at figs. 48 and 49, fig. 46 illustrating a portion of the stripping brush and hood. The

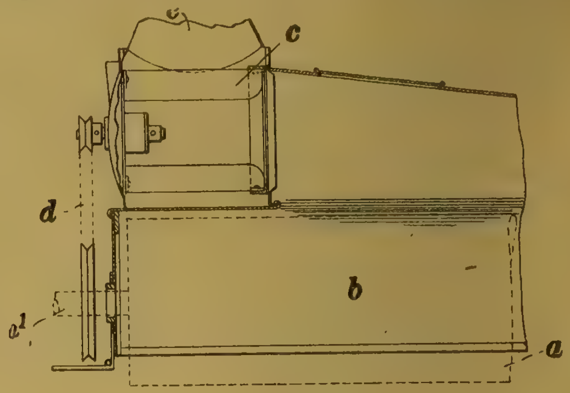


Fig. 48.

stripping brush *a* is enclosed within the casing *b*; the upper portion of the latter contains a fan *c*, driven by a rope *d* from the brush shaft *a'*. The dust and fluff are carried up through the outlet passage *e* to an exhaustion conduit.

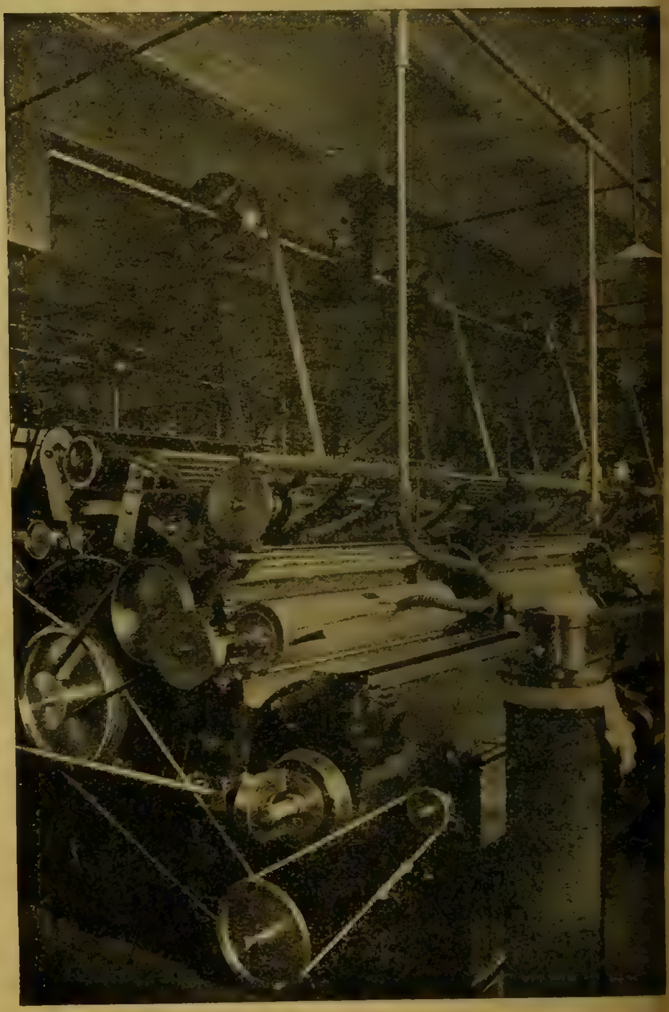
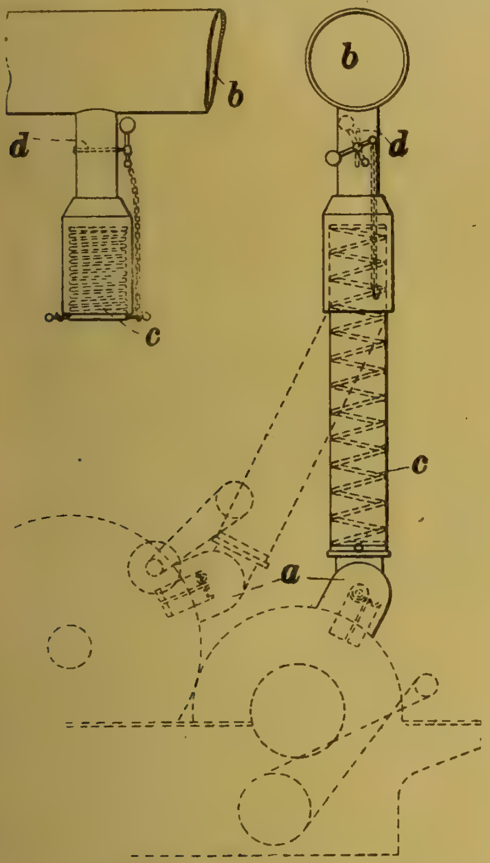


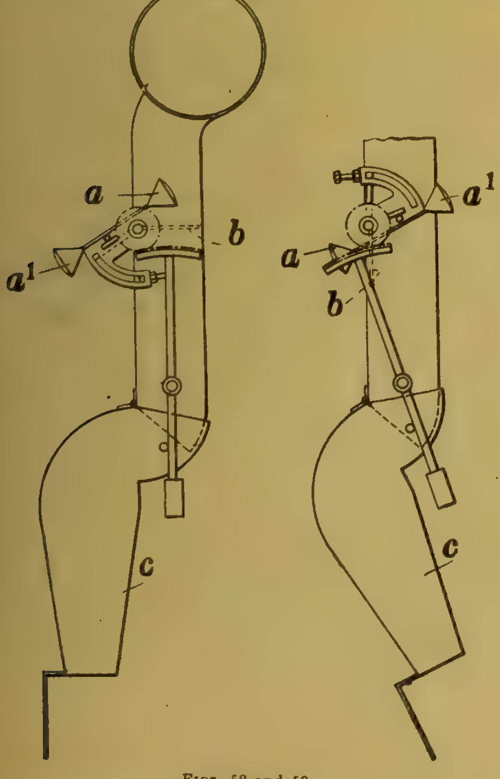
Fig. 46.

To equalise the suction effect over the whole of the mouth of the hood which is brought over the stripping brush, Manwood has proposed in his specification No. 1,859, of 1909, to fit curved plates or baffles in the hood so that the inlet to the hood is narrower at the centre than at the ends.

In the system by James Stott and Company, of Oldham, described in patent specification No. 3,113, of 1909, and illustrated in figs. 50 and 51, the hood *a* is mounted on the stripping brush and carried about with it; a connection is made with the exhaustion conduit *b* by way of the branch inlet over each carding engine. A collapsible tube *c* is fitted within each inlet, and when in use this is extended as shown at fig. 49, and secured to the hood *a*. When detached from the hood, the tube collapses into the branch inlet, as shown at fig. 50; the tube is then supported by a chain attached to the stem of a wing valve *d* in the branch inlet, the weight of the tube *c* causing the closing of the valve. With the tube in its extended position the valve is open.



Figs. 50 and 51.



Figs. 52 and 53.

Bolton and Marsland, in their specification No. 4,076, of 1909, describe an automatic arrangement for closing the valve in the branch connection from the main exhaustion conduit after a sufficient time has elapsed for the stripping operation to be completed. The arrangement is illustrated at figs. 52 and 53, fig. 52 showing the valve in its closed and fig. 53 in its open position.

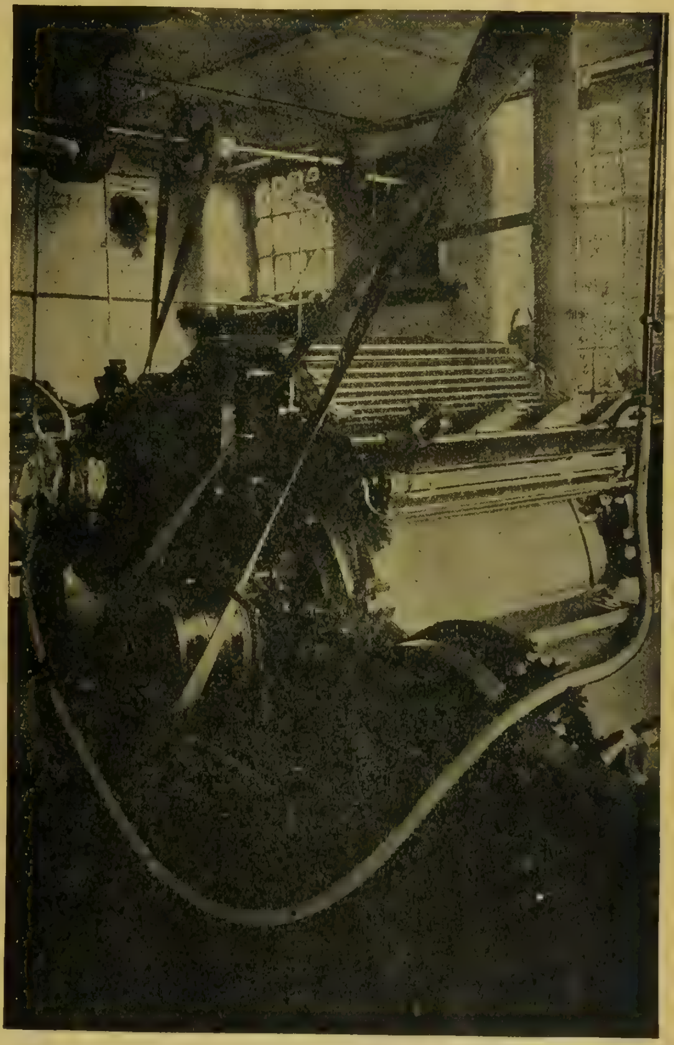


Fig. 47.

Two sand bulbs *a*, *a'* connected by a conduit are carried by a part of the apparatus controlling the movements of the valve *b*, and actuated by the rack and pinion device shown. When the hood *c* is moved into its operative position the bulbs are rotated so that the one full of sand is raised above the other. The sand gradually flows to the lower bulb, and is said to disturb the centre of gravity of the moving parts so as to effect the closing of the valve *b*.

The dust-removing apparatus invented and manufactured by Herbert Smethurst, of Bankside Street, Oldham, is of the portable type, and comprises a truck or trolley, within which is a dust separator and a fan or exhauster connected with a casing surrounding the stripping brush. The fan is driven by a rope from the stripping brush shaft. The stripping brush, with its enclosing hood, is carried upon the trolley as shown at fig. 54, when the apparatus is being moved from one carding engine to another. Fig. 55 shows the apparatus collecting the dust from the stripping brush on the doffer. It will be seen that no fixed exhaustion pipes are required with this system, which can therefore be very readily adopted in a mill with but small capital outlay, and without affecting the heating and lighting arrangements of the card rooms, as no air is extracted from the card room and no overhead exhaust conduits are employed.

(*To be continued.*)

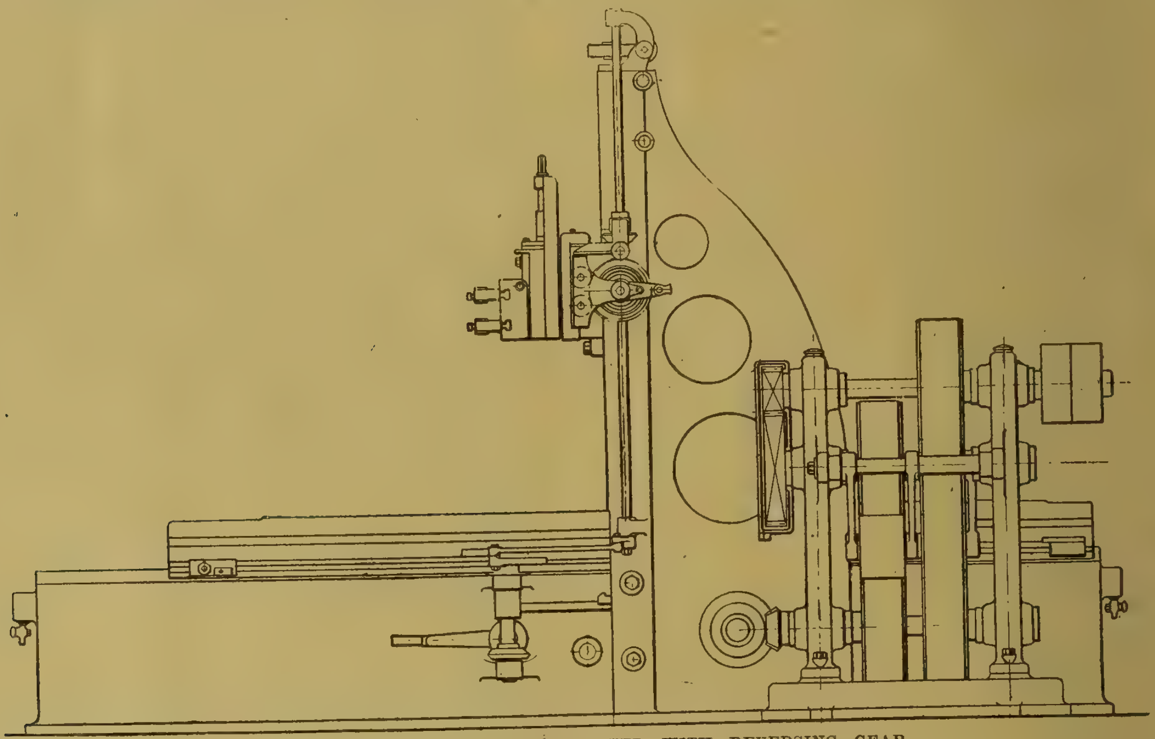
SPEEDING-UP GEAR FOR PLANING MACHINES.

The adoption of high-speed cutting steels into general use in engineering workshops has rendered planing machines of ordinary construction practically out of date, as compared with rotary machine tools, which are now being successfully worked at surface cutting speeds of 50 ft. to 150 ft.

The planing machine, with its reciprocating table, and the additional weight of a large piece of work upon it, could not be moved at the increased speeds, nor could it be promptly reversed with the ordinary gearing and mechanism. For this reason, rotary machine tools, not unnaturally, have received greater attention, and reciprocating tools are the only ones that have been neglected in regard to increasing their speeds.

As a matter of fact, the construction of planing machines, dating back some ten years, is such as to preclude any ready and simple solution of speeding up pulleys. And yet all, or nearly all, existing planing machines could be speeded up to obtain an increased production of from 50 to 100 per cent by the employment of high-speed steel, given a suitable apparatus. In a planing machine the table and the heavy piece of work on it have to be moved at a speed of from 30 ft. to 60 ft. under cut, and the return movement performed at two or three times that speed. Besides, in order to economise time, the reversal of the table movement must be carried out in seconds or fractional seconds of time. Obviously it is important that this movement be effected without any undue shock or jar, and this requirement has given rise to spring relief mechanism, floating racks, magnetic clutches, and other devices, one and all intended to facilitate the operation of rapid reversal.

This problem the High-Speed Plane Reconstruction Co. claim to have solved by means of the Mitchell reversing gear. During their experience of several years in speeding up planing machines they have found considerable ignorance with regard to the problem involved in reversing and starting a heavy table with its load. When the table is operated at slow speeds, the reversing can be done easily without more power being expended than that required to do the cutting, but the moment rapid speeds come into question the problem becomes an entirely different one. The momentum of the table and its load increases as the square of the velocity, and if the speed of the planer be only doubled, four times as much power will be required to reverse it. When the speed is increased three times, the momentum will be nine times as great. It is necessary to bring into play heavy flywheels with stored up energy to give out the large amount of power required at the time of reversing. It is only for a second of time that this power is wanted when the planer table is reversed promptly. But this power must exist. It is a simple technical matter to calculate what amount of power is required to stop and start in an opposite direction a certain load within a certain time. If this amount of power is not available, it simply means that the length of time for the stopping and reversing is increased. This fact is not generally understood, and attempts are made to speed up planing machines by simply increasing the speed of the countershaft or the motor. It is true the table travels at double the speed in the middle of the cut or in the middle of the return movement, but at either end of the stroke the speed drops down to suit the maximum amount of power which is available for reversing, and in practice there has been found to be no benefit derived from this method of speeding up. When working on strokes a few feet long, the speed of the table is sometimes less than it was before, as the power is being absorbed in the reversing, and is not applied to the work.



STANDARD PLANING MACHINE FITTED WITH REVERSING GEAR.

The stored up energy in the Mitchell gear requires very wide belts to transmit it instantly at the moment of reversing. The total motive power for driving the machine is not much in excess of what it was before the planer was speeded up. In fact, in some cases the improved gearing and the construction of the reversing gear have resulted in a less amount of power being used than before the planer was speeded up. But in any case, the difference is not important. The power required to reverse the machine is generally three or four times the amount required for moving the table. Stored up energy to be given to reverse the movement of the table and the rotation of the gearing is absolutely necessary to reverse the table in the shortest time. A table can be reversed slowly by the expenditure of a moderate amount of power if sufficient time is given to do it, but to realise the full benefit and to obtain the best economy, it is necessary that the time of reversing should be reduced to a second or part of a second, and that the table be started off immediately at its normal speed.

In reversing the motion of a heavy table and a heavy load and applying the requisite large amount of power or stored up energy in a moment of time, a further problem arises, viz., to overcome the shock to the table and the intermediate gearing between the reversing gear and the planing machine. This the Company claim to overcome in an exceedingly simple and effective manner by means of a slipping device, which entirely absorbs the shock. A fraction of a second is taken up in avoiding the shock at each end of the stroke, but there being a large amount of stored up energy which effects the reversing rapidly, this loss—which is infinitesimal—has to be put up with.

Our illustration shows the reversing gear fitted to a standard pattern of planing machine. The main principles of the gear are four in number—the use of stored up energy in heavy flywheels; the provision of two wide belts moving in opposite directions for transmitting the stored up energy at the time of the reversing of the table; two jockey or idle pulleys, which can be brought against one or other of the belts to tighten it and bring it into operation; and a release clutch, which takes up any shock or jar at the time of reversing, and which also gives way after a certain force is exceeded or in case of accident.

Very advantageous results are said to have been obtained from planing machines fitted with this reversing mechanism.

TOOLS WITH MULTIPLE CUTTING EDGES.

Widely divergent opinions seem to exist amongst engineers as to the advantages to be gained by using boring and turning tools having multiple cutting edges, as compared with single cutting edge tools. In the opinion of a great number of men of practical experience very much more accurate work can be turned out with the latter than with the former. This opinion can undoubtedly be backed up by the production of work of inferior quality executed with tools having multiple cutting edges, whilst work of great accuracy can be exhibited made with single cutting edge tools.

No doubt the real truth of the matter is that one type of cutter is the best adapted for one kind of work, whilst for another kind of work the other type will give the best results, and consequently the choice of which kind of tool to employ to ensure the best results is largely a matter of judicious discrimination. Also it need hardly be observed that £ s. d. plays an important part in the satisfactory solution of the problem. The following interesting experience on the above subject is given by Mr. W. S. Giele in an article recently published by our American contemporary, *Machinery*:—"The most ardent advocate of multiple cutters," says the author, "will probably continue to turn up his occasional lathe job with a single tool in the tool post, and to bore out his jig holes with a single-pointed boring tool, because that is really the best way; not that it might not be done just as accurately and as well some other way, but because that is generally accepted as the most *economical* way to do the job sufficiently well. On the other hand, the man who firmly believes in the single cutting edge will probably continue to use twist drills with more than one lip, taps and reamers with more than one flute, threading dies with more than one cutting edge, hollow mills with more than one tooth, and very likely more than one cutting edge in his cutting-off machine. And his reason for doing all these things is, again, not because he has no choice, but because he is following what has been accepted as the most economical way.

Whenever multiple cutter tools have failed, it is reasonable to inquire whether each of the cutting edges has been ground with the same care and precision as a single cutting edge would have been, and whether the drive, the feed, the support, and the piece on which the work was being done all had the same relative rigidity in proportion to the amount of metal being removed in the case of the multiple cutter as in the case of the single cutter. The problem is not what can be done, but what will it pay to do.

"As a concrete illustration, let us suppose a line of headstocks in which the spindle bearings are to be bored, varying, in a case which the writer has in mind, from 4½ in. to 17 in. in diameter of bore, each headstock having two bearings of the same diameter and in line with each other. The material is cast iron, and the bearings have caps of the usual form, with liners varying in thickness from $^1/_{16}$ in. to ⅛ in. according to the bore. Boring bars or arbors are made for each size of headstock. These bars are made as short and as large in diameter as the clearances will allow, to gain the maximum stiffness in proportion to the amount of work to be done. On each bar are mounted two roughing and two finishing heads, so spaced that the two bearings will be rough bored simultaneously and finish bored simultaneously. The roughing and finishing heads are so spaced, relatively, that the finishing tools do not come into action until the roughing tools have completed their cut.

"Without discussing here the relative advantages of an odd number of cutters and an even number, it is evident that this is a job for an odd number, as with an even number, equally spaced, there would be two cutters jumping a liner gap at the same instant.

"In this case, the roughing heads have three tools each, all standing in the same plane perpendicular to the axis of rotation and with equal angular spacing. The tools have ample clearance and rake, being shaped much like a round-nosed roughing tool for a lathe. These tools are jig ground and abut against wedges or taper keys, which are graduated so that it is possible to set the tools with ample exactness for rough boring, without calipering. They do the cutting on the leading side and not on the circumference. The finishing heads have a varying number of inserted cutters according to size of hole. The largest has 19 cutters. These tools cut on the leading corner and also take a slight shearing cut on the circumference. They vary in length parallel to the axis of rotation in the different heads, but are all set at such an angle that the arc embraced between the radii to the front and back corners is equal to about three times the liner gap. They are, in fact, equivalent to the teeth of a left-hand helically (commonly called spirally) fluted reamer. They are ground to size in place and gauged to limits. The holes they produce are sufficiently accurate, both as to size and finish, to run as bearings without scraping.

In feeding any boring tool through the work, a point on the cutting edge passes through the hole in a helical path, and its trace as marked on the work appears as a shallow screw thread. The apparent roughness of the finish left by the tools depends on the depth and pitch of this thread; that is, the finer the pitch the smoother the finish appears. The time for cutting a given length of hole, however, depends on the lead of the thread, other things being equal. To increase the lead without increasing the pitch, it is necessary to produce a multiple thread. In other words, for any given pitch or width of tool marks on the work, it is possible to increase the lead or feed in direct proportion to the number of cutting edges, and cut down the time required to feed a given length in inverse proportion. Thus a feed of $^3/_{16}$ in. per revolution with a three-cutter head gives a pitch of $^1/_{16}$ in. to the tool marks, whereas the same feed applied to a single cutter would result in a $^3/_{16}$ in. pitch in the tool marks, and if the depth of metal removed is the same, the single cutting edge would have to remove three times as much stock as each cutter in the multiple tool head, and would leave a rougher finish.

"It is important to remember, when making multiple cutter heads, that the clearance and rake angles on the leading or cutting sides are determined by the lead or feed and not by the pitch. These angles depend on the angle between the helical path of a point on the cutter and a plane perpendicular to the axis of rotation, which is easily found, being the angle whose tangent equals the feed per revolution divided by the circumference of the hole.

"As far as the matter of design is concerned, the number of cutters in a head is limited only by the chip clearance which will be left between cutters and the space required between cutters for the means which hold them in place. The design of the head itself is, however, not the only factor to be considered, as the limit may be set by the rigidity of the machine it will be used on, or the strength of the drive and feed, or the strength and stiffness of the piece being worked on. The ultimate limit which governs all others must, however, always be the economic one.

"The larger the number of cutters in a head, the shorter will be the cutting time for any given length of hole; and also the higher will be the initial cost. Offsetting the higher initial cost is the fact that with a multiple cutter head each individual cutter does an amount of work inversely proportional to the number of cutters, and the head as a unit will therefore have an endurance, in number of holes bored between grindings and total number of holes bored during its life, proportional to the number of its cutters. Even where the total number of holes to be bored is very large, the higher initial cost of the multiple cutter head may not be easily justified if the distance to be bored is very short or the setting-up time is a very large proportion of the total time, because in such cases a saving of two-thirds or four-fifths, or a larger proportion of the boring time, may still represent a very small proportion of the total time.

"To sum up: The number of cutting edges in a boring or turning tool (which may also be made to include tools for internal or external threading) is governed principally by the following considerations: (1) Number of pieces to be machined; (2) proportion of cutting time to total time of operation; (3) rigidity of pieces worked on; (4) capacity of drive and feed; (5) chip clearance between cutters; (6) space required for means to hold the cutter."

NOTICES OF MEETINGS, &c.

September 6th.—The Junior Institution of Engineers. Visit to the Naval, Mercantile, Marine and General Engineering, and Machinery Exhibition, at the Olympia, at 3-30 p.m.

September 7th.—The Junior Institution of Engineers. Meeting to be held in the rooms to consider the proposed joint exhibit of the Institution at the Turin International Exhibition, 1911.

AN IMPROVED RADIAL TRUCK.

The improvement, which is applicable to a single axle radial truck for tramway, railway, and similar vehicles, consists essentially in constructing the truck with side frames coupled at the ends by transoms, and pivoted so as to allow of a parallel movement, the axle boxes being pivoted in the side frame with suitable stays or springs for returning the trucks to the normal position.

The truck is illustrated in figs. 1 to 5, and has been lately patented by Messrs. Heenan and Froude Limited, in conjunction with Mr. J. N. Scholefield. It is constructed of side frames A, fitted with pockets a to take the spring and axle-box swivel plates B B^1, and bars or transoms D pivoted to the ends of the side frames by which they are coupled together, and which also support the car body. The top spring plate B is mounted in the pocket a, and is free to slide therein with a vertical movement, and is held in position by the springs b which are placed between it and top plate a^1 of the side frame A. The bottom swivel plate B^1 is bolted rigidly in position across the bottom of the pocket a. The plates B and B^1 are both formed with sockets b^1, and the axle box C is fitted with trunnions c top and bottom, which enter the sockets b^1, leaving the axle box free to swivel to right or left. The socket b^1 may be lined with a bush b^2 of hardened steel. In other respects the axle box C is of ordinary construction to take the axle E of the wheel E^1. By this construction of side frame and spring plate the support of the springs b is low relatively to the centre of the axle, thus reducing the height of the car body.

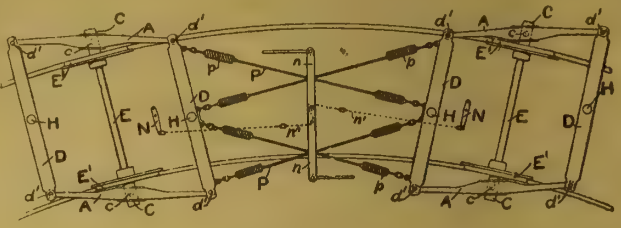
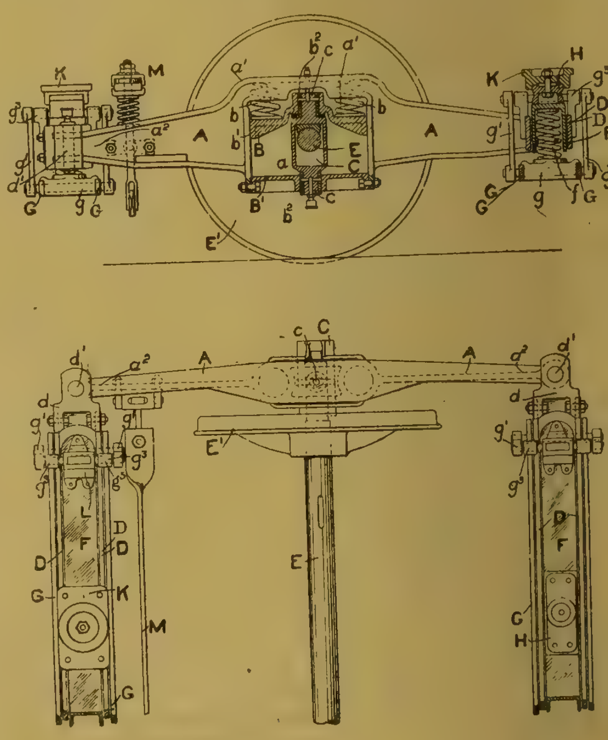


Fig. 1.

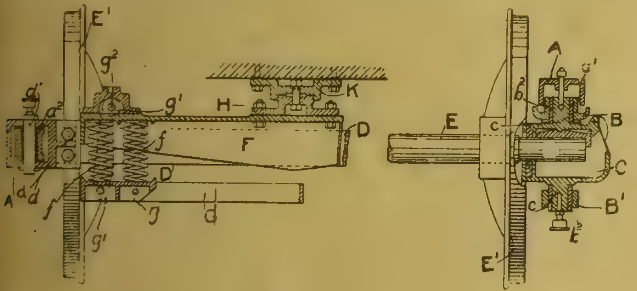


Figs. 2 and 3.

The top plate a^1 of the side frame A is made of inverted trough section to receive socket b^1 of the spring plate B and take the lateral thrust, and the bottom swivel plate B¹ also acts as a "horn block keep," the two taking all the side thrust of the axle. Both may be fitted with renewable rub plates to take up wear. The transoms D by which the side frames A are coupled together are fitted with end castings *d*, to which the side frames A are pivoted at their ends a^2 by pins d^1 to allow of a parallel movement. Thus the two side frames A are maintained parallel to one another, and the transoms D and axle E are maintained parallel, the axle E being given a radial movement about its vertical axis, and the axle boxes C swivelling on their trunnions *c* in the plates B B¹. The transoms D also support the car body bolsters F, which may be of either the rigid or swing type. The car body bolsters F are supported on springs *f* at the ends, the springs at each end resting upon a spring plate *g* bolted or riveted to spring planks G. The spring planks G are supported at both ends by links g^1 depending from pins g^2 carried by brackets g^3. The brackets g^3 are firmly and rigidly affixed to the transoms D. In the swing type of bolster F the links g^1 are loose on their pins; in the rigid type of bolster the links are fast on their pins or are replaced by rigid plates or stays connecting the transom bars D with the spring planks G.

The car body is fitted to the bolsters F by a bracket H affixed to the latter and a top plate K affixed to the body. Side bearer brackets L are also affixed to the bolster F, which engage with rub plates on the car body. Between the side frames a motor suspension bar M is fitted, preferably at the outside end of the truck, and a brake bar, not shown in the illustrations, is fitted at the other side, the brakes being operated by levers N and *n* connected by chains n^1.

Each car is fitted with two independent single-axle radial trucks, as shown in fig. 1, the car body having two points of contact with each, that is, contact with each bolster F. The two radial trucks are connected together by the rods P and springs *p* which control hunting, and tend to return them into normal position with the axles parallel.



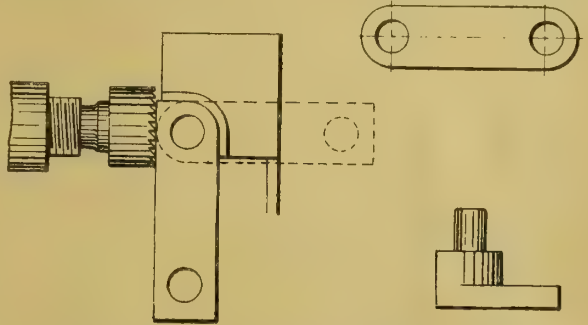
FIGS. 4 and 5.

The frame work of each radial truck having a free parallel motion, the two points of contact of the transoms D with the car body produces the effect of a "virtual king pin" or pivot over the vertical axis of the axle E, about which the truck swivels under the car body as it passes round a curve in the track.

Amongst the advantages said to be obtained by the above improvement, mention may be made of the following:—The radial axle permits of a longer wheel base than with a single rigid axle truck; it can be used instead of maximum traction truck in all instances, and where the car body is excessively heavy the size of the axle and journal can be increased, thus saving a pair of wheels and axles; the truck can never project outside the sole bars of the car, the parallel motion of the side frames drawing the centres in; perfect radial motion is obtained, allowing a wide range before the wheels foul the sole bar of the car body; no special type of car under-frame is required, although slight modifications may have to be made to existing car bodies; there are no small rollers which require fine adjustment or become inoperative; no intermediate framing to raise the height of the car body is required—on the contrary, the standard height of the car body may be reduced if desired; and finally there is a considerable reduction in the number of parts and consequent simplification of construction.

ROUNDING LINK ENDS.

A job which occurs frequently in some shops is the rounding of link ends. These may be called for in varying lots, and the common plan of "knocking off" the corners in a shaper and finishing in a grinder entails both a considerable amount of work and is not as a rule productive of very symmetrical or highly-finished work, and the results are unsatisfactory from a manufacturing point of view, both as to time and cost. The following ingenious method used for performing this operation is given by a correspondent in *Machinery*, New York, and may be useful to some of our readers: "A casting (fig. 3) was made and fitted with a pin the size of the link holes. This block was then bolted to the lathe tool post and an end mill fitted to a shank in the lathe spindle, which completed the outfit. Now after the links were cut off, drilled and reamed, they were slipped over the pin and given a quarter turn in a horizontal plane. A piece of pipe 18 in. long served to give the necessary leverage. In fig. 2 may be seen a link, one corner of which has already been rounded, in position for operating on the second corner. The dotted lines indicate its position when one end has been finished. This attachment was ridiculously cheap, and so simple that a boy could round 50 links an hour and obtain a finish fully up to the requirements."



FIGS. 1, 2, and 3.—Link Rounding Attachment for Lathes.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 25th August, 1910.

ABERDEEN.—*First class:* W. Newton, J. C. Sellar.

GREENOCK.—*First class:* R. Peden, J. Stevenson, R. M. Howison, J. Graham. *Second class:* J. C. E. Milree, J. Dougall, J. A. McFarlane.

HULL.—*Second class:* W. Inches, A. R. Press.

LIVERPOOL.—*First class:* S. G. Holiday, W. Booth, R. H. Roberts, J. H. Humphreys, T. Campbell, T. G. Butler, T. F. Wilson. *Second class:* J. R. Cannell, J. Hughes, P. Hutchinson.

LONDON.—*First class:* C. Ross, A. M. Barnes, T. Brockland. *Second class:* S. F. Herbert, C. W. Jones, T. A. Sargent.

NORTH SHIELDS.—*First class:* J. C. Ness, J. C. Allen. *Second class:* R. B. Fenwick, J. H. Geer.

SUNDERLAND.—*First class:* O. H. Stanley, H. P. Irvin, J. Wardle, E. Colman, J. J. Bailes, G. Irwing, E. A. Mair. *Second class:* H. Bilson, G. W. Brown, V. Morrison.

COMPASS DEVIATION.

LIVERPOOL.—*D. of C.:* C. R. Hird.

INDUSTRIAL BETTERMENT.*

Before entering upon a general discussion of the various methods in business administration which relate to the treatment of the working organisation, I desire to touch upon the phrase "Industrial Betterment," which, in many minds, is confined solely to matters affecting the human element in that organisation, physically, morally, and mentally.

Inasmuch as the human element is so intimately related to everything which takes place in a business or industrial enterprise, such an understanding is, to a large extent, correct; but I desire to make it plain that anything or everything which tends to improve business or industrial conditions comes under the category of Industrial Betterment.

Reverting, for a moment, to the recent past to seek the origin of the phrase referred to, we find that during the last few years of the nineteenth century, when industry was making enormous strides and competition was becoming very keen, every innovation in manufacturing methods was sedulously sought out and carefully scrutinised for the purpose of observing its effect upon the establishment to which it was applied.

In this search for improved methods progressive manufacturers had their attention directed to certain features which German manufacturers, at the instigation of and aided by a paternalistic government, had adopted in a national effort to improve the health, social condition, and intellectual standing of the working classes. These features comprised well-constructed and comfortable factory buildings, with good light and ventilation, sanitary toilet facilities, washrooms with hot and cold water, soap and towels, coat rooms with clothes lockers and drying apparatus, rest rooms, lunch rooms with wholesome food at cost, libraries, safety appliances on the machinery, emergency hospitals with skilled attendants, compensation for accidents, beneficial organisations, furnishing insurance in case of sickness and death, long service and old-age pensions, and many other innovations extending to the housing, environment, and recreation of the employee outside of working hours. These features had obtained the name of *Wohlfahrts Einrichtungen*, or "Welfare Institutions," which, when their purpose was considered, was eminently appropriate.

A careful investigation of these features revealed the fact, however, that not only were they of great benefit to the working people themselves, but that they were productive of increased prosperity to the establishments which had introduced them.

It did not take long to grasp the rationale of this result, viz., that it was the improved workman who was accountable for the more efficient workmanship, and that it was the totality of the effect of this fundamental, economic, and educational movement which was bringing Germany to the front in international trade competition. Action promptly followed the determination to adopt such of these features as were deemed applicable to our establishments here, and the appellation of Industrial Betterment, which was intended to apply to the general improvement in industry which came about simultaneously with their introduction, seemed to refer specifically to these features, was largely so interpreted, and in many minds is still associated solely with them. Later, in an effort to give them a more distinctive title, the term "Welfare Work," an incorrect and misleading translation of a German appellation, was adopted in some of the larger establishments; but this turned out to be very inappropriate and most unfortunate in its effect, as it proved to be obnoxious to working men and women as bearing an implication that they belonged to an inferior class which needed an uplift by the employer, and anything savouring of paternalism or charity was resented by the self-respecting employee.

There was also a hypocritical attitude on the part of the employer implied in the assumption that he was instituting improvements for the welfare of his employees, and as in each case this "Welfare Work" had been installed solely for the benefit of the business, this implication was misleading, tending to place both employer and employee in false and unnatural relations to each other, and increasing the class consciousness which already existed.

The real estate owner who erects a modern office building on the site of an old one, and makes it fireproof, with plenty of light, heat, ventilation, sanitary toilet accommodations and attractive embellishments, does these things to keep abreast of the times, to meet the competition of the day, and to draw a better-paying class of tenants. The employer who erects a modern factory building, making it fireproof, with plenty of light, heat, ventilation, sanitary toilet accommodations and attractive embellishments, also does these things to keep abreast of the times, to meet the competition of the day, and to draw a better class of workmen, who, by their higher efficiency, will make his business pay better. There is not in the mind of either real estate owner or the employer of labour the least idea that he is doing these things for the welfare of his tenants on the one hand, or of his employees on the other. In each case he has done them because it has been found that such improvements are in the line of present-day progress, that they pay an increased interest on the investment, and, therefore, in each case it is initially for the welfare of the projector of the improvements that they were performed; and because these features have a reflex beneficial effect upon those who choose to take advantage of them, neither projector should pose as a philanthropist and patronise the beneficiaries, and feel hurt because they apparently do not realise, or, at all events, do not express their obligations to him for such benefactions.

It is important that warning should be given regarding misleading interpretations of these terms at the outset, since there are instances in which these features have been introduced under the term "Welfare Work," and have actually failed of their purpose on that account.

In the next place, I wish to emphasise particularly the fact that no business or industrial enterprise can afford to do anything which does not bear directly upon securing the increased efficiency of its mechanical processes and working organisation. Anything beyond this as applied to the human element savours of charity, which is outside of the province of a business enterprise, and is bound to react unfavourably upon its success. But anything which will increase efficiency it will be perfectly proper to do, provided care is taken that it is done in the right way. As everything that comes under the head of "Welfare Work" tends towards efficiency, it would be more rational and straightforward to call it all "efficiency work," which would describe it perfectly and be acceptable to both employer and employee.

In this connection, however, we must realise that our standards of living are steadily rising. Certain needs which are imperative to the individual now were not so some time ago, or are so in one place and not in another. These are brought about by advance in civilisation and social or industrial competition, and vary according to location and environment of the individual. Problems have been developed by the growth of shops, from the small one where the owner was a mechanic and knew all of his men by name, and was on friendly terms with each of them, to the larger one with its enormous aggregations of working forces running up to thousands, where the head of the concern never comes in contact with any of his workmen.

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* A lecture delivered by H. F. J. Porter before the Graduate School of Business Administration, Harvard University, Cambridge, Mass.

The study of economics in educational institutions has developed researches into the means for increasing national efficiency and for the conservation of national resources, and we are learning that the waste of labour and material in industrial enterprises everywhere is enormous and unnecessary. Efforts are, therefore, being made in all directions towards its prevention as well as cure. Dr. Eliot has said, regarding the way which human beings are being used up in the trades: "Every blunted intellect, every maimed or diseased body, is a direct tax upon the people, through the necessity for maintaining hospitals and invalid homes at the public expense. We now know that the most effective labour, and cheapest in proportion to its product, is found where the labouring classes live comfortably, are well housed and fed, develop their intelligence, and widen their prospects. The cheapest labour is no longer considered the most profitable."

As a result of this change in our economic standards, political and social reformers in our legislatures are framing laws making it a crime for men or corporations to exploit for their own selfish ends the time and effort of their workers, especially children, regardless of the result upon them, and the courts are enforcing these laws against those who have not attained to these higher standards, requiring their recognition or the payment of a penalty. Manufacturers are being told that they should protect and insure their employees from accident and charge the cost to the product, to be paid by the consumer; then only those who choose to buy the goods pay the tax.

So that now the State, when it grants to a man or a corporation a charter with the privilege to do business or to operate a factory, realising that the conditions and tendencies affecting the employment of people engaged in the enterprise have an intimate relation to the social problems with which the State has to deal, insists that the business or factory shall conserve rather than become a menace to the interests of the people with whom it has transactions and of the community in which it is located.

We must also appreciate that our ethical and economic standards are advancing. A great change has come about in the relations between men generally, as compared to those which existed 25 or 30 years ago. The broader spirit of the times inculcates the doctrine that all men are brothers. The "square deal" and "fair play" are common phrases in the business vocabulary. Giving consideration to the other man's point of view is a practical demonstration of the Golden Rule.

But every concern has certain needs and conditions which must be met in an individual way, irrespective of how some other concern makes the attempt. We must, therefore, be guarded in advocating special methods for one factory merely because they have been successful in another, and careful in our criticism concerning those who have adopted certain methods in their efforts at industrial betterment of this type merely because we know that other concerns adopted them inadvisedly and found them detrimental to their business. This would seem to be self-evident; and yet it is seldom understood.

A short time ago I was visited by a manufacturer, who told me that he desired to improve conditions in his plant, and as he had never done anything in the nature of what he called "Welfare Work" for his employees, he felt that he would like me to tell him what features would be best to introduce. He told me that after he had come to his decision to do something of this kind, he had written to several of the large representative concerns of the country asking what they had done in this direction, and he had their replies to show me.

To his surprise I told him that I did not care to see their letters, as they had no bearing on his case, and that he was acting like a man who felt he had something the matter with him physically, and, without diagnosing his own case, had asked various friends what medicines they had been taking for their ailments, which were probably of an entirely different nature. I told him the only way for him to proceed would be to study his own needs, and when he had found out what they were, to meet them in the most effective manner. And this I then found was what he, on account of his method, or rather lack of method, of management, did not know how to do.

(*To be continued.*)

TRADE NOTES.

H.M. Trade Commissioner for New Zealand reports that the Ministry of Mines invite tenders, up to 30th September, for the supply of (1) iron and steel work for coal storage bins; (2) hydraulic brakes; and (3) coal-picking and distributing belts. It is expressly stipulated in the specifications that, with the undermentioned exceptions, all the steel and iron work for the carrying out of these contracts shall be manufactured in the Dominion of New Zealand. The contractor will have the option of importing the materials, but they are to be imported without work of any kind; steel and malleable iron are to be imported in market lengths, and otherwise exactly in the state in which they left the rolling mills. The following manufactured articles may be imported, viz., rivets, spikes, and bolts, up to and including 24 in. in length; the following work may be done to the steel and malleable iron, viz., cold straightening and cutting bars and plates to exact lengths, provided that such cutting is limited to one saw cut in one plane at each end. The contractor will also have the option of importing the steel crankshafts finished, steel pinions, and the steel segments and manganese liners for the 12 ft. rope wheels. All steel and malleable iron supplied is to be of English manufacture. The materials procured in England must be obtained from such manufacturers as the High Commissioner for New Zealand may approve, and must be inspected and approved by the consulting engineers of the New Zealand Government before being shipped to the Dominion. Copies of the specifications, etc., may be seen by British manufacturers at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*

The steel barque Procyon has been sold by the **Procyon Steamship Co.,** Dundee, to a Russian firm. She is a vessel of 1,995 tons net, and was built by Messrs. Ramage and Ferguson Ltd., Leith, in 1892.

Mr. William Walker, shipbuilder, Glasson, Maryport, has sold the coasting steamer of 430 tons now on the stocks to Messrs. T. W. Ward Ltd., Sheffield. The vessel is 125 ft. long, 25 ft. broad, and 11 ft. 5 in. deep, and is expected to be ready for launching about September 20th. She is of the highest class at Lloyd's, and will be engined at Glasgow.

Messrs. Babcock and Wilcox, Renfrew, have erected three large additional shops at their premises, each 300 ft. long by 60 ft. wide. Two are for manufacture of mechanical stokers and coal-handling plant and the third for manufacture of marine boilers.

Messrs. A. W. Penrose and Co. Ltd., of 109, Farringdon Road, London, E.C., have secured the contract for the electric lifts required in the new head Post Office at Edinburgh, the contract amounting to £4,000.

TRADE CATALOGUES.

Messrs. The Dermatine Co. Ltd., 93 and 95, Neate Street, Camberwell, S.E., are now issuing entirely new catalogues, and all previous price lists are cancelled. Engineers therefore should apply for the new lists.

We have received publications of **Messrs. W. B. Haigh and Co. Ltd.** describing and illustrating Lines' patent wood trimmers, which are manufactured by them; also a number of their standard patterns of wood-working machines. The firm are exhibiting several sizes of these wood trimmers, and also an improved planer and an universal wood worker, at their stand at the Japan-British Exhibition.

We have received from **Messrs. The Adams Manufacturing Co. Ltd.,** Bedford, a publication illustrating their "Adams Igranic" apparatus, which comprises controllers of various types and a number of other electrical devices.

Messrs. A. Reyrolle and Co. Ltd., of Hebburn-on-Tyne have forwarded to us a copy of an illustrated pamphlet describing a new pattern of mining panel which, we understand, they are manufacturing in large quantities.

We have received from **Messrs. The Crypto Electrical Co.,** of Bermondsey Street, London, S.E., a pamphlet containing particulars of their alternating-current motors and combined motor generators, etc.

AN IMPROVED FEED-WATER REGULATOR.

The automatic control of the water supply to steam boilers is frequently desirable for a number of reasons, and the problem of producing a practical contrivance for the purpose is one that has for long received considerable attention from inventors. Hitherto, however, devices for regulating feed water have not come into very general use, although some few of the later types have withstood the test of lengthy trials, and have been free from most of the defects which rendered the performance of the greater number of the older contrivances so unsatisfactory as to at once put them out of the running. Even given an apparatus capable of operating practically perfectly under all working conditions, there are many cases where—owing to the loads being liable to wide fluctuations, and other causes—it would be found more advantageous to effect the regulation of the feed water by hand.

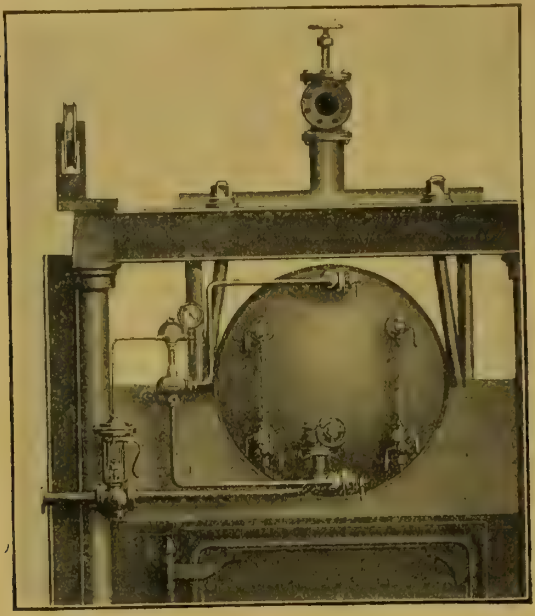

Fig. 3.

There are, however, as has already been intimated, many cases in which an efficient type of automatic feed-water regulator could be profitably used, and consequently the following description of a device lately designed and brought out by the Crosby Steam Gauge and Valve Co., of Queen Victoria Street, E.C., will be of interest to our readers. The makers claim amongst others the following advantages for the apparatus: A low-water level can be maintained with safety, thus increasing the steam space of the boiler and ensuring a supply of dry steam; coal consumption is reduced owing to a regular feed proportionate to the evaporation of the boiler being maintained; and a greater regularity in the steam raising is ensured, which tends to prevent any fluctuations in the pressure.

Most of the original designs of feed-water regulators were dependent for operation upon the rising or falling of some description of float, a mechanical device which in practical working has been found to be more or less liable to failure, and cannot be looked upon as being reliable. The object of the designers of the apparatus under consideration is to eliminate all complication, and as far as possible to do away with all parts likely to cause failure or irregularity of working.

The construction of the regulator is clearly shown in our illustrations. Fig. 1 is a section of the apparatus, by means of which the valve H (fig. 2) is worked. The apparatus shown in fig. 1 comprises a chamber A, which is connected with the boiler steam space through a pipe to be connected up at B. The chamber A is likewise connected through C with the water space of the boiler. The exact method of application will depend upon the type of boiler. In the case of a water-tube boiler, say, of the Babcock type, the device could be mounted—as shown in fig. 3—on the side of the drum in such a position that the upper part J of the chamber A would be situated in line with the desired water level. By then connecting the opening C with the lower portion of the drum, and connecting the opening B with the upper portion of the drum, it will be seen that the water level in the chamber A will be governed by that in the boiler, as a rise of water in the latter will also cause a rise of water to take place in the chamber A, and should this chamber be full of water, steam cannot gain access through the aperture B. The result of this will be that when the water level in the drum is a variable one the above chamber will sometimes be full of water and sometimes contain steam.

At the upper end of the apparatus shown in fig. 1 is a chamber E connected through the opening D to the chamber F of the regulating valve (fig. 2), and when the device is employed in connection with a range of boilers which work with a common steam main, as shown in fig. 3, the valve H (fig. 2), which is of the double-beat balanced type, is connected with the feed pipe in circuit and a regulating valve as above, and an apparatus as shown in fig. 1 is fitted to each boiler. N is another chamber situated above the plate J, and communicating through the pipe shown with the upper chamber E, and M is an air valve affording access to the latter. When only one boiler is in question, the apparatus shown in fig. 1, and the double-beat balanced valve H can be arranged—as indicated at X and Y in fig. 4—to regulate the supply of steam to the boiler feed pump, and to automatically stop and start the feed pump in accordance with slight variations in the water level in the boiler. The chamber F of the regulating valve H is fitted with a diaphragm G connected through a spindle K, governed by a spring L, with this valve, and

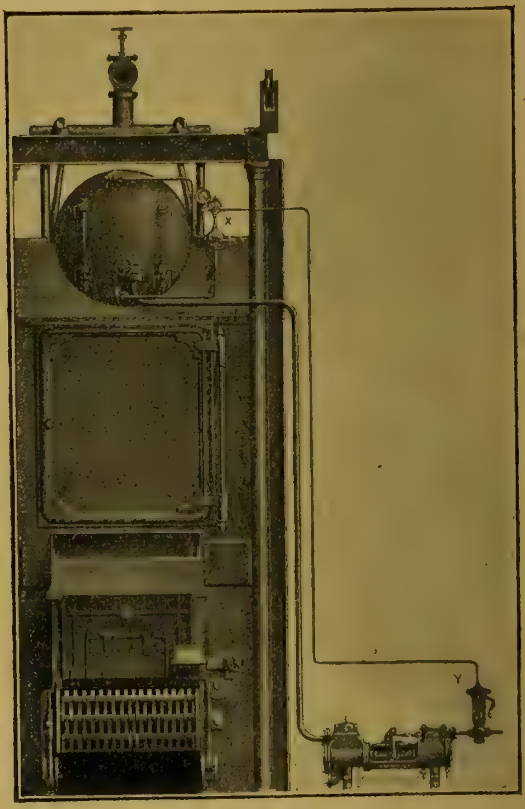

Fig. 4.

on the level of the water in the boiler falling, pressure will be exerted on the diaphragm to open the valve H and compress the spring L; whilst on the water level rising and releasing the above pressure, the valve H will be closed under the action of the spring L, and the water supply to the boiler cut off. The apparatus shown in fig. 1 operates to establish or reduce a pressure in the chamber F in the following manner: On first starting the apparatus the cocks on the boiler are both closed, and neither steam nor water enters the chamber A. The air valve M is then removed, and water poured into the upper part of the apparatus, whilst at the same time the union on the diaphragm chamber F in the feed regulating valve is slackened so that the air contained in the pipe connecting the two devices is ejected. The union is then made tight, and sufficient water inserted through the valve M to half fill the chamber, when the cock is opened and steam admitted to the chamber A. As soon as the apparatus has become heated, the air valve M is again slackened and the contained air permitted to escape, being closed as soon as the water in the chamber E boils over. This process is repeated a number of times, the apparatus being allowed to cool between each operation, and a vacuum is thus obtained in the upper part of the chamber E, the apparatus being ready for use when the gauge shown mounted on the regulator in fig. 5—which registers both pressure and vacuum, the former being registered to the right and the latter to the left of the zero mark—shows a minimum vacuum of 10 in. On this vacuum being secured, both cocks on boiler are opened and the apparatus put into operation.

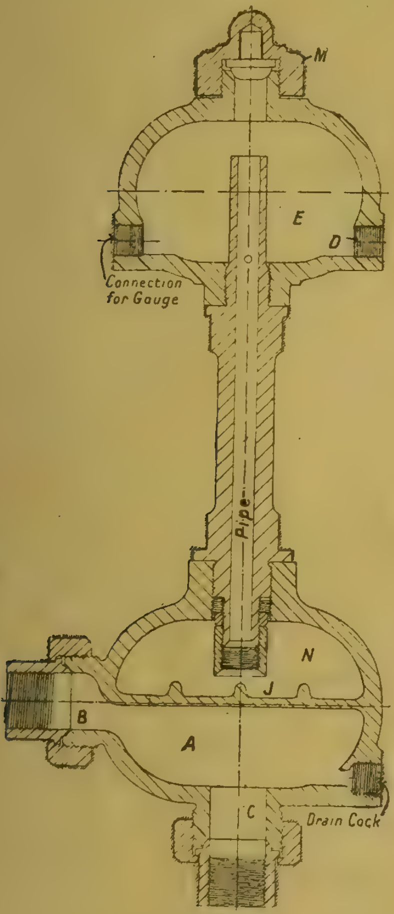

Fig. 1.

In practical working the operation of the apparatus is as follows: On the water level in the boiler falling, steam enters the chamber A through the inlet B, and heat is transferred through the plate J, which boils the water in the chamber N and produces a pressure of steam which acts on the surface of the water E, and causes a pressure on the upper side of the diaphragm G in the chamber F, which depresses the former and opens the valve H to admit a supply of feed water to the boiler, and so raise the water level. The water rising in the boiler drum causes the water to also rise in the chamber A, and on the normal water level in the boiler being attained, steam is prevented from entering through B. Only water is then contained in the chamber A, and the water in the chamber N is no longer evaporated, the steam condenses and the pressure

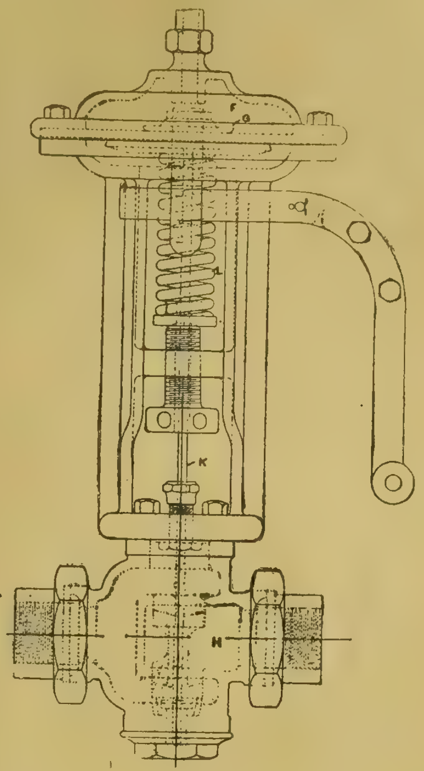

Fig. 2.

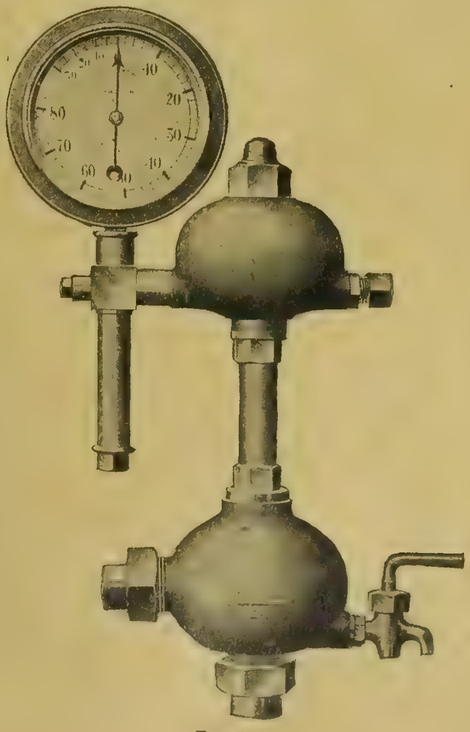

Fig. 5.

in the chamber E falls and the valve H closes, the supply to the boiler being then cut off for the time; and so on, one or other of these actions taking place in accordance with the level of the water in the boiler falling or rising, and the height of the water being thus maintained at or near the predetermined level.

A lever is provided for the purpose of testing the regulating valve H, and by means of which the latter can be kept open if desired; and an adjustable device is provided within the same to adjust the apparatus to maintain the water level in the boiler within various limits, and it is said that such adjustment can be made as to prevent anything but very slight variations in the water level.

ELECTRIFICATION OF SUBURBAN RAILWAYS.*

By F. W. Carter.

(Concluded from page 275.)

The Hammersmith and City Railway is a joint Metropolitan and Great Western line. Except on the Metropolitan section between Aldgate and Praed Street Junction, the power is supplied by the Great Western Co.'s power station at Park Royal. The trains are of the multiple-unit type, the electro-magnetic system of control being used.

The electrified section of the London, Brighton, and South Coast Railway extends for 8½ miles from Victoria to London Bridge Stations, via Brixton. It has the distinction of being the first of the London railways to adopt the single-phase system of operation. It is supplied with power at 6,600 volts, 25 cycles single phase, by the London Electric Supply Corporation, the feeding cables being run to a central distributing cabin at Denmark Hill through a metering cabin near Queen's Road Station. Thence the power is conveyed to a number of switch cabins which feed the overhead track conductors. The outer of the concentric distributing cable is bonded to each length of track rail and forms the return conductor. The trains are of the multiple-unit type, employing the electro-magnetic system of control.

The Liverpool Overhead Railway is one of the oldest of electric railways, having been opened for traffic in 1893. It is seven miles long, and carried on an elevated structure along-side the docks. It is a third-rail line, fed from a power station near its centre. The service was reorganised and greatly accelerated in 1902. The trains are worked by means of motor coaches, the motor control being directly operated by the driver.

The Mersey Railway has 4¾ miles of route, connecting Liverpool with Birkenhead by means of a sub-aqueous tunnel. It was converted from steam to electricity in 1903, largely on account of the difficulty in maintaining efficient ventilation in the tunnel. Power is supplied from a central power station directly to the conductor rails. The trains are of the multiple-unit type, the electro-pneumatic system of control being used.

The Lancashire and Yorkshire Railway have some 28 miles of route electrified in the neighbourhood of Liverpool. Power is generated at Formby power station, and transmitted to four rotary sub-stations, whence it is distributed to the third rail, and also to a number of battery sub-stations. The return conductor is an uninsulated fourth rail bonded to the track rails. The trains are worked by motor coaches, of which the motors are for the most part directly controlled by the driver, although a few multiple-unit trains have recently been introduced, using an electro-magnetic system of control.

The North-Eastern Railway have about 30 miles of electrified route in their Tynemouth lines. Power is bought from the Newcastle Electric Supply Co., and transmitted three-phase to the five sub-stations which feed the conductor rails. The track is used as return conductor. The trains are of the multiple-unit type and employ the electro-magnetic system of control. Some of the later coaches are equipped with commutating pole motors, the North-Eastern being the first railway in the country to use this type. A quantity of fish and parcel traffic is handled by special motor vans, whilst two electric locomotives handle goods trains, particularly on the Quayside line.

The Midland Co's electrified line at Heysham is an inter-urban one of an experimental nature, it being the first single-phase railway opened for traffic in this country. It comprises some 8 miles of route, and as there are only three stations, the average length of the run is about 4 miles, so that the service has little in common with that on a suburban railway, lacking the features which go to make the latter class of service particularly difficult to operate. The line is fed from the harbour power station at Heysham. The trains are of the multiple-unit type, both the electro-magnetic and the electro-pneumatic systems of control being used.

It will be seen that by far the greater portion of the electrically-operated traffic is worked by motor coaches rather than separate locomotives. This method of operation is peculiarly adapted for working suburban railways, and will no doubt remain the standard. The chief advantage of locomotive operation is that the greater portion of the electrical apparatus is immediately under the eye of the driver. If the apparatus were less immune from breakdown, this would be worth making considerable sacrifice to attain, but practically the advantage is small, as balanced against the advantages of motor coach operation. The multiple-unit system of control in which the motors on any bogie and the corresponding motor controllers form a unit—all such units on a train being operated from the driver's cab—is practically universal in the latest equipments, as well for locomotives as for motor coaches. Most of the multiple-unit trains used on surface lines carry the motor-controlling apparatus suspended on the underframe of the motor coach. In the case of the tube lines, however, it is invariably located inside the motor coach, in order to be accessible in case of emergency. In the smaller tubes the control compartment is placed over the motor bogie on a raised platform.

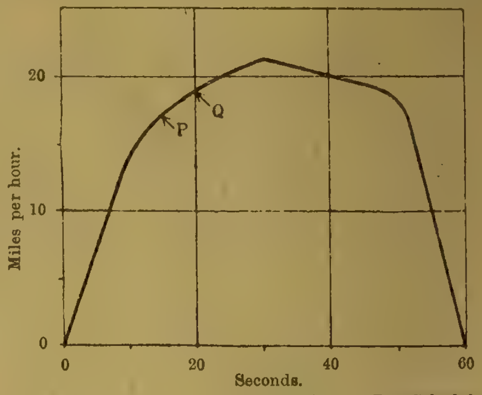

Fig. 2.—Speed-time Curve Corresponding to Two Schedules.

Most of the passenger coaches are of the saloon type; there is, of course, nothing in the nature of electrical working to render this type of coach indispensable, although the shortness of the station stops and the high rates of acceleration usual in electrical service render it preferable from the operating point of view. Some of the most popular of the Metropolitan Railway trains, however, are of the compartment type, being bogie trains, dating from the time of steam operation, converted for electrical working. These trains consist of seven coaches, of which the end ones are motor coaches; they weigh, unloaded, some 172 tons and seat 400 passengers—120 first class and 280 third class. The controlling apparatus is located in what was formerly the guard's compartment, of which the fore end forms the driver's cab.

The London, Brighton, and South Coast Railway have sought to combine some of the advantages of both types of coach in the new rolling stock for their South London Elevated Electric line. The coaches are of the corridor type, being divided into compartments, and having side doors, but having a corridor running the length of the coach for distributing the passengers. The trains consist of three coaches, of which the two end ones are motor coaches; they weigh, unloaded, some 138 tons and seat 188 passengers.

Although most of the railways in this country employ the vacuum brake, the electric railways, with the exception of the Lancashire and Yorkshire and the Midland, have adopted the Westinghouse type of brake. The chief reason for this is that compressed air can be stored to take off the brakes at a moment's notice. If the vacuum brake be employed, it is necessary to use a rather large exhauster, in order to fulfil the function of the large ejector on a steam locomotive in producing a vacuum rapidly. The space and material are, therefore, not used to advantage in this system as compared with a pressure system. The locomotives used on the London Underground Railways, having to work trains of all kinds, are fitted to use either system.

In suburban service the greater part of the energy expended is used in giving speed to the train and is ultimately dissipated in the brakes. Other things being equal, therefore, the more frequent the stops the greater is the energy required per mile, and the more difficult the service. The energy consumption per ton-mile, unless abnormal, is, in fact, a very good measure of the difficulty of a service. If this were more generally realised, the world might be spared some of the absurd comparisons of energy consumption between different systems, in which credit is claimed for obtaining a low energy consumption, which is really due to comparatively easy service. As the author has pointed out elsewhere, the figures derived from test of 42 watt hours per ton-mile for the energy consumption of the Central London Railway trains and 137 watt hours per ton-mile for the Liverpool Overhead Railway trains are strictly comparable and indicate no more than totally different services on totally different railways.

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* Abstract of a paper read before the Institution of Mechanical Engineers and the American Society of Engineers, July, 1910.

If it be granted that the natural and normal energy consumption per ton-mile is a reasonable measure of the difficulty of a schedule, an even more reasonable measure is to be found in a certain acceleration immediately expressible in terms of the particulars of the service, namely, the acceleration that would cause the train to reach a speed equal to the mean running speed in a distance equal to that between stops. This is merely a dynamical result, and in order to show it let figs. 2 and 3 represent speed-time curves corresponding to two schedules, the curves being such that that of fig. 3 is simply that of fig. 2 magnified twice in every direction. The distance represented in fig. 3 is then four times that in fig. 2. At corresponding points P on the two curves the acceleration, and therefore the tractive effort per ton necessary to produce it, will be the same. The power per ton required at P to produce the acceleration, being proportional to the tractive effort and speed, is twice as great in fig. 3 as in fig. 2. The energy per ton required to accelerate between corresponding points P and Q, being proportional to the power and to the interval of time, will be four times as great in fig. 3 as in fig. 2. But the distance is also four times as great, and thus the energy per ton-mile used in accelerating—probably some two-thirds of the whole—is the same for the two services. If the mean train resistance per ton were the same for the two curves, the energy per ton-mile required to overcome the resistance would also be the same, and we might then assert that the total energy output per ton-mile would be the same in the two cases. As it is, there is a small error affecting a comparatively small portion of the energy, which will have to be neglected. This is in general of little consequence in cases in which it would be expedient to employ the result—that is, in suburban service—where a ratio of four to one in distance with similar speed curves is, of course, a very exaggerated case. It will be seen that the acceleration referred to above, which will be called the specific acceleration of the schedule, is the same for the two curves, being the square of the mean running speed divided by twice the distance. It will also be seen that the method is perfectly general: so long as the speed-time curves for two services are similar the specific acceleration will be the same and the energy output of the equipments practically the same. It follows that of two services that having the higher specific acceleration may be expected to show the higher energy consumption per ton-mile. Also that if two services have the same specific acceleration, but differ in energy consumption, the higher can be reduced, in so far as it is not due to lower equipment efficiency, by running so as to assimilate its speed-time curve to that of the lower.

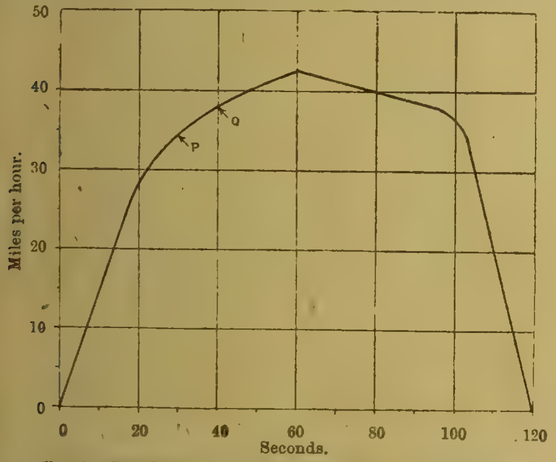

FIG. 3.—Speed-time Curve Corresponding to Two Schedules.

The specific acceleration of a schedule is a better index of the difficulty of the schedule than the energy consumption, inasmuch as it is independent of the equipment efficiency and of the particular manner of running the schedule, in effect reducing equivalent services to the same mode of operation. This, of course, presupposes that the line is not specially graded to reduce the difficulty of operation. The Central London Railway, for instance, was so laid out that each station is at the top of a grade; thus energy that would otherwise be dissipated by the brake shoes is stored and used for accelerating, making the line easier to work and the energy consumption lower than would be indicated by consideration of specific acceleration alone.

The above is an application of a method which the author has more fully elaborated elsewhere. The following table gives some characteristic schedules arranged in order of difficulty as indicated by the specific acceleration:—

TABLE II.

Line.	Average distance between stops.	Schedule speed.	Time of stop.	Average speed, excluding stops.	Specific acceleration.
	Feet.	m.p.h.	Secs.	m.p.h.	m.p.h. per. sec.
Liverpool Overhead	2,145	19·5	11	22·9	0·179
Liverpool-Southport	6,535	30	15	33·4	0·125
Underground, Inner Circle	2,555	15·7	20	19·2	0·106
Baker Street and Harrow	5,000	23	20	26·6	0·104
South London Elevated	4,540	21·5	20	25	0·101
Hammersmith and City	2,830	16	20	19·2	0·096
Central London	2,540	14·7	20	17·7	0·090
North-Eastern, Tynemouth	6,000	20·5	30	24·1	0·071
Midland, Heysham-Morecambe	23,500	26·7	120*	33·4	0·035

* Assumed.

A difficult service—in the sense of a service in which the specific acceleration is high—is one in which it is advisable, in the interests of low energy consumption, to employ high rates of acceleration and retardation; in an easy service this is of smaller consequence and hardly worth securing at the cost of heavy mechanical strains on the bogies, etc., with the great draught of power incident to the use of a high rate of acceleration. The account of the tests on the Liverpool overhead trains indicated a maximum rate of acceleration of 4·2 ft. per second (2·9 miles per hour per second), and this is perhaps as high as it is advisable to employ in service. The author has a record of a run actually made with a coach carrying a motor on each axle, in which an average rate of acceleration of 4·2 miles per hour per second was maintained until a speed of 21 miles per hour was reached (see fig. 4). The test was made with a view of showing the possibility of electrical equipments in this connection, and the acceleration was certainly faster than would be considered comfortable to passengers.

During the period of acceleration by controller notching considerable energy loss is inevitable in the equipment. In the continuous-current system the average equipment efficiency during notching is usually only about 57 per cent, the remaining 43 per cent being lost in the motors, rheostats, etc. It has been hastily assumed by some that the avoidance of rheostat losses in the single-phase system would result in much lower losses and higher mean efficiency during notching. That this is an unwarranted conclusion is shown by the authors of a recent paper on the Heysham electrification, who, although by no means blind to the merits of the single-phase system, found as the result both of test and calculation that the mean efficiency of the equipment during notching was only 56 per cent in the cases considered. The efficiency after notching is, of course, considerably higher for continuous current than for single-phase equipments.

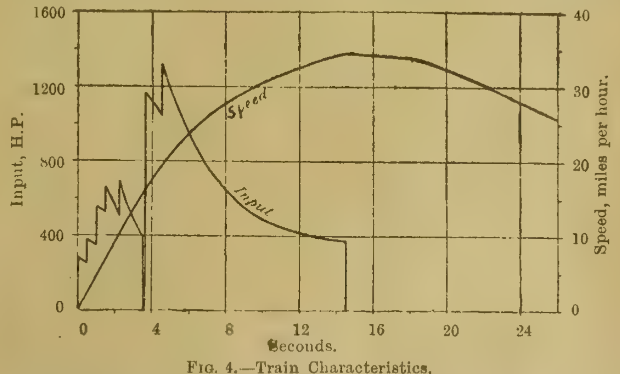

FIG. 4.—Train Characteristics.

The claim that the performance of a suburban electric train can be very closely predetermined may seem an extravagant one, until it is considered how very few are the conditions on which it depends. The relation between the tractive effort and speed of a given motor is perfectly definite at any given voltage, as is the current taken, whilst different motors of the same type agree closely in their characteristics. Assuming the train known as to weight, size, etc., the resisting forces due to grades, inertia, and train resistance are known. It, therefore, requires a dynamical calculation of no great difficulty to determine the effect of the motors on the train for any particular route or schedule. The quantities most likely to be subject to some uncertainty beforehand are the voltage at the train and the train resistance. In suburban work, however, a small error in these has but little effect either on the schedule speed or energy consumption. Perhaps an idea of the accuracy with which the running can be predetermined will be best conveyed by disclosing that the author's practice in making a guarantee of energy consumption is to compute it as closely as possible under the expected conditions of test and add 5 per cent to cover bad driving and other unforeseen contingencies. Such a guarantee would, of course, be of little use unless accurate instruments were available for making tests. Train-testing instruments should be specially designed for the work, so as to secure exceptionally large torque and heavy damping. The delicacy of ordinary stationary instruments renders them useless for train testing where they are subject to great vibration in all directions.

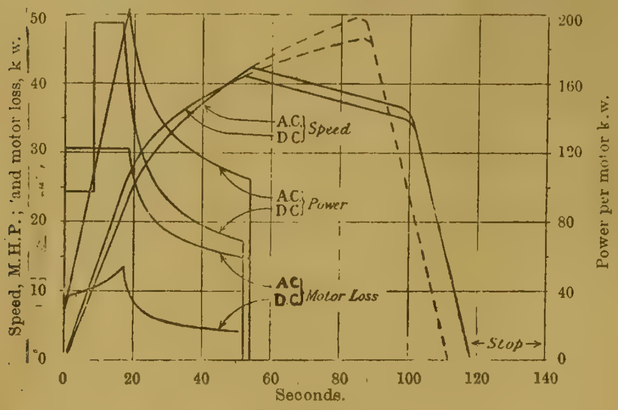

FIG. 5.—Train Characteristics.

These schedule calculations are easy and commonplace, but quite inadequate by themselves to determine whether an equipment is suitable for a given service. More important in this connection are the calculations involving the magnitude and distribution of the losses in the motors, with the facilities for transferring and dissipating the heat generated. Such calculations are, however, almost necessarily confined to the designers of equipments, as the data on which they are based are not generally available. In order to give a rough idea of the quantities involved, it may be stated that the ultimate temperature rise of the hottest accessible part of an ordinary railway motor, totally enclosed and without forced ventilation, as measured by centigrade thermometer after continuous service, is given approximately by:—

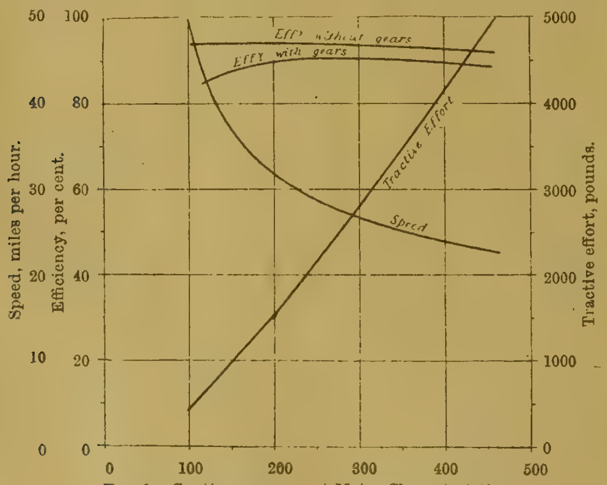

FIG. 6.—Continuous-current Motor Characteristics.

$$T = 7\ W\ w - \tfrac{2}{3},$$

where W is the mean motor loss in service (not including gear loss) in watts, and w is the weight of the motor in pounds, excluding gear and gear case. The motor losses in suburban service usually take from $6\frac{3}{4}$ per cent to 7 per cent of the input to the driving equipment in the continuous-current system, and from 15 per cent to 18 per cent of this input in the single-phase system. The great motor losses incident to the single-phase system form the foundation of all the objections raised to the use of this system for suburban service.

The heating of the motors has always been a limiting feature in the design of equipments for this class of service, and the practicable and desirable means of dealing with it are well understood. The use of forced draught for cooling the motors, whilst practicable for locomotives and single cars, is quite out of place on multiple-unit trains intended for suburban service, where, since the equipment may not be inspected for hours together, it cannot fail to lead to breakdown, increasing maintenance charges and causing delays to traffic.

Fig. 5 gives speed, power, and motor-loss curves corresponding to typical suburban schedule runs with continuous current and with single-phase equipments, the former of which carries 20 tons per motor and the latter 23 tons. Figs. 6 and 7 show the corresponding motor characteristics. It will be seen that the great difference between the systems is in the motor loss, which amounts to 6·75 per cent of the input in the continuous-current case and to 17·8 per cent in the single-phase case. Although both motors are dynamically capable of working the service, the former alone has sufficient thermal capacity for the purpose, the other having to dissipate three times as much energy as it can get rid of by natural cooling.

The author has confined his remarks to the subject of "Suburban Electrification," inasmuch as there appears little prospect at present of general electrification of railways in this country. The properties which give to electrical working its predominant advantages in the case of heavy suburban service become of minor importance when the distance between stops is considerable and the service infrequent. This matter was dealt with by Mr. Aspinall in his presidential address, and having also been recently discussed by the author need not be further pursued. Whilst it is perhaps gratifying to the electrical engineer to reflect that he can propose means fully competent to work the whole railway traffic of this country, and can offer three distinct methods of doing it, it is futile as things are to regard the problem of electrification from any other point of view than that of the ultimate commercial advantage of the railway companies. The author's investigations have convinced him that in this country at least the commercial advantage is only demonstrable in general in the case of heavy suburban service. Even here it should not be taken for granted, for the margin in favour of electrification is by no means overwhelming. This much can be affirmed, however, that where there is any considerable suburban traffic an investigation of the cost of electrification and the economic results of providing improved facilities will repay the trouble and expense, and in many cases justify proceeding with the conversion.

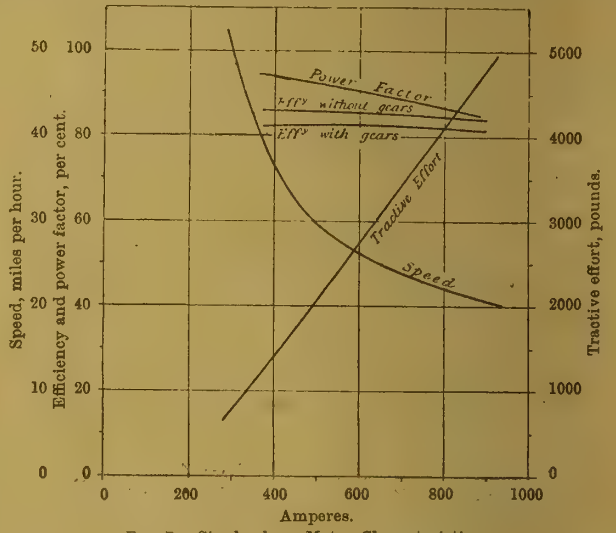

FIG. 7.—Single-phase Motor Characteristics.

It will be understood that the above remarks are intended to apply to the electrification of existing steam-operated lines. The case of entirely new railways is different and much more favourable to electrical operation. In laying out a new branch to an existing railway, again, it may be well worth while to consider electrical operation, the capital cost of which might be more than saved in the cheaper road bed, since steep grades are much less objectionable on an electrical than on a steam road. Of course, there are likely openings for local electrification on existing railways, even apart from suburban systems. It might, for instance, be found profitable to work the pushers on the Bromsgrove incline electrically. It is quite possible, again, that where electric power is already available at goods yards and docks the shunting could be more efficiently carried out by specially designed electric locomotives, fed perhaps by a suitable surface-contact system, than by steam locomotives, that would seem to be uneconomical for such work. For ordinary main-line work, however, there is at present no indication that the steam locomotive can be superseded with advantage in this country.

REPORT OF AERONAUTICAL RESEARCH COMMITTEE.

The committee appointed at the early part of last year to conduct research work in the science of aeronautics has just recently issued its first annual report for the year 1909-1910 in the form of a blue book. The report states that the committee since the inception has held 10 meetings, one at the Balloon Factory, Aldershot, one at the works of Messrs. Vickers, Sons, and Maxim at Barrow, two at the National Physical Laboratory, and the remainder at the War Office. In an interim report issued in July last a preliminary programme was given of experimental work which it was considered desirable to carry out, and the present report states that considerable progress has been made. The equipment which has been provided is described in the report, and is as follows:—

A wind channel 4 ft. square in section and 20 ft. long has been constructed for experiments included under "general questions in aerodynamics." The air is drawn through the channel by a centrifugal fan 6 ft. in diameter. For a velocity of 30 ft. per second the current can be kept satisfactorily uniform. The adjustment of the model to any desired angle with the current can be made without the necessity of stopping the flow. A water channel has also been available. With this equipment several series of experiments have been successfully carried out at the request of the Government departments concerned in constructive work.

The construction of the whirling table in a special building 80 ft. square is now completed. The apparatus for testing model propellers has also been erected. The whirling arm is of 30 ft. radius.

Two steel wind towers 60 ft. high and 110 yards apart have been erected by Royal permission in Bushey Park. They will be employed for experiments in the natural wind on large scale models. On the top of each tower is a rotating platform 20 ft. long by 3 ft. wide, which will enable access to be gained to plates and models of large area.

An electric dynamometer has been installed for tests on the efficiency and endurance of petrol motors, and a similar apparatus for tests up to 50 H.P. is now being set up. This will include special arrangements for an air blast to reproduce working conditions for air-cooled motors, and provision is being made also for tests on machines when tilted and under certain other conditions which obtain in practice.

For the strength determinations of various fabrics for aeroplanes, balloons, etc., a bursting test on cylinders of the fabric has been employed, and the resistance of the fabrics to tearing is also examined. Durability tests have been arranged, including exposure to sun, weather, etc. The methods of manufacture are also being examined by the committee, and experiments as to the employment of various oils and varnishes will be undertaken.

Various forms of indicators for the detection of hydrogen leakage in dangerous quantity are under consideration.

Light alloys and other materials of construction are receiving attention, and research on alloys of aluminium have been carried out at the laboratory, while strength tests on materials and joints have been made for the constructive departments.

The committee have taken steps to obtain particulars as to the existing knowledge on the problem regarding stability. The question will continue to engage their attention, and it is hoped that the experiments to be made in the air channel will lead to useful results.

The importance of collecting data with regard to air currents is clearly recognised by the committee. A valuable report as to present knowledge on the subject of wind structure and on vertical motion and rotary motion in the air has been presented by the Director of the Meteorological Office, and is included among the reports in the appendix. The programme of experiments which it is proposed to undertake at once includes the investigation of vertical air currents and also of rotary movements in the air, together with the designing of suitable apparatus for recording the observations. This work will be carried out at Pyrton Hill, under the superintendence of the Director of the Meteorological Office and with the advice and guidance of Mr. W. H. Dines, F.R.S. It has been arranged that a selection of anemographic records and other curves of interest to aeronauts shall be available for inspection at the Meteorological Office daily.

LAUNCHES AND TRIAL TRIPS.

Horace Stroud.—Messrs. Alexander Hall and Co. Ltd., Aberdeen, launched a steam trawler on August 20th to the order of Mr. Horace Stroud, Aberdeen. The dimensions of the vessel are: Length overall, 115 ft.; breadth, 22 ft. 4 in.; and depth moulded, 13 ft. She will be fitted with triple-expansion engines and boiler working at a pressure of 180 lbs.

Porto Seguro.—Messrs. Murdoch and Murray, Port Glasgow, launched on August 22nd a steel twin-screw steamer, built to the order of Messrs. John M. Campbell and Son, Glasgow, for the Empreza Navegacao Bahiana. The dimensions of the vessel are: Length, 150 ft.; breadth, 27½ ft.; depth to shelter deck, 15 ft. 9 in. She is designed for river and coast service in South America. After the launch the steamer was towed to Glasgow to have two sets of triple-expansion engines of large power fitted by Messrs. Muir and Houston.

Artemis.—On August 23rd Messrs. Ropner and Sons Ltd., of Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions, viz.: Length, about 424 ft.; breadth, 54 ft.; and depth to shelter deck, 36 ft. 3 in. The vessel is built to the highest class in the British Corporation Registry to carry about 9,500 tons; she is for foreign account, and is fitted with both shelter and upper decks, with five holds and large hatchways, thus facilitating rapid loading and discharging. The saloon with accommodation for captain, officers, and engineers is fitted up in deck houses amidships on shelter deck, with the crew in the forecastle. The vessel is built on the deep frame principle, the frames being of channel steel, and the holds are clear of all obstructions to the stowage of cargo, there being no hold beams or stringers. She has capacity for about 2,100 tons of water ballast in her cellular bottom and peak tanks. Her measurement capacity is exceptionally large, and she is fitted with 11 powerful steam winches working in conjunction with 11 derricks, with wire runners and purchase spans. Steam is supplied to the deck machinery from either of three main boilers of the horizontal multitubular type. The outfit includes stockless anchors, quick-warping steam windlass, steam steering gear amidships, and powerful screw gear aft. The engines are of the triple-expansion type by Messrs. Blair and Co. Ltd., of Stockton-on-Tees, of about 2,000 I.H.P. on a very full specification, with three boilers, 15 ft. by 11 ft., working at a pressure of 180 lbs.

Aeneas.—This vessel, which was launched on August 23rd, was constructed by Messrs. Workman, Clark, and Co. Ltd. for the Ocean Steamship Co. Ltd., and has been specially designed for passenger service and for the carriage of refrigerated and general cargo between Great Britain and Australia. She is a twin-screw vessel having a displacement of 19,500 tons, her principal dimensions being: Length overall, 509 ft.; moulded breadth, 60 ft.; and moulded depth, 40 ft. The vessel is lighted throughout by electricity and ventilated by means of electrically-driven fans provided in all the public rooms. Provision has also been made for the comfort of passengers when the vessel is in the northern latitudes, the heating of the vessel being effected by system of steam pipes and radiators throughout the accommodation. An installation of wireless telegraphy will enable the vessel to keep in constant communication with passing vessels and the shore. The refrigerating plant for the preservation of this cargo and the perishable stores is on the CO_2 or carbonic anhydride system, and cooling effect is transmitted to the holds by means of brine-circulating pipes arranged in coils. The Aeneas is propelled by two sets of triple-expansion engines, constructed by Messrs. Workman, Clark, and Co. Ltd. Steam is supplied by three large double-ended steel boilers of the cylindrical multitubular type working under an improved system of forced draught. The stokeholds are provided with ash ejector and steam ash hoists.

Lorca.—The new screw steamer Lorca, built by Messrs. John Readhead and Sons Ltd., South Shields, for the English and American Shipping Co. Ltd., of which the managers are Messrs. C. T. Bowring and Co. Ltd., London, was launched from the West Dock shipyard on August 23rd. The vessel is of the improved single-deck type with large holds clear of beams and other obstructions in stowing cargo, and is of the following dimensions: Length overall, 376 ft.; breadth, 51 ft.; depth moulded 27 ft. 8½ in.; and carries a large cargo on a light draught of water. The engines and boilers have also been constructed by Messrs. John Readhead and Sons Ltd., the cylinders being 25½ in., 42 in., and 69 in. diameter, by 48 in. stroke, with three boilers of 180 lbs. pressure. The vessel is built to Lloyd's highest class, and to their special survey.

Pennan.—Messrs. Scott and Yule, Fraserburgh, launched on the 23rd August the wooden steam drifter Pennan, built to the order of Mr. Charles Forbes and others. She is 86 ft. in length, 18 ft. in width, and 9 ft. in depth.

NAVAL NOTES.

Larne—On August 23rd the torpedo-boat destroyer Larne, of 780 tons displacement, built by Messrs. John I. Thornycroft and Co. Ltd., was successfully launched from the company's works at Woolston, Southampton. The Larne is fitted with Parsons turbines, which are estimated to give a maintained speed of 27 knots, and, in common with other destroyers of her class, will use oil fuel. The Larne was launched with both turbines and boilers on board and with masts, funnels, guns, boats, and other equipment in position. She will shortly be ready to carry out her official speed trials. Although not the first of the series ordered under the 1909-10 programme to take the water, the work on the Larne is farther advanced than is the case with the other vessels of the same type ordered under this programme.

Barasso.—The Brazilian cruiser Barasso ran her trials on the Clyde on August 23rd. The vessel, which has been at Greenock for the past four months, has received an extensive overhaul from the Clyde Shipbuilding and Engineering Co., Port Glasgow, at a cost of over £60,000.

H.M.S. Rifleman.—At East Cowes on August 22nd the new ocean-going destroyer Rifleman, laid down on December 21st last, was successfully launched from Messrs. John Samuel White and Co.'s yard. The Rifleman is a sister ship to the destroyer Redpole, which was launched at the same yard on June 25th last, being the second of three destroyers of this class ordered from Messrs. White last year. The remaining ship, named the Ruby, will shortly be launched. The Rifleman is 240 ft. long, with 26 ft. beam, and 770 tons displacement. She will be fitted with Parsons turbines and White-Forster patent boilers, fed with oil fuel. Her contract speed is 27 knots. She will carry two 4 in. guns, besides several 12-pounders.

H.M.S. Bedford.—The loss of the Bedford with 18 of her crew is one of the most serious disasters which has befallen the British Navy in recent years. The Bedford was one of the armoured cruisers of the earlier "County" class, and was launched from the Fairfield Yard on the Clyde on August 31st, 1901, being completed for sea by November 11th, 1903. She was allotted to the first cruiser squadron on its formation in November, 1904, and remained in that squadron until relieved by the Antrim, an armoured cruiser of a later and improved class, in July, 1905, when she was transferred to the second cruiser squadron. After a few months in the reserve at Chatham she completed her crew to sea-going strength on February 5th, 1907, to take the place of the Diadem, a protected cruiser withdrawn from the China Station. She was recommissioned at Hong Kong on March 25th last year for her third and what has unfortunately proved her final commission.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2271. **Gas Explosion in Cylinder.**—I should be glad if any reader could answer the following questions at the earliest convenience: If gas mixture in explosive proportions were forced into a cylinder and exploded, and fresh explosive charge forced in, would incoming charge explode? if so, would its force be equal to that of two explosions? If it would not "gradually" explode, would it increase the pressure against the walls of cylinder; or what effect would exploding charge have on fresh charge entering? The cylinder would not allow any to escape, being enclosed.—B. A.

2272. **Young's Modulus.**—Having some steel and brass wire, of which I wish to know Young's modulus, should be glad to hear of simple method of finding same. State precautions to be observed, and give any hints, data, etc., likely to help to accurate result.—Modulus.

2273. **Grindstone Formula.**—Please explain how the $(0{\cdot}031\, wv^2)$ grindstone formula is obtained from first principles. Is the formula reliable? What speeds and stresses can I allow in millstones? Show how to calculate the energy stored in same.—K. T.

MISCELLANEA.

The Design of Steam Turbines.—By a typographical slip the figures giving values to the abscissæ in fig. 4, page 268, are placed one division to the left. Fig. 1 should apply to the second line, and so on.

Change of Address.—All communications for the secretary of the Incorporated Municipal Electrical Association should in future be addressed to Mr. C. McArthur Butler, 28, Bedford Square, W.C.

Annual Report.—We have received from the Superintendent of the Cleansing and Destructors Department of the City of Bradford his annual report of the work done during the year ending March 31st, 1910.

A Reuter telegram from New York states that a wireless message has been successfully transmitted from a moving aeroplane at a height of 500 ft., a mile distant from the Sheep's Head Bay aviation track. This is stated to be the first wireless message so sent.

At the meeting of the Sheffield Forge and Rolling Mills the Chairman, Mr. S. M. Johnson, said they had had a great deal of business, but much of it at small profits. The success was largely due to the modernising of the plant, and although the expenditure in that direction seemed lavish, it had been abundantly justified. He foresaw that still further expenditure would be necessary if orders coming in were to be coped with.

The Textile Institute, inaugurated last April, has issued the first number of the *Journal of the Textile Institute.* This publication contains some account of the inception and the aims of the institute, with a record of its inauguration, when the President of the Board of Trade (Rt. Hon. Sydney Buxton, M.P.) was present. The institute is influentially supported, and we wish them every success.

Model Gliders: How to Make and Fly Them.—This is another of the portfolio type of models already associated with Messrs. P. Marshall and Co. as publishers and Mr. E. W. Twining as author. Full instructions are given which will enable anyone to make gliders, not only of the more orthodox patterns but in shapes representing birds and butterflies, a large coloured sheet of which is included. The whole portfolio can be had for one shilling.

Sir W. G. Armstrong, Whitworth, and Co. are building a new cruiser for the Chinese Government. The vessel is to be of the cruiser-scout class of about 2,400 tons, although officially classed as a training ship. Her speed is to be 24 knots, the armament consisting of 6 in. and 4 in. guns. Captain Li, of the Imperial Chinese Navy, accompanied by six students, who will undergo a course of instruction at the Elswick works, has arrived at Newcastle to superintend the construction.

Wireless Telegraphy.—It is reported that as soon as the Commonwealth Government installs wireless stations around the Australian coast, the P. and O. and German mail steamers, the Aberdeen, White Star, Orient and Union Lines will be equipped with wireless apparatus. Some difficulty has arisen over the selection of a site for the wireless station at Sydney, as the contractors wish to erect it on the coast, and the Defence Department insists on its being seven miles inland, so as to be secure from attack from the sea in time of war.

Testing Aerial Motors.—Six aerial motors have been entered for the £1,000 prize offered by Mr. Patrick G. Alexander through the Aerial League of the British Empire, and have now arrived at the National Physical Laboratory, Teddington, where the tests will be carried out by the advisory committee of aeronautics. The regulations require that the motor shall be of British manufacture, giving 35 B.H.P., and weighing not more than 245 lbs. The trials will be of a most exhaustive character. The chief point considered will be reliability and steadiness of running, other matters being the weight and consumption of petrol per brake horse power, the wear of the working parts, security against fire, and air resistance.

At the annual meeting of Messrs. Guest, Keen, and Nettlefolds, Mr. Arthur Keen, who presided, said that considerable anxiety had been caused to the management owing to the unsettled condition of trade due to the scarcity of orders, severe competition, and the cost of production. On the whole, however, their departments had been well employed, and there was only a decrease of about 2 per cent, but this was due to having booked orders at unremunerative prices. Although the sales were lower, the wages paid were 6 per cent higher, the wages bill reaching about £1,500,000. The Miners' Eight Hours Act had borne heavily upon them, and he was apprehensive about the future of it. It had given cause for endless disputes, and, like the Compensation Act, its burdens would increase.

PATENTEES' CHRONICLE
OF
Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

AUGUST 22nd, 1910.

19567 Carriage door lock. Macdonald.
19568 *Clutches. Dixon.
19569 Milk churns. Wickham.
19570 Inner tubes. Barton.
19571 Hat pegs, etc. Hart.
19572 Aeroplane attachments. Mawson.
19573 Gas purifiers. Broadhead.
19574 Aerial railway wagons. Hamilton.
19575 Register for hampers, etc. Sanderson.
19576 Carriage door locks. Whiteside.
19577 *Life saving in mines. Brown.
19578 Main pipes. Helps.
19579 Corsets. Prescott.
19580 Milk can locks. Alderson.
19581 Fire escape. Dodds.
19582 Drying cylinders. Mycock.
19583 *Synchronous motors. Wood.
19584 *Steam drying drums. Hopper.
19585 Invalid's bed rest. Gamble.
19586 Massage apparatus. Winzer.
19587 *Tool holder. Rosenbeck.
19588 Gas lighter. Nagel.
19589 Advertising device. Dott.
19590 Water motors. Goldring.
19591 *Dies. Lund.
19592 Toothed gearing. Humphris.
19593 *Wire manf. Gibbs.
19594 *Wire annealing. Gibbs.
19595 *Vehicle bodies. Mills.
19596 Gramophone record manf. Barker.
19597 Rock drills. Kellow.
19598 *Tobacco cartridge. Rutter.
19599 *Tennis racquets. Mueller.
19600 *Electric batteries.
19601 *Colour photography. Caille.
19602 *Treatment of air.
19603 *Turbine. Kilburn.
19604 Cycles, etc. Powles.
19605 Universal joints. Vincent.
19606 *Gas mantle. Storer.
19607 *Metal casting device. Mertens.
19608 *Gas lamp. Smith.
19609 *Valves. Meyer.
19610 *Lathes. Yeates.
19611 Tins for containing foods. Thompson.
19612 Wreath manf. Charlton.
19613 *Lubrication device. Hall.
19614 *Lubrication device. Hall.
19615 *Type casting. Buigné.
19616 Aerial torpedo. Linsmeyer.
19617 Liquid raising device. Humphrey.
19618 Boot trees. Stevenson.
19619 *Electric trams. Battaille.
19620 Furnaces. Massey.
19621 *Sterilising milk. Diener.
19622 Window lock. Watt.
19623 Toasting appliance. Thomas.
19624 Windflier. Winnington.
19625 *Reversing internal-combustion engines. Gravdahl.
19626 Ash ejecting device. Parsons.
19627 *Flooring clamp. Craddock.
19628 *Tyres. Azulay.
19629 Siphon bottles, etc. Paterson.
19630 *Boilers. Thiro.
19631 Bottle stoppers, etc. Schanermann.
19632 Stand for vibratory machines. Quace.
19633 *Looms. Hadden.
19634 *Metal rolling. Grey.
19635 *Metal rolling. Grey.
19636 Ring manf. Wacker.
19637 Cocoa, etc., manf. Hildesheim.
19638 Cycle tubes. Rogers.

AUGUST 23rd, 1910.

19639 Pipe plug. Capman.
19640 Hatpin. Stansfield.
19641 Reservoir pens. Schulz.
19642 Vehicles. Clegg.
19643 Rubber stamp holder. Jackson.
19644 Deodorising waste gases. Haas.
19645 Waffle iron. Marston.
19646 Relating to heat. Sides.
19647 Safety valves. Cockton.
19648 Soldering iron. Cockton.
19649 Cycle brakes. Blythe.
19650 Motor car engines. Sumpter.
19651 Grip tyre. Sneyd.
19652 Golf club. Robson.
19653 Gas producer. Hall-Brown.
19654 Fire extinguisher. Wollheim.
19655 Candle clamp. Byron.
19656 Armour plates. Putman.
19657 Rolling mill guide block. Riley.
19658 Wheels. Brewer.
19659 *Electrical firing instrument. Aitken.
19660 Belt joining tool. Gainsford.
19661 Carburetter. Hayes.
19662 Vacuum cleaner. Sutton.
19663 *Food preparation. Wotherspoon.
19664 Saucepans. Halliday.
19665 Gas purifying. Laverack.
19666 Engine. West.
19667 *Gramophone disc. Munzer.
19668 Boot protector. Doyle.
19669 Speed indicator. Ludovici.
19670 Pipe junction piece. Wood.
19671 *Lamp. Galvao.
19672 *Looms. Bauer.
19673 Building warming, etc. Phillips.
19674 Candlesticks. Harrison.
19675 Wire strainers. Price.
19676 Relating to rubber. Rankin.
19677 *Granular bichromate of sodium. Wedekind.
19678 Screens. Love.
19679 *Acid manf. Diers.
19680 *Cutting off machine. Gorton.
19681 *Wood charcoal manf. Felizat.
19682 *Tool case. Zange.
19683 *Brushes. Cardinet.
19684 Wheels. Aldred.
19685 Showcase. Shaw.
19686 *Combination code card. Hoffman.
19687 *Check identifying. Hoffman.
19688 Trouser stretcher. Ley.
19689 Necktie fastener. Rosa.
19690 Vaginal tampons. Ryan.
19691 Bearings. Johns.
19692 Pudding basin. Smith.
19693 *Typographical composing device. Walker.
19694 Polishing pad. Turner.
19695 *Axle boxes. Lake.
19696 *Piano. Lake.
19697 Vertical retorts. Cutler.
19698 Hooks and eyes. Cowie.
19699 Withdrawing pit props. Crosier.
19700 *Aeroplanes. Beach.
19701 *Electric signalling. Quertier.
19702 *Weighing machine. Quertier.
19703 *Recording apparatus. Quertier.
19704 *Milkers. Story.
19705 *Clutch, etc. Maggiora.
19706 *Fertilisers. Forbes.
19707 *Leather, etc., manf. Smith.
19708 Roller skates. Vollmer.
19709 Ejecting articles from canisters. Freudenberg.
19710 Axle box. Lake.
19711 Hose rake. Crossing.
19712 *Bracelets. Mirra.
19713 Calipers. Harris.
19714 *Water proofing. Blackman.
19715 Jewels. Burckhardt.
19716 Speed indicator. McCann.
19717 *Coupling. Langen.
19718 *Aeroplanes. Le Rouge.
19719 *Sugar purifying. Homans.
19720 Roundabouts. Behnam.
19721 *Spill lighting appliance. Liske.
19722 *Wearing apparel.

AUGUST 24th, 1910.

19723 Kerbs for fireplaces, etc. Edman.
19724 Potato digger. Grant.
19725 Bassoons. Bailey.
19726 Vases for flowers, etc. Temple.
19727 Displaying lantern slides. Clarke.
19728 Umbrella locks. Alderson.
19729 Miners' lamps. John.
19730 Treating rubber latex. De Costa.
19731 Hose suspender clip. Barnwell.
19732 Wheel pump. Hurford.
19733 Braiding machine. Hopkinson.
19734 Sounders for doors. Hines.
19735 Boot protector. Caton.
19736 Carriage door lock. Brearley.
19737 Swimming baths. Row.
19738 Carriage door lock. Walker.
19739 Rubber article manf. Tarvey.
19740 *Brakes. Crossley.
19741 *Motor car wheels. Crossley.
19742 *Carburetter. Connolly.
19743 Internal-combustion engine. Butterfield.
19744 *Eyeglasses, etc. Payton.
19745 *Spring mattress. Day.
19746 Coupling. Wareham.
19747 *Button holes. Cavill.
19748 *Steam generator. Vesely.
19749 Stair rod eye. Harmann.
19750 *Gas, etc., turbine. Brown, Boveri, and Co.
19751 Internal-combustion engine. Maggiora.
19752 *Tea packing. Lovell.
19753 Motor collar for wearing apparel. Rubens.
19754 Lubricator. Emery.
19755 Internal-combustion engine. Cole.
19756 Collar, etc., stud. Fairchild.
19757 Petrol engine. Trelease.
19758 Glass washing machine. Becker.
19759 Aeroplanes. McClelland.

19760 Chimneys. Faber.
19761 Solvent for carbon. Gilbert.
19762 *Decorticating grains, etc. Gourdon.
19763 Steam turbine. Smith.
19764 Pneumatic tyres. Ivinson.
19765 Tyre. McCabe.
19766 Army cow collar. Balcombe.
19767 Photo printing frame. Bradley.
19768 Summer house. Callcutt.
19769 Wrapping device. Brassard.
19770 *Ceiling. Gutzeit.
19771 *Coat manf. Shaiken.
19772 Production of antimony. Ruthenberg.
19773 Carriage door lock. Bradley.
19774 *Beds. Martinez.
19775 Puzzle. Shepherd.
19776 Dustbins. Goodair.
19777 *Ladies' hat fastener. Cohn.
19778 Ammonia manf. Johnson.
19779 *Aeroplanes. Regnard.
19780 Gear wheels. Beaumont.
19781 Pocket flasks. Roberts.
19782 *Relating to fibrous cloth. Perin.
19783 Calculator. Williams.
19784 Stamp mills. Dunn.
19785 *Mouse, etc., trap. Jaeger.
19786 *Clutch. Miran.
19787 Internal-combustion motors. Crayssac.
19788 Alarm siren. Bilham.
19789 *Decorticating leaves, etc. Faure.
19790 Rifle. Formby.
19791 Valve gear. Barker.
19792 *Plate washer. Boult.
19793 Internal-combustion engine lubricator. Buckman.
19794 Carburetters. Buckman.
19795 Lamp supports. Peard.
19796 *Index indicator. Gibb.
19797 Detachable wheels, etc. Riley.
19798 Flying machine. Beadon.
19799 *Bottle stoppering. Lassen.
19800 *Pipe coupling. Lake.
19801 *Razors. Lake.
19802 *Typewriting ribbons. Kanzler.
19803 Air and steam couplers. Haddan.
19804 *Electric furnace. Reid.
19805 *Electric furnace. Reid.
19806 *Wrenches. McLane.
19807 *Shell fuses. Risch.
19808 *Utilisation of volcanic rock. Ribbe.
19809 Cycles. Stevens.
19810 Spare wheel carrier. Hall.

AUGUST 25th, 1910.

19811 Rest for billiard cues. Williams.
19812 *Talking machines. Lindstrom.
19813 Anti-fouling composition. Phillips.
19814 Holders for lamp shades. Challis.
19815 Door checks. Pritchard.
19816 Starting device for internal-combustion engine. Haigh.
19817 Driving mechanism for motor vehicles. Dent.
19818 Measuring instruments. Armand.
19819 Box cover. Herbert.
19820 Receptacles for liquids. Smith.
19821 Wire-drawing tool. Jeffrey.
19822 Looms. Tootall.
19823 Cranks. Parry.
19824 Necktie fasteners. Brian.
19825 Petrol carrier. Graham.
19826 Electric lampholders. Copland.
19827 Flushing device. Lees.
19828 Separating fibres. Broome.
19829 Doors. Johnston.
19830 Bending and cutting tools. Jones.
19831 Safety device for mining cages. Claytor.
19832 Cameras. Coupe.
19833 Motor vehicles. Peck.
19834 Windows for road vehicles. Charles.
19835 Cue tips. Taylor.
19836 Lamp shade frames. Taylor.
19837 Binder for stationery. Macgregor.
19838 Perpetual calender. Emanuel.
19839 Overshoes. Brown.
19840 Wheels. Horner.
19841 Flushing cisterns. Brown.
19842 Gas lamps. Keith.
19843 *Pipe joints. Constantine.
19844 Breech loading ordnance. Dawson.
19845 Tyre. Walton.
19846 *Tachometers. Holft.
19847 Actuating gear for ordnance. Dawson.
19848 Door handle fastening. Base.
19849 Loco. spark arrester. Ferran.
19850 SECRET APPLICATION.
19851 Electric cut-out. Reyrolle.
19852 Airship. Zweifel.
19853 *Glue. Kelly.
19854 Mine ventilation. Strauch.
19855 Pocket pencils. Semadeni.
19856 Collapsible case. Murray.
19857 Aeroplane. Kirk.
19858 Book rest. Stephens.
19859 Roller skates. Peers.
19860 Tobacco pipe charging. Rippingille.
19861 Carriage door lock. Austin.
19862 Internal-combustion engine. Brearley.
19863 Electric motors. Stirk.
19864 *Spiral spring manf. Cowen.
19865 Railway couplings. Rossiek.
19866 *Fireproof material. Siemens.
19867 *Manf. of rubber goods. Marks.
19868 Billiard table. Whitty.
19869 Bookbinding. Sweetser.
19870 *Stop cocks. Pearson.
19871 Sight for rifles. Fisher.
19872 Pedal block for cycles, etc. Brown.
19873 *Internal-combustion engine. McCollum.
19874 *Letter copying machine. Nahmer.
19875 *Letter copying machine. Nahmer.
19876 Bread manf. Humphreys.
19877 *Lawn mower. Harrison.
19878 Tin cover fitting. Slinn.
19879 *Plate basket. Günther.
19880 Heating device. Skipworth.
19881 Article displaying cabinet. Brand.
19882 Agricultural machinery. Stephens.
19883 Egg boiler. Lesseville.
19884 Apparatus for infusing tea, etc. Hymans.
19885 Stools. Robinson.
19886 Carburetters. Swan.
19887 *Ships' guns. Markhof.
19888 Liquid containing receptacles. Osmond.

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19889 Bottle. Boom.
19890 Fireguard. Hardy.
19891 Metal tube manf. Hayes.
19892 Power transmission. Merington.
19893 Piston. Moores.
19894 Dough rolling. Vicars.
19895 Belt pouches. Corbin.
19896 Motor car tyres. Wilford.
19897 *Diamond boring crowns, etc. Corvilain.
19898 Internal-combustion engine. Bramsby.
19899 Railway indicator. McWhire.
19900 Felt hat manf. Turner.
19901 Looms. Ashworth.
19902 Retorts. Hopkinson.
19903 Paper, etc., rolling machine. McHenry.
19904 Indicating device. Pickles.
19905 Biscuit cutters. Clarks.
19906 Steering aeroplanes, etc. Horton.
19907 Casement stays. Newbold.
19908 Gas stoves. Wallis.
19909 Lock nuts. Holt.
19910 Circuit breakers. Brown.
19911 Spinning mules. Collier.
19912 Button hooks. Pickering.
19913 Lasts. Whitton.
19914 Electric lamps. Straussler.
19915 Boot protector. Penton.
19916 Speed gear. Richardson.
19917 Capsules. Mansfield.
19918 Self-propelling wheel. Schraivogel.
19919 Child's carriage. Grose.
19920 *Bookbinding. King.
19921 Buttons. Smith.
19922 Goods displaying device. Bowling.
19923 Velocipedes. Mappin.
19924 Fire escape. Richardson.
19925 Aerial propeller. Bell.
19926 Fabric manf. Bell.
19927 Umbrella covers. Fletcher.
19928 Tailor's cutting patterns. Morris.
19929 Cradle winch. Cleall.
19930 *Electric switch, etc. Druseidt.
19931 Ball joint. Rogers.
19932 Electric cable. Wheelwright.
19933 Weather protector. Finkelstein.
19934 Stair covering. Fuller.
19935 *Power transmission. Pittler.
19936 Knife cleaner. Dunlop.
19937 Hats, etc. Thomson.
19938 Biscuit manf. Matthews.
19939 Coke treatment. Ely.
19940 Internal-combustion engine. Polkey.
19941 Fire alarm. Popham.
19942 *Gear casing. Stock.
19943 *Liquid seals for pipes. Ofen.
19944 Motor car seats. McIlwraith.
19945 *Relief embossing in metals, etc. Wickel.
19946 *Flying machine. Romme.
19947 Cotton gins. West.
19948 *Beams. Hetzer.
19949 *Doug nets. Blum.
19950 Calculating machine. Harris.
19951 Tyres. Davies.
19952 *Electro-magnetic clutch. Seidel.
19953 Boats. Ingovitich.
19954 *Drying fabrics. Heberlein.
19955 Wireless telegraphy. Balsillie.
19956 Cycle forks. Jubjan.
19957 Vehicle covers. Turner.
19958 Driving gear. Kimberley.
19959 *Toilet boxes. Wye.
19960 Boot protecting devices. Plé.
19961 Letter files. Hymans.
19962 *Metal tube manf. Siemens.
19963 *Driving clutch. Rainsforth.
19964 Gas burners. Hanwell.
19965 *Boot lasting. Bates.
19966 *Handcuffs. Busch.
19967 *Spring scales for wagons. Johnson.
19968 *Differential axle. Jones.
19969 *Railway points. Siemens.
19970 *Railway points. Siemens.
19971 *Electro-magnets. Siemens.
19972 *Telewriter. Ritchie.
19973 Wheels. Simpson.
19974 *Top. Schumain.
19975 Ships. Lennox.
19976 Cash register. Briden.
19977 *Cash register. Briden.
19978 *Cash register. Briden.

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19979 Cartridge. Clifford.
19980 Percussion tool. Brindley.
19981 Ash ejector. Goddard.
19982 Looms. Place.
19983 Massage. Jones.
19984 Yarn manf. Broome.
19985 Soap. Leese.
19986 Turbine. Gauldie.
19987 Mudguard flap. Brown.
19988 Boiler. Barker.
19989 Electric lamp holder. McLean.
19990 Wind screen. Poole.
19991 *Ordnance. Bremlerg.
19992 Gas purification. Elliott.
19993 *Electric resistance. Kallmann.
19994 Syringes. Schultz.
19995 *Photo reproduction device. Jantsch.
19996 Rowing boats. Mitschke.
19997 Screw wrenches. Kokot.
19998 Inkstand. Lötel.
19999 Air pumps. Hanel.
20000 Propeller. Weise.
20001 Horse collar. Liebig.
20002 Weaving. Chadwick.
20003 Railway points. Johnson
20004 Sparking plug. Ashdown.
20005 Cigar, etc., holder. Bull.
20006 Air pressure regulator. Marshall.
20007 Motor car accessories. Smith.
20008 Tobacco pipe. Gartside.
20009 Water boiler. Brooks.
20010 Horse applied brake. Phillips.
20011 Advertising device. Heath.
20012 Sweet pea, etc., supports. Dick.
20013 Laundry irons. Lynas.
20014 *Woven fabrics. Taylor.
20015 *Tramcar, etc., ventilation. Leeming.
20016 Photo camera. Newman.
20017 Roller skates, Wunderlich.
20018 Perambulators. Ehrenberg.
20019 Gas engine silencer. Hand.
20020 Lamp indicator. Riley.
20021 *Waste utilising. Smith.
20022 Free wheel clutch. Bohle.
20023 *Cutting out garments. Armstrong.
20024 Poultry food manf. Franklyn.
20025 Dye manf. Newton.
20026 *Transport of vessels. Schneider.
20027 Internal-combustion engine. Halle.
20028 Suspension device. Deauchesne.
20029 Chairs. Whitehead.
20030 Drinking flasks. Johnson.
20031 Frozen meat storing. Nelson.
20032 Photo stand. Jensen.
20033 Wheels. Swallow.
20034 Ships' berths. Staines.
20035 *Slab gauging machine. Degelow.
20036 *Ornamental slabs. Wassermann.
20037 Tyres. Bodenheimer.
20038 Cuff links. Lewers.
20039 Flat iron. B. T.-H. Co.
20040 *Electric lamp socket.
20041 *Furnaces. Ramén.
20042 *Shaft coupling. Sundstrom.
20043 *Power transmission. McCarty.
20044 Wheels. Hunter.
20045 Showcard. Cohen.
20046 *Ore treatment. Emanuel.
20047 *Ore treatment. Emanuel.
20048 *Sodium aluminate manf. Emanuel.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to October 3rd, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

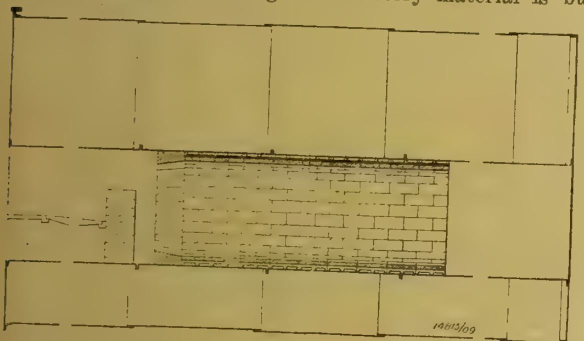
Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

9720 **Barham**: Arrangement and construction of apparatus for the production of petrol-air gas. 9721 **Barnes**: Rotary engines, pumps, meters, and the like. 9958 **Wildbore (Haggenmiller)**: Smelting of pyritic and other sulphide ores. 11503 **Gourlay and Cruickshanks**: Spring and pulley driving gear. [Post-dated December 9th, 1909.] 12452 **Fisher**: Electric plugs. 12927 **Harries**: Revolving muffled calcining and smelting furnace. [Post-dated October 11th, 1909.] 14627 **Fauber**: Construction of boats and ships. [Patent of Addition to 20281, 1908.]

14815 **Smallwood**: Furnaces of boilers of Lancashire, Cornish, marine, or other similar type.

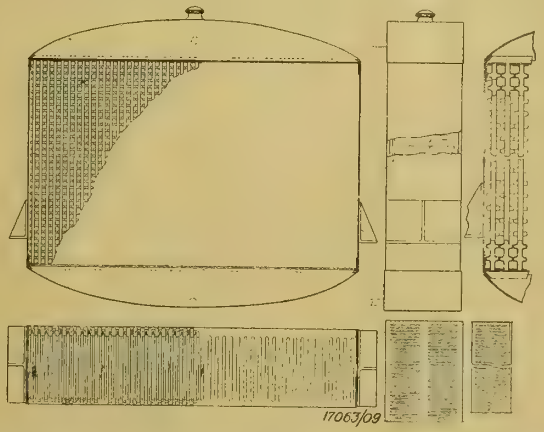
Comprises improvements in or relating to the furnaces of boilers of the Lancashire, Cornish, marine, or other similar type. The object is to provide for the better utilisation of the heat for purposes of steam generation than has heretofore been the case, and consists in providing means whereby a zone of extremely high heat intensity is generated and maintained in the near vicinity of the surface to be heated. The improvements are also such that the smoke is consumed and an economy in fuel secured by reason of the completeness of combustion, coupled with the efficient means of transmitting the heat to the heating surface of the boiler. According to the present invention a lining of refractory material is built in close relation to the boiler plates in such a manner that while an inter-space or spaces is left between the refractory material and the boiler plate no air or furnace products circulate in such space or spaces, which latter are thereby enabled to maintain a particularly high temperature and at the same time to provide for efficient transmission of heat to the boiler plates for purposes of steam generation. The brickwork may conveniently take the form of an arch or lining commencing at or near the bridge and extending backwardly as far as may be required to obtain complete combustion. The space or spaces between the lining and the boiler plate may be open at the rear but closed at the front, and the refractory brickwork becoming readily incandescent radiates its heat to the heating surface of the boiler. The present invention also consists of a brickwork lining having restricted contact with the boiler plate, and so arranged that no comparatively cold media enters the space or spaces between the lining and the boiler plate.



14829 **Bunge**: Apparatus for reproducing perforated sheets employed in mechanically-actuated musical instruments. [Request under Section 19 of the Act not granted.] 14916 **Pickles, Pickles, and Pickles**: Method of and means for operating the reciprocating tables of ironing machines. [Post-dated December 9th, 1909.] 14950 **James (Compagnie Generale de Phonographes, Cinematographes, et Appareils de Precision)**: Process for re-utilising the band supports of cinematographic films. 14993 **Junod and Meyer**: Automatic selling machines combined with an advertising apparatus. 16034 **Renshaw, Fairhurst, and Cranshaw**: Ring-spinning machines. [Post-dated January 7th, 1910.] 16111 **Meatyard**: Apparatus for the purpose of introducing liquid into barrels. [Post-dated October 29th, 1909.] 16951 **Quinlivan**: Traction engines, motor cars, and other like self-propelled vehicles. 16960 **Bell**: Mixer for paper pulp. 16965 **Smith**: Bronzing and bronze-dusting machines. 17003 **Charonnat**: Food products formed from germs of wheat and the like. 17018 **Faller**: Process of dyeing wood. [Date applied for under International Convention, July 25th, 1909.]

17063 **Mulholland and Coakley**: Radiators for use in connection with internal-combustion engines.

This invention relates to certain improvements in radiators for use in connection with internal-combustion engines, and its object is to produce a radiator which, whilst being constructed almost exclusively of sheet metal, is exceedingly light and strong. It has also a large radiating surface, whilst it is similar in appearance to and has all the advantages of the well-known "honey-comb" type of radiator. It has been proposed to construct heating and cooling devices from thin metal sheets having projections pressed up from same, each sheet being folded upon itself in opposite directions at equal intervals along its length and that it has also been proposed to construct flat tubular elements for radiators from sheet metal having teat-like projections, the sheet being folded, and its longitudinal edges secured, so that the projections on the outer sides of the tube lie opposite and in contact with each other and provide internal and intercommunicating cavities or enlargements. In the construction of surface condensers or feed-water heaters it has also been proposed to use removable elements consisting of corrugated plates united at their ends and stayed internally, the removable elements being connected at their ends to headers and juxtaposed in a casing containing water so that the abutting corrugations form passages for water. The present improvement comprises perforated top and bottom plates, a series of water tubes having external bosses or projections inserted vertically between the top and bottom plates, the bosses or projections of each tube contacting with the bosses or projections of the next tube to form air passageways, locking strips fitted to the top and bottom plates between each tube, and external top and bottom pieces secured to the perforated top and bottom plates.

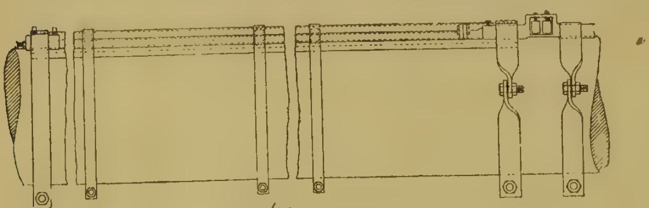


17076 **Johnson**: Device for drafting trousers. 17112 **Gibbons and Masters**: Vertical gas retorts. 17139 **Roux**: Process for converting peat into charcoal. [Date applied for under International Convention, July 22nd, 1908.] 17151 **Rayner, Taylor, and Simpson**: Sanitary towels and the like. 17167 **Clapham**: Pirns or bobbins. [Post-dated January 22nd, 1910.] 17191 **Plant**: Machines for inserting metallic fastenings in the manf. of boots and shoes. 17194 **Wolf, Bambury, and Bernardy**: Incandescent gas lamps. 17195 **Wolf, Bambury, and Bernardy**: Apparatus for supplying gas for illuminating and like purposes. 17209 **Leaver**: Apparatus for solidfying tar. 17210 **Breitbart**: Method of and apparatus for indicating the presence of inflammable gases and other substances in mines and other places. 17214 **Piscicelli**: Actuating devices of cash registers with one row of keys. 17215 **Eisenstein**: Mast or post for wireless telegraphy or other purposes. 17225 **Roberts**: Apparatus for filling liquids into bottles, cans, jars, or other receptacles. 17230 **Wardle Engineering Co., and Wardle**:

Electric incandescent lamp fittings and the like. 17241 Frost and Hansford: Mechanical birds or like objects and means for imparting motion to the same. 17255 Arthur George Hopper and Joanna Elisabeth Hopper Greenwood, Executors of Arthur Greenwood, deceased, and Andersson: Construction of surface condensers. 17259 Cannon: Jockeys or rope grips for mechanical haulage systems. 17260 Bates, and British United Shoe Machinery Co.: Heel-breasting machines. 17274 Schultz: Electric switches.

17302 Bevis and Clayton: Means or apparatus for determining and indicating stresses applied to metal bodies.

This invention has reference to means for determining and indicating stresses applied to metal bodies, and has chiefly for its object to provide such a means which is simple and inexpensive, and is not liable to become deranged or defective under large stresses (or weights). The change of dimension in length of a shaft, bar, or other metallic body when put under stress due to pressure applied thereto is adapted to determine and indicate the thrust or amount of such pressure; and in one application, the change of length of a shaft which is under longitudinal or axial pressure or stress due to the thrust of a ship's propeller, or other longitudinally directed force, is, through the means referred to, adapted to indicate upon a suitable indicating, or indicating and recording mechanism, the thrust. In the case of the invention being applied to determining and indicating longitudinal thrust on a shaft by pressure applied to it longitudinally such as takes place in a ship's propeller shaft, a rod or bar is connected to a suitable part of the length of the shaft, and at another point on the shaft there is applied and fitted the indicating instrument proper which is adapted to indicate in suitable terms the longitudinal movement in or longitudinal extension of the shaft, such terms being indicated as horse power or the like. Within the instrument is arranged or placed a bar or strip of metal, say, spring metal of flat thin form, having a part between its ends a comparatively small amount out of the line or plane in which the two ends lie. One end of the thin strip is supported by and attached to a carrier which is fixed to the shaft at one point in its length, while the other end of the strip is attached to the bar fixed to the shaft at another point in its length. When the shaft is under compressive thrust between the two points referred to, the shortening will be transmitted to the movable spring part through the bar, and the amount of movement transmitted by the bar to the strip or plate will in its movement from the line in which its ends lie (which is parallel with the axis of the shaft) be multiplied, and this magnified or multiplied movement is transmitted to an indicating or recording device, or both, and is thereby indicated. Several modifications of the invention are also described.



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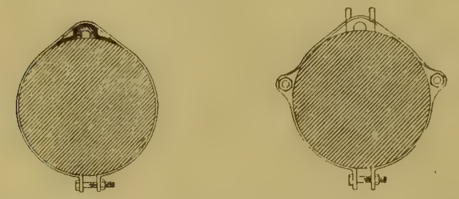
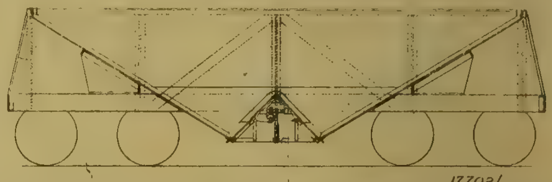


17346 Noble: Compound air or gas compressors or pumps. 17354 Lomschakow: Apparatus for the continuous automatic determination of the quantity of steam or pressure fluid delivered through a pipe. 17367 Reid (Reinforced Concrete Pipe Co.): Reinforced concrete pipes. 17381 Lake (Pine Street Patents Co.): Process of and apparatus for making cement. 17405 Laidler, Laidler, Laidler, and McLoughlin: Miners' safety lamps. 17420 Hiby: Treatment of gases produced by destructive distillation of coal or the like. 17440 Clark: Screw stoppers and their bottles. 17461 Lake (Gail): Machines for buffing or polishing metallic articles. 17467 Bruce and Downie: Apparatus for heating and supplying water to steam generators or the like. 17474 Bailey: Recovery of tin from tin scruff. 17475 Brougham (Akt.-Ges. der Maschinenfabriken Escher, Wyss, and Co.): Method of and apparatus for driving low-pressure steam plants with slightly variable consumption of steam. 17477 Lake (Standard Varnish Works): Liquid-coating machines. 17481 Marks (Soc. Anon. des Plieuses Automatiques): Packing machine. 17482 Clifford: Rifle sights. 17488 Berardi: Appliance for preventing fraud in connection with electricity meters. 17490 Steinert and Stein: Electromagnetic separator with rotating magnet drum. [Date applied for under International Convention, July 27th, 1908.] 17505 Loncaster and Fleming: Gallows hanging blocks for fishing vessels. 17506 Bones: Tool holder for turning lathes, slotting, and other machines. 17520 Holmes: Induction motors. 17523 Marks (Clark): Target practice attachments for firearms. 17547 Bates, and British United Shoe Machinery Co.: Pounding-up, levelling, or smoothing rolls used in the manf. of boots and shoes. 17548 McFeeley: Pulling-over or like machines. [Date applied for under International Convention, July 29th, 1908.] 17553 Baron: Means for charging smoking pipes. [Application for Patent of Addition to 15557, 1909. Cognate Application. 18759, 1909.] 17554 Bruhn: Apparatus for preventing fraudulent manipulation of the registering mechanism of taxameters. 17555 Heurtley: Electrical means for magnifying small mechanical effects. 17614 Cox: Dumb bells. 17619 North and Kirby: Mechanical sirens or fog horns. 17636 Eaton: Window blind clips. 17661 Bronner and Quick: Apparatus for transporting liquids and delivering them in measured quantities. 17662 Geyer: Fireproof doors. 17693 Bradford: Machines for ironing collars, cuffs, and similar articles.

17702 Midland Railway Carriage and Wagon Co., and Currall: Dumping wagons.

Relates to improvements in discharging wagons, and has for its object to provide simple and more effective mechanism for operating the discharging means. A hopper wagon is provided with inclined floor surfaces falling from the upper part of each end of the wagon toward the transverse axis thereof, but arriving at their lowest points at a distance each side such axis. From such points upward and opposite inclining surfaces are formed which meet above the transverse axis and form a central ridge across the wagon, but this is not claimed as new *per se*. In the inclined surfaces of this ridge the mechanically-operated discharge doors are arranged and are operated by a short longitudinal shaft or shafts driven by a transverse shaft presenting a hand wheel or other rotative means or a square for engagement by a key at the side of the wagon where it may be readily operated. Two short longitudinal shafts are arranged under the upper part or crown of the ridge at each side, and each carries a worm wheel or a segment thereof which is driven by a worm on the transverse driver shaft. On each of the short shafts is an arm connected by a link to a transverse rod coupling the mechanism at each side up together. On this rod at each side two arms are jointed, projecting from opposite sides and connected at their extremities with arms jointed to the doors. The doors are hinged at their upper margins and on each a steadying or thrust bar is connected at about the hinge point and is connected to the jointed arms at the joint thereof.



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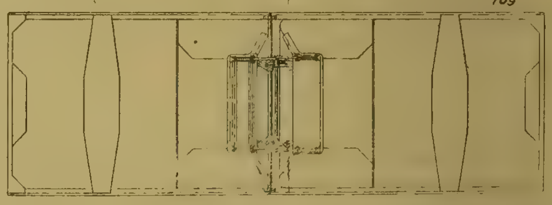
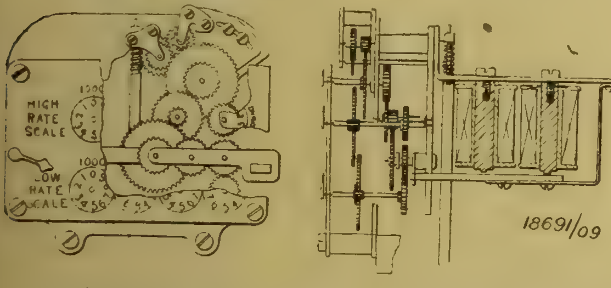


17714 Gordon: Feet of tables and other articles of furniture. 17718 Stoker: Treatment of metals and their alloys. 17726 Clough and Edmondson: Damping and dewing machines. 17750 Munson: Steam boiler furnaces. 17751 Roberts, and British United Shoe Machinery Co.: Machines having a rotary tool or brush for applying cement or other coating material to stock. 17752 Jones: Beverage-dispensing apparatus. 17754 Seymour: Folding machines. 17775 Seymour: Machines for producing pamphlets or the like. 17791 Whitfield: Bedsteads, also applicable for other purposes. 17808 Boult (United Shoe Machinery Co.): Machines for evening and grading soles and other parts of boots and shoes and for other allied uses. 17809 Boult (United Shoe Machinery Co.): Work supports for boots and shoes. 17830 Knoll and Co.: Manf. of purified extracts from aperient drugs. [Date applied for under International Convention, August 24th, 1908.] 17847 Leitner: Reversible variable-speed dynamos. 17854 Scott: Apparatus for storing and preserving eggs. 17856 Basch and Basch: Elastic tyres for the wheels of vehicles. [Request under Section 19 of the Act not granted.] 17862 Kreidl and Heller: Manf. of incandescent gas lamp mantles. 17864 Maggiora and Sinclair: Disc talking machines. 17900 Smith : Cut-off valves for water and other liquids. 17902 Justice (Plant): Insoles for boots and shoes. 17913 Justice (Plant): Work supports for boot and shoe machines. 17919 Mainwaring and Forty: Looms for weaving coir mats and the like. 17934 Faith: Sling for recovering persons or bodies from the water. 17941 Neumann: Ratchet drills. 17951 Johnson (Badische Anilin and Soda Fabrik): Manf. of ammonia and apparatus for use therein. 17952 Temperley, Wild, and Wild: Engines for use in breaking and bleaching paper-making materials. 18059 Jones: Spraying instrument for diffusing water for moistening and dust-laying purposes in mines and other places, and also for use in spraying other liquids. 18098 Lewis: Secondary batteries. 18148 Wilson: Lavatory basins and fittings. 18284 Baudoux: Automatic device for looking springs in different positions and for sustaining loads. [Date applied for under International Convention, August 14th, 1908.] 18390 Heenan and Froude Ltd., and Scholefield: Radial trucks for tramway, railway, and other vehicles. 18471 Tucker: Electrical switches. 18528 Aylett: Construction of concrete arches and the like. 18623 Lake (Goss Printing Press Co.): Variable-speed mechanism for printing presses.

18691 Hamilton, and Ferranti Ltd.: Counting trains for electricity or other meters.

This invention relates to meters of the kind which enable different rates to be charged for the consumption during different predetermined periods, for instance, during night and during day, for example, electricity meters. In such measuring instruments it is usual to employ two separate recording dials, one for night or high tariff and the other for day or low tariff, and the recording motion is caused automatically to change between the two dials exactly at predetermined times. In usual change gears for this purpose a wheel on an arm receives a rotary motion, a portion of which is transmitted to the wheel of the dial train on coming into mesh, but on leaving mesh this wheel may be rotated back again slightly towards the initial position; owing to back lash of the gear, however, the wheel is not brought back fully to the initial position. A gear of this type is therefore objectionable and an incorrect reading is obtained. The object of the present invention is to obtain an improved counting train for meters, more particularly electricity meters, free of this disadvantage. The invention consists in a counting train for electricity or other meters in which there are two or more recording dials, having epicyclic gear so that when changing from recording on the one dial to recording on the other dial no rotary motion is imparted to the dials in the act of changing either when approaching or receding.

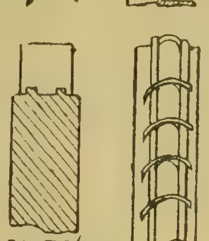


18691/09

18707 Higgs: Transmission gear of motor vehicles. 18759. *See* 17553, 1909. 18815 La Grill and Beveridge: Nut locks. 18989 Fleming: Steam steering gear. 19128 Hayes: Controlling or feeding of colour ink, or such like in printing machinery. 19217 Bontemps: Machine for printing webs of textile fabric. 19369 Pointon and Pointon: Baking ovens. 19386 Macivor, Hommel, and Metals Extraction Corporation Ltd.: Manf. of oxide of zinc for smelting. 19734 Farrer: Bacterial filter beds. 19917 Frew and Sexton: Manifold writing machines. 19929 Marks (Montague Mailing Machinery Co.): Addressing machines and the like. 20017 Cowper-Coles: Reflectors. 20196 Field and Hough: Hat and like pins and point protectors therefor. 20262 Standring: Buffers on looms. 20330 Purdeau: Coal-cutting machines. 20555 Back: Aerial machines. 20558 Dickson: Treatment of sewage. 20612 Jarvis: Appliance for operating on wood and analogous materials, particularly applicable for end-matching boards, and otherwise jointing or treating same. 20866 Walton: Apparatus for collecting the dust caused by stripping the cylinders and doffers of carding engines. 20893 Imray (Farbwerke vorm. Meister, Lucius, and Bruning): Manf. of concentrated formic acid from formates. 20926 Hopper: Folding bicycle frames. 21014 Gabriel: Apparatus for catching crustacea. 21112 Vickery: Machines for feeding or separating sheets of paper and the like. 21174 Loloff: Process for enriching bacteria and like cultures. [Date applied for under International Convention, May 29th, 1909.] 21249 Kohler: Alternating-current motor controllers.

21275 Brien: Process for autogenously welding turbine blades to the body supporting them. [Date applied for under International Convention, September 30th, 1908.]

The present invention refers to an improved process for autogenously welding turbine blades to the body or drum supporting them. In order to facilitate the welding of blades to the drum, it has already been proposed to form thin fillets thereon. According to the present invention, however, not only are one or more fillets provided on the drum, but the blade itself is provided with one or more prolongations or heel pieces for receiving the welding action and one or more relatively thin fillets on the drum for the purpose of facilitating the welding. The welding is then effected by simultaneously melting a portion of the heels and the corresponding parts of the fillets limiting the groove on the disc. A number of modifications of the above invention are also described and illustrated in the specification.



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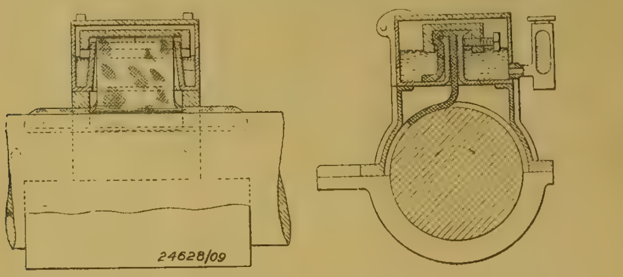
21335 S. Allcock and Co., and Schooling: Fishing rod fitting. 21440 Chalkley: Locking nuts and bolts. [Post-dated March 17th, 1910.] 21515 Hollingworth (Crompton and Knowles Loom Works): Filling replenishing mechanism for automatic looms. 21537 Short: Golf and other balls. 21636 Godsal: Breech-loading small arms. 21666 La Barre: Apparatus for stopping railway trains independently of the drivers. 21775 Thompson-Kelly: Artificial teeth. 21865 Barbour and Orr: Resilient wheels for motor cars and other vehicles. 21892 Macdonald and Baudart: Reinforced concrete construction. 21910 Smith: Steam-heated cooking vessels adapted to be placed in saucepans or similar utensils. 22284 Lamb and Crowley: Means for locking nuts. 22365 Walke: Construction of rollers used in machines for ginning cotton. 22413 Ellis (Le Crinoid Soc. Anon.): Alkaline precipitating baths for cellulose threads. 22434 Chitty and Jago: Treatment of wheat for flour-milling purposes. 22461 Cartland and Esson: Appliances for retaining articles in position upon the ground. [Post-dated October 2nd, 1909.] 22563 Adkins and Lewis: Conveying apparatus. 22634 Douglas: Free-wheel mechanism for cycles and motor cycles. 22797 Anderson: Mechanism applied to and for locking circular air-tight, water-tight, or other closures. 22915 Brashier: Knife-cleaning machines. [Cognate Application. 25764, 1909.] 23447 Benstead and Aron: Lifting jacks. 23458 Chambers: Sharpener for scissors and the like. 23681 Shone and Ault: Liquid ejector apparatus. 23786 Fowler: Breasting machines for the heels of boots and shoes. 23839 Chitty and Jago: Treatment of wheaten stock and flour, and of wheat for flour-milling purposes. [Cognate Application. 8948, 1910.] 23913 Cargill: Adjustable mirror. 23921 Harrison: Revolving heel pad for boots and shoes. 23962 Barnett: Saddle covers for cycles. 24157 Bagguley: Ham-slicing machines. 24451 Holmes: Form or construction of toe case or puff for boots and shoes. 24459 Woolnough: Ladies' handbags and the like. 24463 Eve: Certain games played with pegs or the like in holes. 24498 Helfenstein: Method of utilising the gases resulting from reduction operations carried out in electric furnaces, and electric furnaces for carrying out the same.

24628 Vacuum Oil Co. (Vacuum Oil Co.): Lubricating apparatus for journals and the like.

Relates to lubricating devices for journal bearings and the like, and has particular reference to apparatus of the kind in which a wick or felt conveys the oil from an oil box through an upwardly extending tubular portion within the oil box to the part to be lubricated, the wick being pressed against the tubular portion by a clamp to regulate the flow of oil. According to this invention the oil box, which may be situated immediately above the bearing, is in the form of an annulus—that is to say, it may be provided with an approximately central upwardly extending flanges—one to press, by means of a rib or the oil box nearly to the top thereof, or the oil box may be in the form of a rectangular box with a longitudinal opening at the bottom enclosed by uprising walls open at the top. The wick is threaded through the tubular portion or the uprising walls; one end is bent down and immersed in the oil, whilst the other rests preferably flat upon the shaft. A clamp is arranged to embrace the upper bend of the wick and preferably comprises two downwardly extending flanges—one to press, by means of a rib or projection, the upper portion of the lubricating wick against the tubular portion of the uprising walls of the oil box, and the other to receive a screw which bears on the side of the tubular portion or uprising wall remote from the wick and is adjusted to vary the pressure upon the wick. One side of the upper end of the tubular portion or uprising walls of the oil box may be shortened to allow for the thickness of the wick, so that when the latter is in position the upper end of the unshortened portion of the tube or opening will be flush with the wick as it lies over the shortened portion.



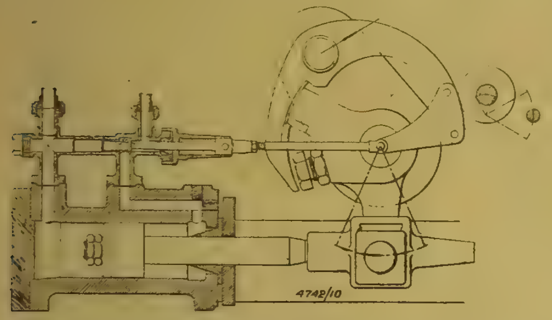
24674 Holden: Machine for the purpose of opening cotton, wool, cotton waste, and other fibrous material. 24881 Spencer and Cobain: Means for darning stockings and the like. 25014 Triumph Cycle Co., and Hathaway: Clips chiefly for use with motor cycle stands. 25081 Gas-Laternen-Fernzundung, System Dr. Rostin Ges.: Gas lighting apparatus. [Date applied for under International Convention, November 6th, 1908.] 25119 Klotz: Safety razors. 25383 Redfern (Compagnie Generale d'Electricite): Apparatus for soldering the filaments of incandescence lamps. 25502 Harrison: Game of skill. 25574 Dier and Whitcher: Electric gas lighters. 25626 New: Tank-enclosed filter for petrol and other liquid fuels. 25764. *See* 22915, 1909. 25797 MacCallum: Photographic printing frames and the like. 25809 Swan: Separation of liquids from finely-divided material such as gold ore slime. 25979 Lindblad and Stalhane: Method and furnace for the reduction of zinc. [Date applied for under International Convention, November 11th, 1908.] 26054 Chinn: Receptacle for preserving bread and other substances. 26063 Aron: Oil or like lamps. 26116 Rossiter: Tobacco pipes, cigar holders, and the like. 26137 Grant, Giusti, and Agretti: Auxiliary road shoe brakes for motor cars and vehicles generally. 26234 Teufel: Porous plaster. [Date applied for under International Convention, November 12th, 1908.] 26285 Muller: Paper-bag machines. 26443 Von Borosini: Pessaries. 26481 Obermiller: Time stamps. [Date applied for under International Convention, November 18th, 1908.] 26564 Lambie: Addressing machines. 26569 Jarvis: Charging of acetylene or other like gas generators. [Post-dated December 17th, 1909.] 26649 New Ignition Syndicate, and Sandy: Electrolyte for use in electric batteries. [Application for Patent of Addition. 10520, 1908.] 26722 Gulline: Foldable boxes and crates. 27036 Parker, Winder, and Achurch Ltd., and Achurch: Holders for sliding window sashes. 27111 Mackenzie (Miner Engineering Co.): Rotary pumps, blowers, prime movers, and the like. 27117 Simon: Holders for emery cloth. 27130 Dreyfus, Friedl, Bentley, and Clayton Aniline Co.: Manf. or purification of indiarubber and the like and the obtainment of by-products therefrom. 27160 Pusey: Device for use in connection with wood screws. 27244 Justice (Plant): Jacks for slugging and other machines. 27294 Dickinson: Boxes or cases used as containers for shaving soap or the like. 27976 De Laminiere, and Soc. Anon. des Accumulateurs de Laminiere: Accumulator plates. [Date applied for under International Convention, December 8th, 1908.] 28107 Hutton: Intercepting traps for drains. 28431 Wiedemann and Templin: Vacuum pumps. [Date applied for under Rule 13, August 11th, 1909.] 28468 Kurze: Metal cores for use in casting hollow bodies. 28931 Brown and Scott: Reversible slow or high-speed steam turbine. 29109 Greenfield: Bottles and similar receptacles. [Date applied for under International Convention, December 14th, 1908.] 29191 Sudre: Process and apparatus for cleaving slate blocks and the like. 29558 Sharp: Folding leg for tables and the like. 29674 Bloxam (Akt.-Ges. fur Anilin-Fabrikation): Manf. of a new yellow monoazo-dyestuff for wool. 29691 Claes: Process for agglomerating minerals, combustibles, metals, and other material which is in small fragments. 29731 Wilson: Board for use in finishing cloth or for other like purposes. 29774 Dardeau: Locks. [Date applied for under International Convention, December 21st, 1908.] 29850 Converse: Type-line casting machines. [Date applied for under International Convention, April 19th, 1909.] 29878 Bloxam (Firm Geb. Sulzer): Internal-combustion engines. 30022 Beasley and Burnett: Flooring cramps. 30218 Westlake: Bottle stoppers. 30253 Robinson: Reciprocating traverse motions of wood-mortising machines. 30294 Kopper: Regulating and reversing apparatus for regenerative gas furnaces.

1910.

10 Bernard: Sights for firearms. 257 Buss, Jucker, and Rossetter: Fast reed stop motions for looms for weaving. 349 Krause: Metal filaments lamps having filament carriers arranged elastically. [Date applied for under International Convention, July 5th, 1909. Originally included in 22458, 1909.] 484 Rodman: Mixture for case-hardening purposes. 774 Von Pausinger: Alarm apparatus for preventing explosions and poisoning by gas. [Date applied for under International Convention, January 11th, 1909.] 830 Meyer-Zimmerli: Bunsen burner for illuminating purposes. [Date applied for under International Convention, January 19th, 1909.] 1001 Dumont: Automobile vehicles. [Date applied for under International Convention, January 16th, 1909.] 1328 Hubner: Process of extracting caffeine from coffee. 1408 Bergstrom: Dish washers. 1698 Striebel: Corsets with stocking suspenders. 1743 Witte: Process for making butter. 1773 Newton (R. Hoe and Co.): Sheet delivery mechanisms. 1776 General Composing Co. Ges., and Degener: Matrix for matrix-setting and line-casting machines. [Date applied for under International Convention, October 13th, 1909.] 1806 Schauman, Luxenburg, and Schlegel: Polishing devices for knives, forks, and the like. 1874 Kapp: Means for the suspension of portiere rods upon doors. 2016 Jenkins: Receptacles or boxes of paper or like material. [Date applied for under Rule 13, October 29th, 1909.] 2512 Pinders: Ball-grinding machines. [Application for Patent of Addition to 17849, 1909.] 2739 Fairbrother and Smith: Apparatus for the production of carburetted air. 2896 Chaddock and Chaddock: Gloves. 3083 Chemische Fabrik von Heyden Akt.-Ges.: Manf. of a new class of chemical compounds. [Date applied for under International Convention, February 10th, 1909.] 3266 Mitchell: Hydraulic presses. [Application for Patent of Addition to 11769, 1909.] 3373 Beckmann: Manure distributors. 3409 Lehrl and H. N. Schasny Nachf. Ges.: Valve for water pipes and the like. 3559 Knoll and Co.: Manf. of films from acetylcellulose. [Date applied for under International Convention, February 16th, 1909.] 3572 Ransom: Device for teaching billiards. 3655 Schlesinger: Boots. 3673 Levin: Manf. or treatment of flour. 3698 Giesecke: Process and apparatus for dressing ores. 3711 Bethke: Centering chucks. 3773 Lendrum: Tobacco pipes and holders for cigars, cigarettes, and the like. 3835 Morelle: Devices for turning the leaves of music, books, and the like. 3837 Griffiths: Liquor-serving contrivances. 3858 Hulot: Wire-stapling machines. [Date applied for under International Convention, February 16th, 1909.] 3938 Roellig: Marine steam turbines. [Date applied for under International Convention, April 29th, 1909.] 3955 Robbins: Umbrellas, parasols, walking sticks, billiard cues, hunting crops, and the like. 3964 Manufactures Royales De Corsets P. D. Soc. Anon.: Stiffenings for corsets, belts, and other articles of wear. [Date applied for under International Convention, August 28th, 1909.] 4142 Evans and Evans: Railway rail chairs. 4159 Favary: Apparatus for expanding, stretching, or enlarging or contracting or compressing. 4286 Mathis and Brennan: Automatic self-closing funnels. [Date applied for under International Convention, February 20th, 1909.] 4494 Johanssen: Closing devices for preserve tins. 4508 Osman: Method of and means for attaching collars to shirts. 4678 Rockstroh: Controlling device especially applicable for use with electrically-operated printing and stamping machines. 4731 Boyler: Button-hole sewing attachments for sewing machines.

4742 Hargreaves and Hudson: Trip valve gear for steam engines.

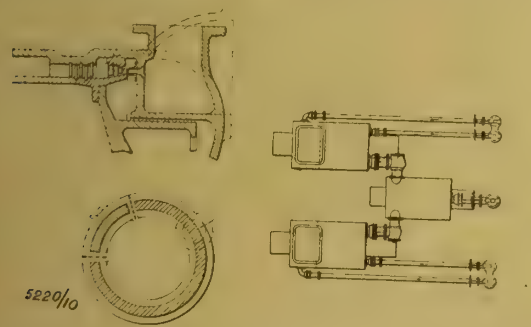
Steam dashpot devices for Corliss and other trip valve gear have the disadvantage common also to the usual spring or vacuum-operated dashpots that the pressure or reaction acting to close the valve acts also against the opening of the valve, with the effect, of course, of throwing a greater strain upon the gear during the opening moment. The present invention has for its object to overcome this objection by the provision of valve gear operated means for balancing (or partly and to an effective extent) the steam pressure upon opposite sides of the dashpot piston during the opening movement of the valve, and at the same time providing adequate unbalanced pressure upon the effective side of the piston during the closing period of the valve. According to the invention these means comprise a valve operated from the main valve gear and controlling ports communicating with opposite ends of the dashpot cylinder and connections respectively to the valve chest and to the engine cylinder in such manner that during opening of the main valve steam at the higher pressure is admitted to both sides of the dashpot piston, and during closing of the main valve this steam continues to be admitted to one side of the piston, but the other side is put in communication with the engine cylinder where the pressure is lower, and there is thus a preponderating pressure upon one side of the dashpot piston adequate to effect closure of the main valve.



4806 Davis: Tobacco pipes and the like. 5051 Paget and Horseman: Combined table and wringing and mangling machine. 5219 Akt.-Ges. Brown, Boveri, et Cie.: Ahead and astern turbines. [Date applied for under International Convention, October 25th, 1909.]

5220 Akt.-Ges. Brown, Boveri, et Cie.: Marine turbine installation with three shafts. [Date applied for under International Convention, November 29th, 1909.]

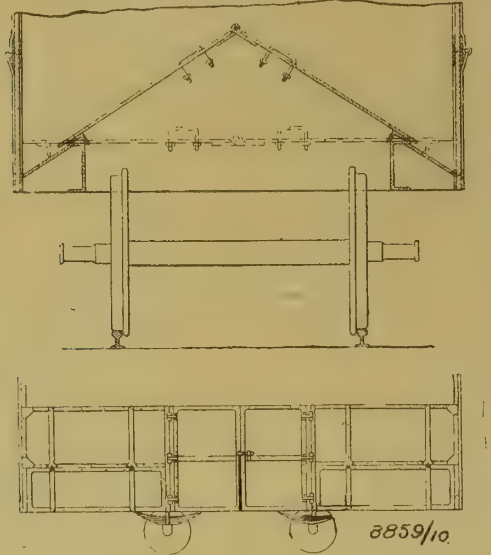
This invention relates to marine turbine installation with three shafts, and the object of the same is to utilise the drop of pressure of the steam as economically as possible, even if the low-pressure turbines are supplied with live steam (for instance, when manœuvring or occurrence of damage to the ship owing to collision or the like). It has already been proposed in a turbine having an action section followed by a reaction section to provide two sets of nozzles, one set being adapted to admit high pressure and the other low pressure working fluid to the action section so that the fluid emerging from all the nozzles will be at the same pressure, the guide blades between the successive rows of moving blades of the impulse wheel being omitted in the part of the action section supplied with low-pressure fluid, whereby the low-pressure fluid after being throttled in the nozzles passes through the first row of moving blades, but flows idly through the rest of the blades on the action wheel to the succeeding reaction stage. This arrangement, however, introduces a serious disadvantage in the losses occasioned by the friction and consequent retarding action of the fluid on the remaining rows of blades on the action wheel. The present invention, which is designed to overcome the above disadvantage and to provide in a three-shaft installation a turbine which shall run with maximum efficiency and economy, consists in a three-shaft turbine installation the low-pressure elements of which are provided at their inlet end with an action stage having two independent sets of nozzles for admitting high-pressure and low-pressure working fluid respectively, the working fluid in each case after passing through the same number of blades in the action stage being further expanded in a succeeding action or reaction stage. The invention also consists of a three-shaft turbine installation having two similar action or reaction low-pressure turbines, each of which is provided at the steam inlet with an action stage having two separate sets of nozzles, one set of which extends around a greater arc of the bladed drum than the other set, and is adapted to admit steam to the action stage when the low-pressure turbine is working in series with the high-pressure turbine, while the other set of relatively smaller arc is available when live steam at a high pressure is to be admitted directly to the low-pressure turbines.



5259 Jackson: Wheels. [Date applied for under International Convention, March 11th, 1909.] 5392 Tabourin: Steam engines. 5560 Frost and Bradwell: Ferrules for umbrellas, parasols, walking sticks, and crutches. 5571 Midgley and Vandervell: Electric switches. 5663 Hammerstein: Mouthpieces and lip protectors for cigars. 5708 Muller, Muller, and Sebanek: Life guards and obstruction removers for vehicles. 6155 Nobel's Explosives Co., and Hodge: Machine for breaking up cartridge cases. 6317 Forster: Mode of adjustably securing shuttle box fronts on lays of looms. 6343 Wing and Hempy: Street cars and similar vehicles. 6454 Henry Millard and Sons, and Bartleet: Manf. of artificial fishing bait. 6495 Brown: Air-hose couplings. [Date applied for under International Convention, March 15th, 1909.] 6503 Atkinson: Piano-playing mechanism and the like. [Application for Patent of Addition to 1439, 1909.] 6674 Levens: Pneumatic or inflatable tyres. 7154 Siemens Bros. and Co. (Siemens and Halske Akt.-Ges.): Electrical signalling apparatus. 7172 Collins: Variable-speed and reversing gearing. 7543 Soc. Anon. de Commentry, Fourchambault et Decazeville: Crushing machines. [Date applied for under International Convention, April 14th, 1909.] 7544 Luke: Means of reinforcing concrete beams, piles, columns, struts, floor slabs, and the like. 7623 Ball: Propellers. [Date applied for under International Convention, April 27th, 1909.] 7643 Schade: Paper rolls. [Date applied for under International Convention, July 16th, 1909.] 7709 Worcester (Turner and Co.): Pulleys. 7805 Huttner: Combined table and swing seats. 7820 Wootton and Howett: Fire alarms automatically operated by excessively high temperature. 7822 Siemens Bros Dynamo Works (Siemens Schuckertwerke Ges.): Starting of polyphase electric asynchronous motors. 7836 Loret: Lever for effecting the movement of wheeled vehicles. [Date applied for under International Convention, April 19th, 1909.] 7857 Schumann: Machines for perforating porcelain ware or the like. 8067 Murie: Rotary strop or sharpener for razors or like implements. 8089 Flachs: Process and apparatus for stopping the burning of highly volatile liquids in receptacles and tanks. [Date applied for under International Convention, April 5th, 1909.] 8121 Adams: Bicycle stands or supports. 8134 Buhring and Wagner: Device for testing steam. 8137 Justice (Societa Anonima Fiat san Giorgio): Floating docks adapted for testing the resistance to external pressure of submarine or submersible vessels. 8171 Ullrich: Dredge for powder cans. 8202 Watts: Process of manf. of reinforced air tubes for tyres. 8203 Erste Triester Reisschalfabriks Akt.-Ges.: Process for rendering gluten or substances containing gluten soluble. [Date applied for under International Convention, March 1st, 1910.] 8207 Wilson: Fire resistant shutters or curtains. [Date applied for under International Convention, May 19th, 1909.] 8219 Leitner: Reversible variable-speed dynamos. [Date applied for under Rule 13, July 31st, 1909.] 8220 Giesecke: Process of dressing ores. [Application for Patent of Addition to 3698, 1910.] 8353 Harrison (Maschinenfabrik Sack Ges.): Machine for straightening metal plates, rods, and the like. 8442 Deskins: Sash holder and lock. [Date applied for under International Convention, April 7th, 1909.] 8449 Hewitt: Light-transforming reflectors. [Date applied for under International Convention, September 18th, 1909.] 8467 William Newman and Sons Ltd., and Newman: Appliances for opening and closing fanlights, roof lights, windows, and the like, and for analogous uses. 8717 Martin: Means for securing railway rails to sleepers. [Date applied for under International Convention, April 9th, 1909.] 8736 McFeely: Pulling-over or like machines. [Date applied for under International Convention, July 29th, 1908.] 8841 Griffiths: Automatic apparatus for preventing explosion in grinding and crushing mills.

8859 Birle and Audouin: Goods wagon with adjustable bottom. [Date applied for under International Convention, April 15th, 1909.]

This invention relates to a goods wagon with an adjustable bottom. Wagons already exist in which the discharge is obtained by rocking of the floor, but in these the discharge is not truly automatic, since it is produced by the raising of the floor and of the load which requires the action of motive power. Moreover, these wagons are only adapted for the transport of friable goods and cannot serve at the same time for the transport of ordinary merchandise in the form of packages. This invention refers to a wagon the floor of which is movable and may be either arranged horizontally in the ordinary manner or at an angle in such a manner as to form a double incline permitting of an automatic discharge of the material conveyed. For this purpose the floor is made in two longitudinal flaps or panels hinged in the middle and carrying at their extremities under their lower faces longitudinal stops which, when the middle ridge of the floor has been raised, serve to maintain



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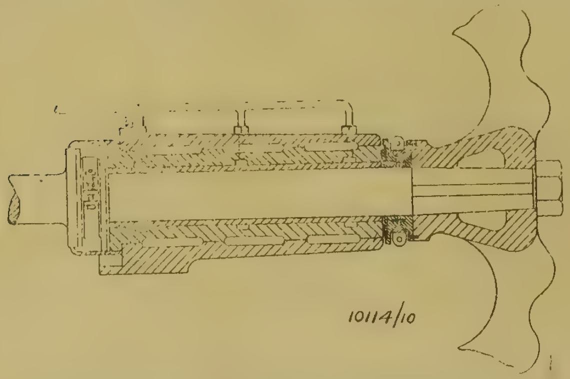
the double inclination of the same in position, while resting on lower supporting frames with lateral parts forming fixed inclined planes for the purpose of prolonging the surfaces of the floor. Movable handles are suitably mounted in the panels of the floor for permitting of adjusting the latter.

8948. *See* 23839, 1909. 9046 Siemens Bros. Dynamo Works (Siemens Schuckert-Werke Ges.): Polyphase electric compensated series motors. 9431 Ninde: Straps for corsets, abdominal belts, and the like. 9589 Carah: Heel pads or protectors for boots and shoes, and means for securing the same. 9618 Smith: Spark plugs. 9745 Evans: Bolts and nuts. 9867 Northey: Sound-producing devices for fog-signalling, position locating, or the like. 10105 Pryce: Panelling and marking apparatus for brick-making machines. [Post-dated August 3rd, 1909. Originally included in 2470, 1909.]

10114 Wm. Simons and Co., Brown and Brown: Bearings for dredging apparatus. [Post-dated December 4th, 1909.]

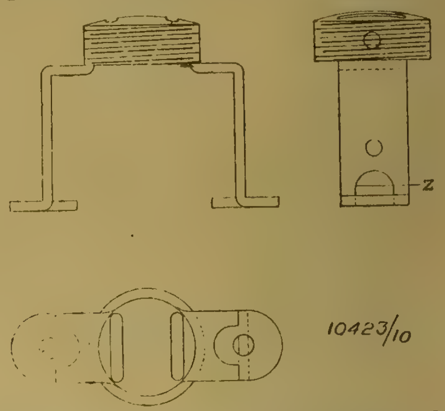
This invention relates to improvements in and connected with bearings for dredging apparatus, and has for its object to provide improved means in substitution for those heretofore employed for taking up thrust on the cutter



10114/10

shaft and protecting the bearings against the entry of sand. To this end the means employed comprise cone-shaped rings forced apart by a correspondingly shaped spring collar whereby the face of one of the rings is pressed tightly against the end face of the shaft bearing.

10423 Lundberg, Lundberg, and Lundberg: Electric switches. Relates to electric switches of the tumbler type, and more particularly to a construction of bridge piece for same. It will be seen from the figures that the upper ends of these legs are connected with the lower edge or part of the screw-threaded cap or cup-shaped part by horizontal pieces. This construction causes the legs to be separated further apart than is ordinarily the case and provides more room for the switch movement. The alteration in the spacing of the legs may, and probably will, cause trouble in the secure fixing of the bridge piece to the switch base, as the flanges on the lower ends of the legs, if made of an area large enough to have a firm seat on the base, may or will interfere with the fixing of the base to a wall or abutment or some of the electric terminals or connections. The flanges are, in accordance with this invention, not made larger than is ordinarily the case, additional bearing or footing surface being provided by flanges which extend



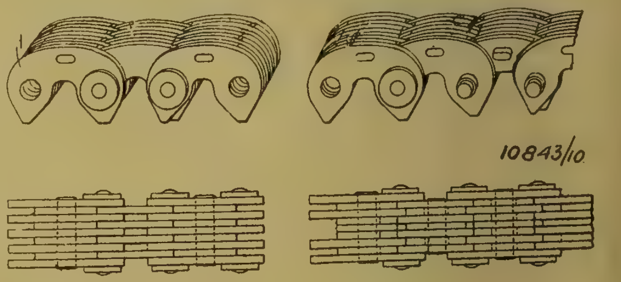
10423/10

inwardly with respect to the legs and are formed by cutting the leg on the line marked Z and bending such cut out piece downward until it is in the same plane as the flange. The holes to receive the ends of the screws that attach the bridge piece to the base are formed so as to come below the legs and within the recesses or openings left when the flanges are formed.

10458 Peignon: Fencing and the like. [Date applied for under International Convention, May 29th, 1909.]

10843 Morse: Power transmission mechanism. [Date applied for under International Convention, December 15th, 1908. Originally included in 28923, 1909.]

This invention relates to drive chains, more particularly to the type of chain in which the links are composed of a plurality of plates adapted to arch over the sprocket teeth, the chain links being joined by joint pins usually with a number of plates forming one link interspersed on a joint pin with the plates of the adjacent link. According to the invention the plates of a number, or all, of the links of a chain are secured rigidly together with spacing pieces or

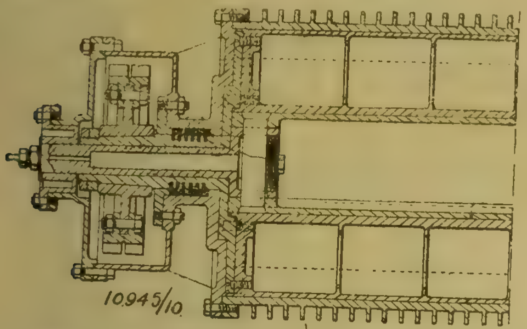


10843/10

washers interposed between the plates of the links prior to assembling and jointing the links to form a chain. This construction provides openings in a link for the plates of the adjacent link, thus permitting free movement between the interspersed plates of adjoining links; at the same time the plates of one link are rigidly secured together and irregular movements of the plates tending to cause relative lateral movement between the joint pins and plates is prevented. In the preferred construction the spacing pieces or washers are interposed between the plates of a link at the middle or arch portion.

10945 Raclot and Enderlin: Rotary pumps. [Date applied for under Intetnational Convention, May 3rd, 1909.]

This invention relates to a rotary pump suitable for liquids and gases, but designed more especially for use as a compressor and a vacuum pump. Rotary pumps are known of the type in which two intersecting parallel fixed pump cylinders of equal diameters having common suction and delivery openings are each provided with a fixed hub recessed at its periphery on the side facing the other hub along a cylindrical surface coincident with the internal surface of the other cylinder, and each contains a pair of diametrically opposed slides fixed to each other, rotating around each hub in the interior of each cylinder fluid-tight with the hub and internal surface of the cylinder. Each pair of slides is connected to and driven by a shaft extending through the hub in the respective cylinder, and the two shafts are geared together outside of the pump casing in such a manner that the slides of one cylinder rotate in the contrary direction to the slides of the other cylinder and without colliding with them. Each slide in moving past the suction opening encloses between itself, the other slide of its cylinder, the hub, and the side of the cylinder, a quantity of fluid which is then forced out by it through the delivery opening. The present invention has now for its object to provide an improved rotary pump of the type above specified, and it consists substantially in an improved arrangement and construction of its parts. In the improved rotary pump the fixed hubs extend from end to end of their respective cylinders, and each is supported at each end by an axle or extension on which a plate or part driving the two rotary slides of that cylinder is rotatably mounted, there being no shafts or axles extending through the fixed hubs or the cylinders.



11254 Verhoeven: Burglar alarms. [Date applied for under International Convention, May 6th, 1909.] 11365 Claessen: Manf. of smokeless gunpowders. 11784 Paton: Kind of game. 12150 Justice (Dupont, Dupont, and Hodgkinson): Starting devices for internal-combustion and like engines. 12463 Crowley: Hatpins. 12678 Robinson: Rotary cutter heads or blocks for wood-planing machines. 12834 Muller and R. M. D. Syndicate: Presses for making screw-threaded bottle stoppers and the like. 13188 Winz: Props for mines. [Date applied for under International Convention, June 1st, 1909.] 13307 Brauereigesellschaft vorm. S. Moninger Akt.-Bes.: Bottles and the like. [Date applied for under International Convention, March 23rd, 1910.] 15272 Hess: Ball bearings. 15826 Ziron: Locks. [Date applied for under Rule 13, May 22nd, 1909.] 15832 Hugon: Protecting shields for resilient tyre blocks. [Date applied for under International Convention, July 12th, 1909.]

Complete Specifications Open to Public Inspection before Acceptance, under the Patents Act, 1907.

1909.

25899 McNab: Registering and indicating apparatus. 27392 Marthinson: Paper receptacles and means for securing the ends or closures therein. 28140 Akt.-Ges. Brown, Boveri, et Cie.: Blading for steam turbines and the like.

1910.

6781 Compagnie pour la Fabrication des Compteurs et Materials d'Usines a Gaz: Method for preserving constant tension in driving springs. 8197 Heine: Machines for trimming the edges of metal boxes. 8503 Champ: Automatically-operated valves. 8831 Jellinek and De Tovaros: Suspension of trolley wires. 9764 Reutter: Collapsible covers or hoods for motor and the like vehicles. 10528 Voss: Windlass for cranes. 11267 Kupke: Holders for tools and the like. 11417 Schlogel: Strap-fastened boots having adjustable buckles. 11600 Firm Robert Bosch: Terminals for electric cables. 11782 Maschinenfabrik vorm. Geb. Guttsmann und Breslauer Metallgiessei Akt.-Ges.: Liquid meter with Woltmann screw. 13013 Barbaudy: Supporting devices for aeroplanes or the like. 14273 Behringer: Gas main stoppers. 14575 Firm Robert Bosch: Constructing magneto electric ignition machines for internal-combustion engines. 15050 Optische Anstalt C. P. Goerz Akt.-Ges.: Magazine dark slides with change boxes. 15407 Derreumaux-Bulteaux: Means for dyeing fabrics. 15540 Yberty: Resilient heel and sole tread pads for boots and shoes. 16048 Walther, Wolf, and Co. Ges.: Manf. of new compounds containing iron albumin and phosphorus. 16150 Edge: Hinging machines. 16270 Bergmann: Folding seat especially suitable for motor vehicles. 16632 Farbwerke vorm. Meister, Lucius, and Bruning: Manf. of a remedy for tuberculosis. 16700 Hartmann: Device for folding sheets. 16732 Soc. Industrielle de Celluloid: Floating doll. 16836 Chemische Fabriken vorm. Weilerter-Meer: Stirring and mixing apparatus. 16932 Farbenfabriken vorm. F. Bayer and Co.: Process for producing solutions of cellulose esters. 16988 Boudouin: Apparatus for automatically cutting off steam supply to pipes in case of accident. 16997 Siemens Schuckertwerke Ges.: Electric speed regulation of machines. 17013 Kulelka, nee Stoffel and Friedmann: Method of securing natural or artificial hair in pulp. 17047 Siemens Schuckertwerke Ges.: Electric fuses. 17066

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The patent covers an invention interesting to manufacturers of Condensers or of Apparatus for cooling water or other liquids.

Detailed information as to the invention will be found in the patent specification, of which a copy will be supplied to any interested party on request.

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THE
PRACTICAL ENGINEER
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SOME PROBLEMS OF MOTOR VEHICLE CONSTRUCTION.

ALTHOUGH great progress has been made of late years in motor vehicle construction, and a great portion of the difficulties formerly experienced have been satisfactorily overcome, there still remain some problems of construction to be solved. The ordinary types of clutch gearing, for instance, can hardly be called a mechanical device which appeals to a truly mechanical mind, and although the patterns in common use both work better and last longer than might reasonably be expected, there certainly is room for improvement in this direction. Mr. Dugald Clerk suggested some time ago the possibility of designing a pneumatic clutch by means of which the motor could be connected with the transmission gear without imparting any violent shock or jar to mechanism.

Many different special forms of clutch mechanisms have been invented, but so far few of them seem to have survived the test of practical work, and none of them have proved themselves to any appreciable extent superior to the ordinary forms in general use. Here, then, is still an opening for some inventive genius!

Another portion of the mechanism of a motor vehicle which appears to be anything but a triumph of mechanical skill, which indeed, without undue exaggeration, may be termed a perfectly barbarous device, and is undoubtedly the weak link in the common type of motor vehicle, is the change-speed gearing. Yet in spite of the lack of scientific qualifications, the apparent liability to rapid deterioration and to injury by accident, the ordinary pattern of change-speed gear seems to serve the purpose exceedingly well, and has easily survived the numerous contrivances, some of them extremely ingenious, that have been devised.

Many attempts have been made in the above connection to design an oil engine the speed of which can be sufficiently controlled to admit of change-speed gearing being entirely dispensed with, or at least of reducing to a minimum the number of change wheels required.

A difficulty to be overcome in an arrangement of this description is the comparatively non-elastic nature of the explosive engine. Without the accession of power obtainable through the speed gearing, the motor employed must obviously be of a power sufficient to enable the vehicle to surmount with a direct drive the steepest gradients to be met with.

This means that the power and the weight of the engine would have to be excessive for ordinary conditions of road surfaces and gradients, and this would be decidedly disadvantageous. Attempts to overcome this objection and to admit of the use of a motor of moderate power have been made; for instance, in the petrol-electric type of motor vehicle in which a dynamo and an accumulator are employed for adjusting or regulating the working of the motive power, by storing up energy when the resistance to the movement of the vehicle is slight, and giving it up again to assist the petrol motor when required upon emergencies.

Other inventors have tried to attain the object in view by the use of air pumps supplying to the petrol motor a charge of air and of petrol at a high pressure. This would, of course, enable a smaller engine to be used, but the higher cylinder pressures call for greater strength, and against what would be gained in compactness must be placed the extra weight. Mr. Clerk's experiments with different arrangements for super-compression have demonstrated that the pressure on the piston at slow speeds can be increased by about 50 per cent over the mean pressure, and the general results obtained indicate that speed gearing could almost be dispensed with, at any rate for moderate powers.

Another opening exists for the design of an explosive engine of increased elasticity, but we hope to return to this subject in a later issue.

EXPERIMENTS of considerable interest have lately been conducted in the English Channel with the object of testing the ability of a modern warship to repel an attack by aeroplane. The scout Adventure put to sea, having on board a contingent of men of the balloon section of the Royal Engineers from Aldershot, and a new type of military kite, which has recently been subjected to a series of exhaustive and highly satisfactory tests. At some preliminary trials made by the Adventure, four kites were flown to a height of 3,000 ft., and they lifted a target 1,500 ft. in the air. At first only the working of the mechanism was tested, but at a subsequent stage of the proceedings the target was fired at while the ship was steaming at a high speed with the kites in tow, the object being to test the ability of a ship as at present equipped to destroy by gunfire a hostile body moving rapidly at a great height through the air, and consequently to destroy an aeroplane before it could take up a position overhead to deliver an attack. Strict secrecy has been observed both by the naval and military authorities as to the results of the experiments, but it is understood that some valuable data has been obtained.

AN opinion was expressed in the *Electrical Review* some few months back that the so-called secret syndicate in the German electrical industry, which was composed of the four leading manufacturing firms, with the object of attempting to secure all contracts thrown open to public competition, was either no longer in existance, or the revelations of its "price protection" policy had wholly counteracted its efficacy in the matter. It is now, says our contemporary, announced that the syndicate will expire in October, and is not likely to be renewed. The agreement was at first kept secret, but, on its becoming public, it was severely criticised, and was subsequently only rarely brought into operation, especially as the announcement of the details led to firms, other than those forming the syndicate, being invited to participate in the competitions, and this caused the objects of the syndicate to be frustrated.

A RECENT judgment has decided that there is no master patent in steam heat accumulators, and this decision lends additional interest to the designs for contrivances of this kind which are now being put on the market. The General Electric Co., of Schenectady, U.S.A., has recently patented an apparatus of this class which possesses several novel features. There is, as in most apparatus of this kind, a large tank partly filled with condensed steam, through which the steam coming from the primary engine bubbles on its way to the exhaust turbine or engine. The chief novelty lies in the method of securing a proper mixing of the steam and the water. The steam is introduced through a horizontal pipe which is immersed in the water and leaves the pipe tangentially through nozzles. The pipe is, moreover, mounted on ball bearings, so that the reaction of the steam escaping from the nozzles causes it to rotate and thus assists in the proper mixing of the steam and water. The advantage possessed by the above arrangement is that it is automatic and does not require motor or engine-driven pumps for circulating the water.

OUR contemporary, *Canada*, gives some interesting particulars regarding the working of the St. Clair tunnel by the Grand Trunk Railway. The St. Clair tunnel was electrified presumably in order to escape smoke nuisance, and the use of expensive anthracite locomotive coal had probably much to do with electric traction's good showing, but as this has been achieved on a road and with traffic conditions which the railway man would presumably—smoke nuisance apart—not hesitate to work by steam on the grounds of cost alone, the result must be more than ordinarily satisfactory to those who believe that the paying sphere of electric traction can be much more widely extended than it is at present. How far the case of the St. Clair tunnel—where success has largely resulted from reduced fuel cost—may apply to steam lines in this country it would be difficult to say, but as the railways of the United Kingdom spend annually some 5½ million pounds on locomotive fuel alone, or an average of over 4d. per train-mile run, there is evidently some scope for economies in this direction.

BATTLESHIPS FOR TURKEY.—According to the *Times* correspondent in Constantinople, the Ottoman Government will forthwith place an order for battleships with the Armstrong group, the only point which has not yet been settled being whether one or two ships shall be ordered. The same authority fully confirms the statement of the *Tanin* with regard to the decision of the Government to buy no more old warships, and adds that an order for fifteen or twenty merchant vessels will shortly be placed in England.

IT is reported that an amalgamation between the Birmingham Small Arms Co. and the Daimler Motor Co., of Coventry, is about to take place, and that an announcement of the fact will shortly be made. In 1907 the Birmingham Small Arms Co. absorbed the Eadie Manufacturing Co. The authorised capital is now £1,000,000, of which £796,850 is in ordinary shares and the remainder in five per cent cumulative preference. All the preference and £17,225 of the ordinary shares have been paid up. The dividend last year was 10 per cent, and an interim dividend of an equal amount was declared in March. The last balance sheet issued showed that the reserve funds amounted to £130,000. The authorised capital of the Daimler Co. is half a million in £1 shares, £300,000 being 6 per cent cumulative preference shares, and £200,000 ordinary. £76,300 preference and all the ordinary shares have been paid up. An interim dividend of 5 per cent has been paid to the ordinary shareholders on account of the present year.

The completion of the direct cable connecting Montreal with the Bamfield Creek Cable Station effects the connection of the longest cable in the world, viz., one of 3,458 nautical miles, with a land line of 3,000 miles in length. As a result of this new arrangement it is expected that the average time occupied in the transmission of a message between Australasia and London will be reduced by some fifteen minutes.

The Allan Line Ltd., of Glasgow, are said to have under preparation designs for three turbine liners for use on their mail service between Great Britain and Canada. The vessels will be larger and faster than any yet on that route, and are understood to be due to the fact that the mail working service with the Canadian Pacific Co. is not to be renewed. The Canadian Pacific Co., it is also stated, will enter the market for two fast steamers.

PRACTICAL METALLURGY.

By Horace Allen.

(Continued from page 229.)

Wrought Iron Manufacture Direct from the Ore.

The comparatively low temperature at which oxide of iron can be reduced to the metallic state renders it possible to produce wrought iron in small quantities at a time by very simple and inexpensive means. Even at the present date hundreds of tons of wrought iron are produced in India alone by extremely primitive methods, and in which the temperatures attained by the furnaces never reaches that necessary for the manufacture of cast iron, the product of these native furnaces being more or less impure iron in the form of a porous lump, in which a considerable portion of slag remains intermingled.

Small furnaces, built of clay and sun-dried bricks, of which over 400 are frequently operated during the year, produce, in from 12 to 14 hours, a lump of iron weighing about 70 lbs. from 370 lbs. of ore and 390 lbs. of charcoal; no flux is employed, and there is a considerable waste of ore in the slag formed. The ironmaker is not paid for building his furnace, and the primitive bellows used is made of goat skins, only lasting a season.

Smaller furnaces, in about three hours, produce a lump 20½ lbs. in weight from 92½ lbs. of ore and 86½ lbs. of charcoal.

From a description of the methods of producing wrought iron in the central provinces of India, by Mr. L. F. Begbie, I.C.S.,[*] the writer has sketched the typical furnace used by the natives in fig. 70. The materials of which the furnace is constructed consists of clay and sun-dried brick, the back being somewhat semi-circular and the front wall of clay, only about 2 in. thick, which only lasts for about eight days, when it has to be replaced. The top of the furnace is covered by clay about 1½ in. thick, having a hole about 6 in. square for the exit of the gases.

The bellows, of goats' skins, are worked by a man sitting in the trench in front of the furnace, a roof of branches forming a protection from the sun. The building of the furnace occupies about 10 to 20 days. Owing to the small height of the furnace, carbon deposition in the ore as it becomes reduced does not occur to any great extent, so that instead of forming cast iron, the reduced metal forms a porous lump in the bottom of the furnace. There are many other primitive types of furnaces still to be found in use for producing malleable or wrought iron direct from the ore, but as the progress of metallurgy has rendered these methods almost obsolete, the above has been referred to as showing that the reduction of metallic iron from its oxides can be effected at moderately low temperatures with very inexpensive apparatus. Though the product of these furnaces only varies up to about 3 cwt., the lumps can be welded together to form larger masses. While the yield of the furnaces above quoted only amounts to about 20 per cent, other types range up to 33 per cent of iron from the ore. The removal of the intermingled slag is effected by reheating and hammering or remelting in an open-hearth furnace. The chemical action of reduction is similar to that which occurs in the upper part of the modern blast furnace.

Wrought Iron Manufacture from Pig Iron.

Although for structural and many other purposes the use of wrought iron has very largely been replaced by mild steel made by the open-hearth or Bessemer processes, owing to its special characteristics, there are many purposes for which it is still preferred, and occupies a space in specifications. For many forgings and drop-stamp work wrought iron gives a more satisfactory result than mild steel, and though the latter can be produced with excellent welding qualities, the results are not so certain and of as good a quality as can be obtained with wrought iron. The reason of this is that wrought iron is not so liable as steel to injury by overheating in the smith's fire when being raised to and above the welding heat. Also the physical properties of wrought iron differ from those of steel, owing to the method of manufacture in each case, and the thermal and mechanical treatment being so widely different.

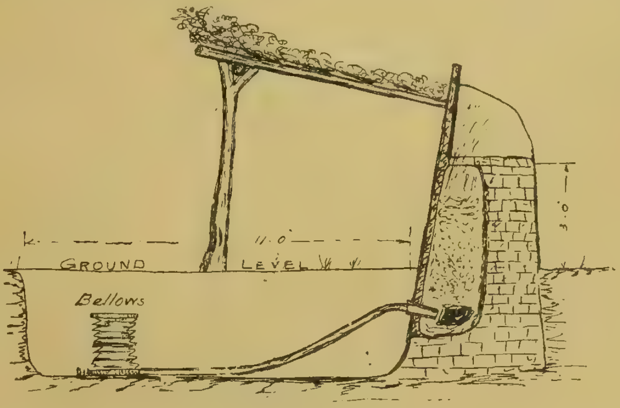


Fig. 70.—Modern Indian Blast Furnace.

Both steel and wrought iron are manufactured from pig iron, and in the case of basic open-hearth steel the purification of the iron is conducted in an open-hearth furnace, somewhat similar to that employed for producing iron, while oxide of iron is in both cases the principal refining medium. In the early stage of melting the pig iron there is also very slight difference, if we overlook the fact that steel furnaces treat a charge up to 50 tons, and sometimes more, as against 4 or 5 cwt. for each heat in a puddling furnace. The melting down of the charge is best carried out in each class of furnace, open-hearth steel, or wrought-iron puddling, at a high temperature, and in the steel furnace this high temperature is maintained until the end of the operation, but in the puddling furnace the heat is modified after the melting stage is reached; in the following stages the quality of the slag has to be regulated from time to time. When the steel is sufficiently refined, a deoxidising agent is added, and the metal, being liquid, is run out into ingot moulds of capacity up to 4 tons each, while with wrought iron the metal is removed in balls of about 80 lbs. weight, not molten but spongy and plastic, with a considerable proportion of slag intermingled; no deoxidising agent is used.

---

[*] "Iron, Steel, and Hardware in India." *The Ironmonger*, January 23rd, 1909.

In the manufacture of steel the chemist takes a very active part in the conduct of the process, but in the puddling of iron the quality is largely, if not solely, dependent upon the skilful manipulation of the puddler. This is evidenced by the fact that specifications for steel include certain limits of the constituents by analysis, combined with physical tests, whereas wrought iron manufacturers only comply with physical tests, not undertaking any responsibility as to the chemical composition, though usually the total impurities remaining only range from 0·25 to 0·8 per cent.

According to Mr. T. Turner,* pig iron containing

	Carbon.	Silicon.	Sulphur.	Manganese.	Phosphorus.
Per cent ..	2·60	1·20	0·08	0·50	0·57

would require for six full heats in a turn, 26½ cwts. of pig iron and 13 cwts. of fettling, yielding about 27½ cwts. of puddled bar, while an iron having 3·6 per cent carbon and 1·00 per cent phosphorus (the other constituents being about the same) would show a loss of about 3½ per cent in yield.

The weight of fettling required in the puddling furnace amounts to about one-half of that of the pig iron charged, but as this fettling is usually made up of a variety of substances of prices ranging from 1s. to 17s. 6d. per ton, mixed according to the class of pig iron employed and the quality of the puddled bar produced, it is obviously a question of considerable importance to arrive at the most economical mixture. In some instances the mixture of fettling consists of the following materials in proportions given in percentage. :—

	Per cent.
Best tap cinder	23·1
Iron ore	5·8
Bulldog	30·8
Scale	9.6
Hammer slag	30·7
	100·0

The furnace in which the puddling of pig iron is conducted is somewhat similar in longitudinal section to that shown in fig. 69, but the firing hole is on the working side, so as to be convenient for the puddler to regulate the fire. A door, raised and lowered by a counterbalanced lever which projects at right angles to the working side, is provided for admitting the charge and the withdrawal of the balled iron; it has a notch in the bottom, through which the puddler inserts and works his tools.

A damper is provided, also controlled by the puddler, to enable the amount of draught, the temperature, and the character of the flame, oxidising or reducing, to be regulated at different stages of the process. When the fire is good, the hearth fettled, and the flue open, the charge, weighing about 5 cwts. of pig iron, is introduced round the sides of the hearth. In about half an hour the pigs soften and begin to melt, while a certain amount of oxide of iron, formed by the oxidising action of the flame, runs down into the bed of the hearth. Generally the hearth is constructed of slag somewhat of the composition of tap cinder, and the sides and bottom are covered with fettling. By means of a rabble, the puddler works down the pig iron into the hearth, where it is just about covered with the slag formed. At this stage the damper is lowered, and as the silicon and phosphorus become oxidised and removed from the iron this begins to thicken, and the puddler mixes it thoroughly with the slag, the amount of labour required varying with the class of pig iron and product desired.

The action of the oxide of iron in the slag upon the carbon causes the evolution of carbonic oxide gas, which is freely given off during the *boil*, and the slag becomes greatly increased in bulk, which causes it to either flow down the flue leading to the bottom of the stack or to issue from holes provided for the purpose at the surface of the metal. The slag remaining in the hearth after the removal of the iron is run out at a tap hole, and is called tap cinder. Mr. Turner has examined the composition of the slags from puddling furnaces, the results of which are of considerable value in selecting the most economical materials to be provided for the fettling mixture. He gives the mean composition of the slag from seven heats as:—

	Boilings.	Tappings.
Ferric oxide, Fe_2O_3	6·9	12·9
Ferrous oxide, FeO	62·6	64·6
Silica, SiO_2	19·4	15·5
Phosphoric acid, P_2O_5	6·3	3·9
Other constituents, not estimated	4·8	3·1
	100·0	100·0
Metallic iron	53·5	59 3

As the iron becomes purified the temperature is raised by lifting the damper, and the iron is collected by means of a tool termed the *puddle* into balls of about 80 lbs. in weight. When the balls are taken to the shingling hammer they carry with them a considerable proportion of slag, very similar, of course, to the slag tapped from the furnace at the end of the operation; this constitutes the *hammer slag* used in the fettling mixture.

The iron, after being shingled, is rolled into *puddle bars*, which are afterwards used for the manufacture of bars, plates, etc., by being cut up into short pieces, which are made into *piles*, and, after being reheated to a welding heat, are rolled into structural forms. To meet the competition of steel made in large furnaces and by cheap processes, endeavours have been made to reduce the cost of wrought iron manufacture by increasing the sizes of the furnaces; the employment of mechanical apparatus to reduce the cost of labour in puddling—the application of producer gas to economise fuel, etc.—but, generally speaking, these attempts have not been found to be permanent improvements, and most have fallen out of practice, so that the process is still in the hands of the skilful puddler, rather than the metallurgist or chemist.

The slags from puddling furnaces are not waste products, as they are employed over and over again, changes being brought about in their properties by oxidation or reduction.

Consisting principally of oxide of iron, they take up silicon, etc., from the pig iron during the melting stage. In a reducing atmosphere the silica combines with protoxide of iron to form the protosilicate $2FeO \cdot SiO_2$, which readily melts and becomes liquid at a white heat. The remaining protoxide of iron can take up oxygen to form magnetic oxide Fe_3O_4 to some extent when the slag is capable of reducing further impurities from the pig iron. However, if the bulk of the protoxide becomes oxidised, as when the slag is roasted for a considerable period, the constituents become silica and ferric oxide, both of which are refractory. This is the substance used for making the puddling furnace hearth. The theoretical percentage composition of the two substances are as follows:—

	Proto-silicate of iron.
Protoxide of iron	70·59
Silica	29·41
	100·00

---

* "Economical Puddling and Puddling Cinder." Iron and Steel Institute, May, 1891.

	"Bulldog" roasted tap cinder.
Peroxide of iron	72·70
Silica	27·30
	100·00

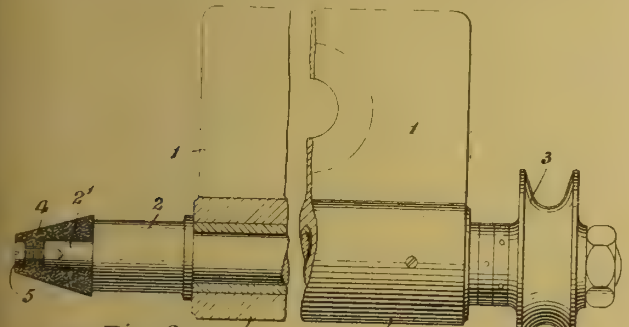
Protosilicate is neutral in action, but the addition of oxygen from the atmosphere, or iron ore, renders it of an oxidising nature, and the skill of the puddler is expended in adjusting the nature of the slag by regulating the mixture of materials constituting the fettling. As the working of a charge only occupies about two hours, the puddler has to depend upon his knowledge, gained by long training, to decide which mixture is most suitable for refining the class of pig iron available and the purity of the wrought iron to be produced; also the operation of puddling involves the expenditure of considerable manual labour.

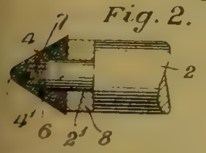
(*To be continued.*)

AN ATTACHMENT FOR GRINDING TOOTHED GEARS, ETC.

The appliance we are about to describe may be attached to a lathe, milling machine, or similar machine for the purposes of grinding after hardening, toothed gear wheels, milling cutters, gear cutters, etc., to eliminate the distortion due to hardening, the attachment also embracing a device for accurately shaping and trueing the emery wheel to the required form.

Fig. 1.





Referring to the illustrations, fig. 1 is a plan view, partly in section, of the grinding appliance. Fig. 2 shows an alternative method of securing the emery wheel or grinding surface to the rotatable spindle. Fig. 3 represents, partly in section, a worm or like body with an emery wheel or grinding surface in position to commence grinding, and fig. 4 shows, in plan, the means for accurately shaping and trueing the emery wheel or grinding surface to the required form.

Fig. 1 represents a bracket which may be bolted to the slide rest of the lathe, backing-off machine, grinding machine, or other machine tool, or which may alternatively be constructed as an integral part of any of such machines.

Carried in suitable bearings in the bracket 1, so as to be free to revolve without any end play, is a spindle 2 having fast on one end a pulley 3 to transmit motion by belt to the spindle 2 from any convenient source, to cause the spindle to be rotated at a high velocity.

The front end of the spindle 2 is reduced, as at 2^1, to a convenient diameter for the attachment of a special emery or like wheel surface 4, the outside or surface of which is ground or cut to the true shape which it is required to cut in or to impart to the worm, hob, or other toothed gear wheel to be ground, and the grinding surface is applied in such a manner that its axis of rotation lies between the teeth of, and at right angles, or approximately at right angles, to the axis of the toothed body under treatment.

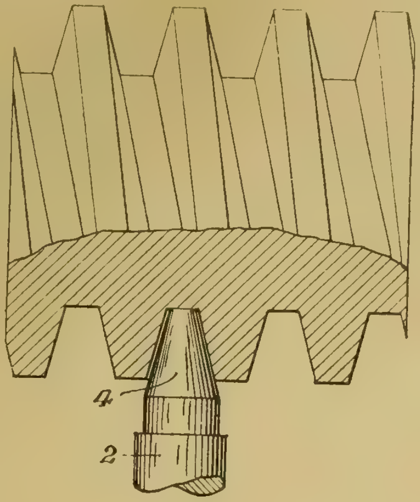


Fig. 3.

The emery wheel or surface 4 may be attached to the spindle in the manner shown at fig. 1, where the front of the said wheel is hollowed out to admit of a screw 5 being screwed into the reduced end 2^1 of the spindle, or alternatively, the method shown at fig. 2 may be adopted. In this case the emery wheel has a solid point 4^1, and is hollowed out at the back and plugged with lead or other suitable material, as at 6, the lead or other material being drilled and tapped to receive a screw 7 projecting from the end of the spindle.

Fig. 3 shows a worm or the like to be ground with an emery wheel in position to commence operations, the method for giving the best results being to first set the emery grinding surface or wheel in or about the middle of the worm, hob, or the like, and then move it to grind from the right and left of this position, so that the grinding of the surfaces is equalised. By this means the error due to distortion through hardening the worm or other body is rectified by the removal of the least possible amount of material, and without the same risk of the emery wheel getting underneath or grinding through the hardened surface of the body being ground.

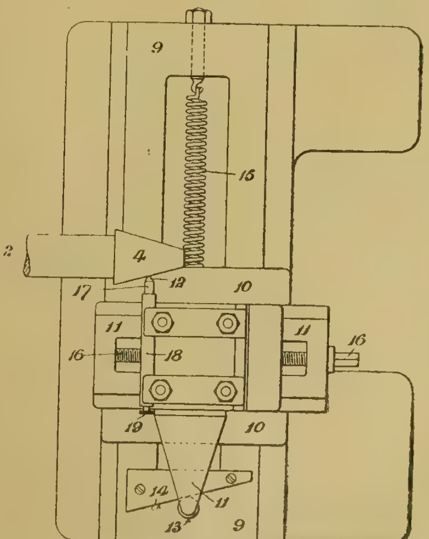


Fig. 4.

The means for imparting the correct shape to the emery wheel are shown at fig. 4.

A bracket or slide 9 carries a slide 10, on which is mounted to slide transversely a bracket or slide 11, in which is held a diamond or equivalent point 12. A roller 13 carried by the bracket 11 is held against a cam or template or forming surface 14, secured to the slide 9 by means of a spring 15, attached at one end to the slide 9 and at its other end to the slide 10. By revolving the screw 16, passing through the bracket 11, whilst the emery wheel 4 is revolving at a high velocity, the diamond or equivalent point 12 is traversed across the face of the emery wheel, its path being directed and governed by the action of the cam or forming surface 14, and the desired contour is given to the emery wheel.

A further fine adjustment can be provided for the diamond or equivalent point 12 by mounting its holder 17 in a casing 18 in such a manner that by revolving the knurled or milled head 19, the holder 17 is moved backwards or forwards through the casing 18.

The arrangement shown is an adaptation of an ordinary lathe slide rest, the traverse screw being removed and replaced by the spring 15, a bracket fixed to the tool holder to carry the roller 13, and a cam or template or forming surface 14 fixed to the usual lower slide of the slide rest. The diamond or equivalent point may, however, be mounted in a slide specially designed for the purpose and operated and directed by means of a cam or forming surface in essentially the manner described above.

The cam 14 may, instead of having a straight surface as shown, be made with any convenient curve or be otherwise formed to impart the desired contour to the emery wheel.

The above device has been brought out by Messrs. David Brown and Sons (Huddersfield) Ltd. and F. E. Brown.

THE ENGINEERING AND MACHINERY EXHIBITION, OLYMPIA.

THE Naval, Mercantile Marine, and General Engineering and Machinery Exhibition was formally opened by the Marquis of Graham on the 1st September in the presence of an exceptionally large gathering of leading engineers and scientists. It is not necessary here to report the speeches and customary mutual congratulations which marked the opening ceremonies. They were quite up to expectations. Generally speaking, the exhibition, as a whole, merits wide attention from all classes of engineers. Whilst previous engineering exhibitions at Olympia have been larger—in that more firms were represented and larger floor space per exhibit were the rule—the present is not by any means a small show, and it is certainly valuable and representative in the variety and nature of the machinery and specialities shown.

The marine engineering phase of the exhibition is centred mainly in the many fine examples of models shown by leading shipbuilding firms, such models including battleships, cruisers, and ocean liners. One of the most prominent exhibits is the anchor intended for the steamship Olympic, now building for the White Star Line by Harland and Wolff, Belfast. It is stated that this is the largest anchor in the world, weighing 15½ tons and having a length of 18 ft. 6 in. The visitor is immediately impressed with the trouble and expense to which the makers, **N. Hingley and Sons Ltd.**, of the Netherton Ironworks, Dudley, have been put in bringing this massive exhibit into position. At this stand also are to be seen other examples of heavy forged work. Five links of the anchor cable of a Hamburg-Amerika liner, each weighing 1¾ cwts. are shown; each link is 2 ft. long, and the class of work is known as "The Netherton Crown Special Best Best Cable." Other exhibits of Messrs. Hingley and Sons are: A 5-in. bar of Staffordshire wrought iron tied into a complete knot, cold, without exhibiting signs of flaw or fracture; various stud-link cables of several sizes, as supplied for the Admiralty and leading marine service.

Wm. Beardmore and Co. Ltd., of Parkhead Forge Rolling Mills, Glasgow, have provided an imposing array of specimens well in keeping with their international reputation. Here is shown a 4-in. gun in various stages of manufacture—inner tubes, jackets, winding wire, etc., are arranged in sequence. The wire necessary for a gun of this size is 2·6 miles of a section of ·06 in. by ·25 in. In a 13·5-in. gun there are about 120 miles of this wire. This latter size of gun is now being built at the exhibitors' works for the Colossus. The mounting of these monsters of ordnance are to be hydraulic worked. Other naval exhibits of Messrs. Beardmore include nickel-steel air vessels and ends for torpedoes.

A marine engine of the paraffin type suitable for propelling yachts, fishing boats, barges, ferry boats, lighters, etc., and for driving electric lighting, air-compressing, pumping plants, and general power service is exhibited. The engine is of the two-cycle type, having two cylinders each 10 in. diameter, and is capable of developing 60 B.H.P. at 340 revolutions per minute. The engine consumes only paraffin; no petrol is required even for starting purposes. The paraffin is vaporised by means of a specially-designed type of vaporiser heated by a blow lamp at starting. Immediately the engine is under way the blow lamp is dispensed with, and the heat necessary for vaporising the continued feed of fuel is provided by utilising the compression and explosion. A high-tension magneto machine is also provided for ignition.

The consumption of paraffin by this engine is given as from ·65 pint to ·6 pint per brake horse power at full load, depending upon the size of the engine. The air compressor is fitted as an integral part of the engine, being driven direct from the crankshaft. The circulating pump of the cooling system is also driven direct from the cam shaft; it is of the reciprocating type, with gun-metal body and plunger. The starting of the engine is entirely effected by the mechanically-operated compressed air gear, which can be immediately thrown out of action when the engine receives its first explosive impulse.

Other marine exhibits of Messrs. Beardmore include a number of ships' models: H.M. first-class battleship Agamemnon, H.M. first-class armoured cruiser Carnarvon, H.M. second-class protected cruiser Gloucester, and steam yacht Zaza.

In the way of railway material there are numerous specimens of interesting work to be seen. A pair of 3-ft. 7-in. wheels and axles for the 5-ft. 6-in. gauge Indian railways shows the form of "Kirtley" spokes welded solid into the bosses of the wheels. The tyres, after being shrunk on the centres, are further secured by the "Mansell" ring fastening. Another example shows a similar pair of wheels for one metre gauge, but with the tyres secured by the "Gibson" ring fastening.

For railway carriage stock the "Mansell" teak-centred wheel is shown. The centre of the wheel consists of 16 teak segments, cut radially, and fitting into pockets in the cast-iron "star" boss. The tyres are secured by the "Mansell" ring. There are also many examples of forged wheel construction shown as for locomotive, wagon, and carriage rolling stock.

Nor is this all of Messrs. Beardmore's exhibit—samples of boiler furnaces, plain and corrugated, welded with water gas and hydraulically flanged; parts of motor car frame construction, and complete car frames, boiler plates, and so on, all combine with the work described above to make one of the most attractive and valuable collections of engineering work to be seen.

The Chadburn's (Ship) Telegraph Company, of Bootle, show various types of their well-known telegraphs, these being exhibited on a three-tier stand, coupled up as for actual service. Admiralty pattern telegraphs, as supplied by the firm to the British, Japanese, Italian, and Russian Navies, are shown on the centre platform. One platform carries a bridge transmitter suitable for twin-screw engines, connected to two engine-room indicators; also a single-dial transmitter for single-screw ship, and the latest pattern of transmitter suitable for a vessel fitted with three steam turbines. One dial of the latter transmitter is connected to the indicator for controlling the port turbine, the other side to the indicator controlling the starboard turbine; the centre turbine, which does not go astern, being controlled by a centre lever on the transmitter, giving only "ahead" signals.

Telegraphs are shown which signal the number of revolutions at which engines are required to run; others are for transmitting "look-out," "anchor," and special steering orders, etc., and for controlling stokeholds, boiler-rooms, etc., on large liners.

Kynoch Ltd., Birmingham, have in this case concentrated their exhibit on gas engine matters, showing a 100-H.P. engine in operation on town mains gas and a 10-H.P. suction plant and electric set complete. There are many points of the Kynoch gas engine which merit attention in detail. An important feature making for stability is that the cylinder is supported throughout its entire length by the bed plate. The main bearings are large, and in the sizes of 80 H.P. and upwards are in four parts, and are adjustable downwards and endways. The bearings can be moved without taking out the crankshaft which, however, can be easily removed when necessary. The liner joint has no contact with either the water on the one side or the explosion chamber on the other, and a constant cause of back end joint leaking is obviated. The cylinder and combustion chamber are provided with special facilities for removing lime or other water deposit. The gear wheels are machine cut, of the most careful design and manufacture, and run in an oil bath.

Engines of 100 H.P. and upwards have the pistons water cooled on the trombone principle, having two sliding pipes provided with stuffing boxes; the water is conveyed by these pipes to that part of the piston which is exposed to the heat of the explosion. With this method risk of trouble is reduced to a minimum, and it is claimed that this method of water cooling has an enormous advantage over the articulated or flexible pipe methods used by other manufacturers. The exhaust valve is water cooled. The method of cooling is so arranged that the water on leaving the various parts can be seen and the quantity adjusted when necessary. All valves are arranged vertically, and consequently the wear on them is reduced to a minimum; they can be easily removed for cleaning. Valve springs are protected from the corrosive action of gases and from dust and dirt. Ring oilers are fitted to the main and outer bearings and also to the side shaft of the engine, and, in addition to lessening to a very great extent the danger from hot bearings, a considerable saving of oil is effected. The bearings on the crankshaft and side shaft are provided with oil throwers, which return to their respective oil wells any oil thrown off the bearings, thus preventing any creeping along the shaft.

On engines of 80 H.P. and upwards the crank pin is oiled by forced lubrication and by a special sight feed arrangement on the end of the crankshaft, the quantity of oil passing to the crank pin can be seen. The small end of the connecting rod is lubricated by a combination of sight feed and inclined plane lubricators operated by the piston, and on tandem engines by forced lubrication.

The electric ignition fitted is of a most up-to-date type, and can be timed over a considerable range of strokes whilst the engine is running. When desired the spark can be seen when the engine is stopped by simply removing a cover, which affords a very easy method of detecting ignition troubles. In engines of the tandem type the steadiness of running is greatly increased, as an impulse is obtained every revolution. The flywheel is slit at the boss and is secured by a sunk key and four bolts, thus ensuring a perfect fit and relieving the key from shock of explosion. All engines of 70 H.P. and upwards are fitted with barring gear.

There are quite a number of important machine tool exhibits, particularly in connection with woodworking. These and other distinctive features of the exhibition, which remains open until the 26th inst., will be dealt with at length in the next issue of *The Practical Engineer.*

Readers should know, however, that arrangements have been made for the reading of a number of scientific papers on the occasion of the official visit to the exhibition of several engineering societies. The dates of these visits are as follow:—

Sept. 14th.—Institute of Metals.
,, 15th.—Sanitary Engineers.
,, 17th.—Institute of Marine Engineers.
,, 21st.—Society of Engineers.
,, 24th.—Association of Engineers-in-Charge.

Facilities are available for admitting workmen and employees connected with dockyard and engineering firms at reduced rates, and probably many will take advantage of this opportunity of seeing an exhibition of modern engineering work which is exceptionally interesting.

(*To be continued.*)

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"Elementary Experimental Electricity and Magnetism." By W. T. Clough. London: Methuen and Co. Ltd. Price 2s. 6d.

The arrangement of the matter throughout this book has been well considered for progressive tuition, a point of the first importance where experimental work has to go hand in hand with theory.

The book has a wide scope, being intended for students preparing for the London University Matriculation College of Preceptors, Oxford and Cambridge Local, and the First Stage Board of Education.

The experiments, of which there are nearly 200 described, bring out clearly the first principles underlying magnetic effect and electrical phenomena, and many are of a quantitative nature.

As is usual with such books, numerous sets of questions are connected with each chapter, and at the end are sample papers as set by the University of London and the other examining bodies.

We have no hesitation in recommending this volume as one of the best companions for the class student that can possibly be had.

"The Construction and Working of Internal-Combustion Engines." By R. E. Mathot. Translated by W. A. Tookey, London. Constable and Co. Ltd. Price 24s. net.

The work which this author presents to us is of no mean order. Among the many books now obtainable upon the construction and working of internal-combustion engines, the volume now before us stands out as one of the best. It is a treatise dealing with the practical side of the subject, and has been written for the use of designers and manufacturers, and includes, besides, a critical study of present-day types of internal-combustion engines.

The rapid advance in popularity of this class of power generator from those of the more ordinary dimensions to engines of several thousands of horse power, due to its high economic working, has taxed the designing powers of our manufacturers to the utmost.

In this latest publication we have a treatise which enters into the calculations for the strengths and dimensions of the component parts, with a critical study of present-day types of engines. All the most essential details of the arrangement of valves, governing devices, etc., are described and illustrated, and the book throughout is full of sectional views which will aid designers to a considerable extent. Part I. constitutes a historical introduction upon the progress of gas power, its merits as compared with the steam engine, and the possibilities of the future, including the aspect of the gas turbine.

Part II. is the main subject of the book. The principal types of gas engines are reviewed, the author, with his wide experience, being also in a position to quote examples of American and Continental practice. Much space is given to the characteristics of large engines, the designs of two and four-cycle engines, the design of stuffing boxes, the compression chamber; also calculations for flywheels, bearings, crankshafts, and other moving parts.

Part III. enters fully into the testing of internal-combustion engines, the types of absorption brakes, the indicator and its gear, the interpretation of the diagrams, fuel, its analysis, and other factors necessary to ensure reliable results.

A table of 138 tests of all types of engines dating from 1900, and many conducted by the author, is a valuable compilation. There are three appendices—a bibliography, a list of gas engine and gas producer makers, and the description of a device designed by the author for controlling the speed of internal-combustion engines.

The thoroughness of the book is reflected in the copious index, and the illustrations, which number nearly 500, and no little credit is due to Mr. Tookey for the care he has bestowed in the translation. The merit of the work lies largely in the wide experience gained in connection with engines of all sizes and the ability to place that knowledge in a suitable form before the public.

BOOKS RECEIVED.

"Official Gazette of the United States Patent Office." Vol. CLVII. Nos. 2 and 3. Published by authority of Congress, Washington.

"Workshop Wrinkles and Receipts." No. 10, Marshall's Practical Manuals. London: Percival Marshall and Co. Price 1s.

"Electric Motors: Continuous Polyphase and Single Phase Motors. Their Theory and Construction." By H. M. Hobart. Second Edition. Entirely Re-written and Enlarged. London: Whittaker and Co. Price 18s.

"Transactions of the Manchester Geological and Mining Society." Parts XIV. and XV., Vol. XXXI. From the Secretary.

"British Engine, Boiler, and Electrical Insurance Co. Ltd." Chief Engineer's Report for 1909. From the Company.

"British Standard Specification for Wrought Iron for use in Railway Rolling Stock." The Engineering Standards Committee. London: Crosby Lockwood and Son. From the Secretary.

"Power and its Transmission." By T. A. Smith. London: E. and F. N. Spon. Price 2s. net.

BOILER explosions have been traced to connecting together two or more of them when in a battery and different pressures existed in each boiler. The steam pressure gauges should therefore be examined carefully before opening the steam valves, and this operation, moreover, should be performed as slowly as possible.

AN IMPROVED FORM OF SAFETY CLUTCH.*

THE improved form of safety clutch about to be described is intended for use with hoisting machinery, and with internal-combustion engines, and in the latter direction would seem to be especially suitable for use on motor vehicles.

Fig. 1 shows an application of the clutch gearing to hoisting mechanism. The device consists of a pinion *a* mounted loosely upon the shaft *b* and meshing with a toothed wheel *c* secured to the drum of the hoisting apparatus. On the extremity of the boss of the pinion *a* is a hollow internally and externally-turned cone *d* located within a part or box *g* provided with a conical part *e* adapted to bear against the external surface of the cone piece *d*, whilst another cone *f*, likewise secured to the box *g*, is arranged to engage the internal surface of the same cone. These two conical surfaces consist the one of washer or discs of compressed leather, the other of a cast ring faced with leather and secured to the internal surface of the box *g*, as shown. The diameters of these different parts are so calculated as to admit of the box *g* occupying at a given moment such a position relatively to the cone piece *d* (connected with the pinion *a*) that the latter will not be subjected to the action of the cone surfaces *e* and *f*. The box *g* is keyed to the nut *h*, which is mounted upon a portion of the shaft *b* provided with a multiple or fast screw thread.

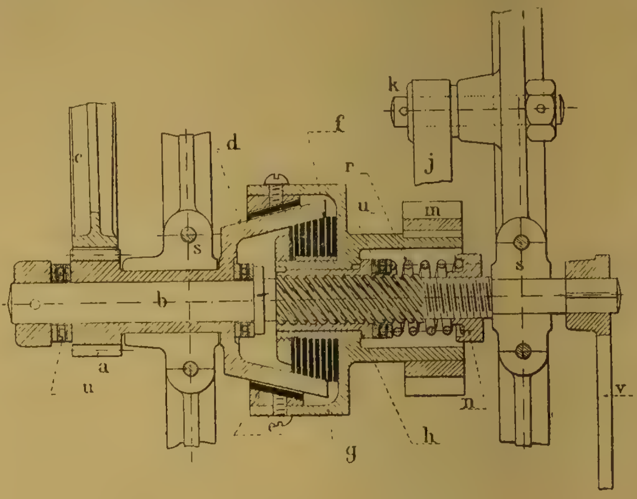


FIG. 1.

A pawl J mounted freely, as shown at *k*, engages with the teeth of a ratchet wheel *m* secured to a hollow extension or sleeve on the boss of the box *g*; *r* is a spring which can be compressed by a nut *n*, and which spring transmits its effort to the cone *f*. The shaft *b* is mounted to rotate in bearings *s*, and is provided with a crank *v*. Any lateral movement of the shaft is prevented by ball thrust bearings *u*, an arrangement which greatly conduces to easy running.

The operation of the device is as follows: When rotating the shaft in a direction for raising or hoisting a load, the cone *f*, under the action of the spring, will raise the load through the intermediary of the pinion *a* and of the toothed wheel *c*. The strength of the spring is adjusted in accordance with the maximum weight of the loads to be raised, and should the power required to raise the latter exceed that allowed for, a slipping action will take place between the two cones, and no hoisting or elevating action take place. Should the crank handle be released the tendency of the parts to rotate in a reverse direction will be prevented by the pawl *j*, which engages with the teeth of the ratchet wheel *m*, and the load will therefore remain suspended in position.

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* Specially translated for *The Practical Engineer* from *Le Mois Scientifique et Industriel*.

Should the crank handle be turned in a direction contrary to that required for raising or hoisting, the ratchet wheel *m* will be prevented from turning by reason of the pawl, and the shaft will act to compress the spring, and, through the screw-threaded portion, draw back the box *g* to release the two cones *d* and *f* from engagement. The pinion *a* being then free to rotate on the shaft *b*, the load will immediately descend. On continuing to turn the crank handle in the opposite or reverse direction, the longitudinal displacement of the box *g* will become sufficient to cause the exterior cone surface of the clutch to engage in its turn on the inner cone surface of the pinion, thus instantly arresting the hoist and maintaining the load suspended in position. This action, it will be seen, is effected by the sole means of imparting a reverse motion to the crank handle. On a cessation of the reversing effort on the crank handle, the friction between the two cones *e* and *d* will be immediately diminished, and the load will be then lowered more or less quickly in accordance with the manipulation of the crank handle by the operator, which he uses in the same manner as an ordinary brake.

The extent of the play between the cones *e* and *d* is only a few millimeters, and this clearance governs the amount of movement in a reverse direction that it is necessary to impart to the crank handle. At the termination of this rotating movement in either direction, the load is retained in position either by the pawl, when the crank handle is released, or by throwing the cones into gear if the crank handle be moved to the extreme position as before described.

An application of this clutch device to internal-combustion engines, especially when used on motor vehicles, is shown in fig. 2. The crankshaft in this case comprises four distinct parts—1, 2, 3, 4. The sleeve *a*, which engages the shaft g^1 of the motor by means of a clutch device, is mounted so as to be normally free upon the shaft *g*, and is maintained in position between a collar *e* and a nut *i*, each of which is provided with a race in which are placed balls to form the bearings. The ratchet part *b* forms a nut, and it has a conical portion *f*, which can engage in the hollow conical part or recess *k* on the sleeve *a*. A ball bearing *o* takes the end thrust of the ratchet *b*, and is acted upon by the spring *c*, the compression of which latter can be adjusted by means of the nut *d*. The bracket *s*, which is intended to be fixed to the frame of the motor vehicle, carries the parts, and is fitted with the spring-pressed stop or pawl *t* and the clutch withdrawal spring *u*, which serves to automatically move the clutch mechanism backward in order to disengage it from the motor.

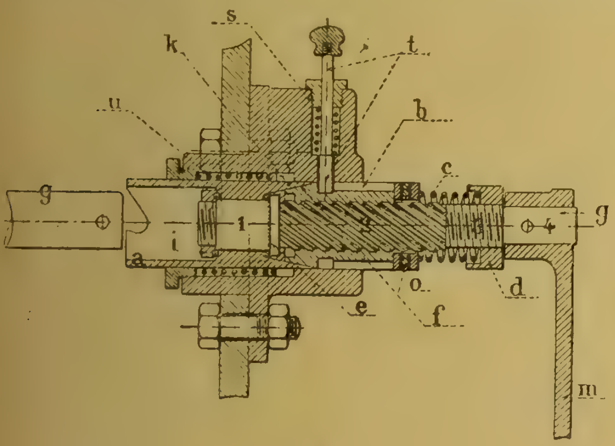


Fig. 2.

In order to start the motor the spring-actuated stop or pawl *t* is raised, and the crank handle is operated to throw the clutch into gearing with the motor, the stop or pawl *t* being allowed to re-engage itself automatically, under the action of its spring, with the teeth of the ratchet *b*. If the crank handle be then operated to start the motor the two conical surfaces, which are maintained normally in contact under the action of the spring *c*, set up a much greater friction than that which results from the contact of the shaft *g* and of the ratchet *b*. The shaft *g* will therefore revolve by itself, and by such rotation move closer together, through the medium of the multiple or fast screw-threaded portion 2 of the shaft *g*, the cones *f* and *k*, until they are finally firmly engaged. Rotation of the crank handle will then be transmitted to the motor shaft g^1.

Should at any time the motor shaft g^1 be caused to rotate in a backward or reverse direction, the engagement of the above-mentioned two cones, resulting from the manipulation of the crank handle by the operator, will be annulled by such backward movement of the motor, and the cones will be only maintained in engagement by the pressure of the spring *c*, which pressure is adjusted to merely keep them in light rubbing contact, and is insufficient to couple up the sleeve *a*, which runs free upon the shaft *g*, and itself turns backwards without affecting any other part. The general assembly of parts and, consequently, also the crank handle are prevented from rotating in a reverse direction by the pawl *t*, which is in engagement with the teeth of the ratchet *b*.

If the operator, without releasing the crank handle, turns the latter in the reverse direction, the shaft *g* operates the ratchet *b* and compresses the spring *c*, the two cones becoming then separated by several millimeters and isolating or disconnecting the sleeve *a* from the rest of the mechanism.

As soon as the crank handle is released the expansion of the spring *c* automatically brings the cones into contact, and the apparatus is again ready for effecting a forward movement; that is to say, for starting the motor.

PARAFFIN MOTOR LAUNCHES.

The internal-combustion engine has provided an ideal motive power for launches. The nature of the fuel used is exceptionally compact, the consumption economical, and the rate of efficiency high. In fact, it is a highly practical application of heat as a mode of motion, and may safely be predicted to be the marine motor of the future, so far at least as launches are concerned.

The experimental stage in the construction of internal-combustion motor launches is past, and although finality has not by any means been yet reached, a great degree of perfection has been arrived at. In a motor launch the full power of the machinery is in continual demand, and consequently the design must be such as to meet the requirement. For fuel, paraffin or heavy lamp oil, having a flash point between 75 deg. and 112 deg., is the most desirable both on account of greater safety and also by reason of its being some 50 per cent cheaper per unit measure than petrol, although it may be observed that the latter is much less explosive than is generally supposed.

The use of paraffin in internal-combustion engines of ordinary construction results in imperfect combustion, accompanied by an offensive smoke and clogging of the valves, etc., and the aim of every motor engineer is to design a paraffin engine that will be practically free from these defects, and will start without unnecessary delay.

To vaporise heavy oil, with its tendency to immediately condense and return to its original liquid condition, considerable heat is necessary, whereas petrol readily evaporates and is easily consumed in its entirety. Engines designed to use paraffin can be started by preliminary heating with a blow lamp, or by running for a sufficient time on petrol to heat the parts.

In the Thornycroft engine petrol is used through a carburetter for starting, and paraffin through a vaporiser. A change-over throttle valve is fitted, so that when running on petrol the carburetter is in connection with the inlet pipe of the motor, and when running on paraffin the vaporiser is connected in place of the carburetter. The exhaust is taken through the vaporiser in both cases, so that the change from petrol to paraffin can be immediately effected by turning the change-over valve. This arrangement allows of the motor being started up instantly on petrol, and, after a minute or two, paraffin being switched on. Only a very small quantity of petrol need be carried.

The motor may be started entirely on paraffin by removing the bottom cover of the vaporiser, and heating the inside for about 10 minutes by means of a blow lamp.

The Mitcham engine is of the "two-cycle" type, and a vaporiser or generator valve is employed in lieu of a carburetter. This valve is simple and positive in action, operates only as the motor runs, feeds a charge with every upward stroke of the piston, and closes with every downward stroke, thus shutting off the fuel during the explosion.

The Westmacott vaporiser, which consists essentially of a casing containing a set of exhaust heated tubes, is used with the Woodnutt engine. The quantity of fuel supplied is regulated by a screwed needle valve, and a tee-piece and two cocks are provided at the fuel inlet, the one leading to the main paraffin tank and the other to a small petrol tank for starting. A door in the casing admits of the tubes being heated by a blow lamp for starting without petrol.

Amongst other engines adapted to work with heavy oils are the Seal and the Allsop. The former is of the inverted pattern, working on the Otto cycle, the oil being fed by gravity and sucked by the engine through a valve automatically supplying the proper charge for varying speeds, and warm air being taken from over the exhaust to assist vaporisation. The latter engine, which also works on the Otto cycle, is fitted with a mechanical carburetter or measurer in the form of a pump.

A most important factor in the reliability of the engine is the ignition. For marine motors the low-tension magneto system is preferable to the high-tension coil and battery system.

For going astern either a reversing clutch or a reversing propeller are available, where a motor is only used as an auxiliary to sail-power, the latter being the most suitable, as the blades can be feathered when sailing. For the largest powers, and for use in deep-sea work, however, a reversing clutch, admitting of the propeller shaft being stopped and reversed, is to be preferred. An internal-combustion engine can be built to run in either direction, but when reversing it would have to be slowed down, and the operation would take valuable time, besides necessitating a certain amount of skill.

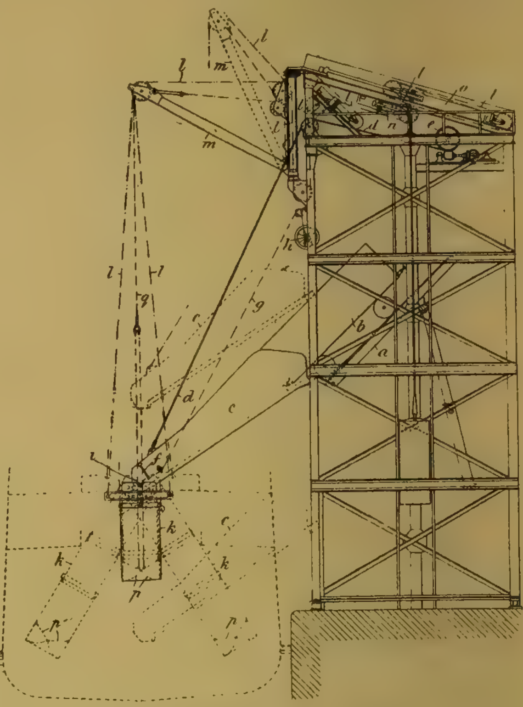
The motor base and thrust should be designed to maintain the propeller shaft in line and take up the entire thrust of the screw, the only strain on the crankshaft being that due to the effort required to turn the propeller. It is important that the engine be not lightened at the expense of stability, and the frame be sufficiently substantial to ensure absolute rigidity and safety to withstand the continuous explosions. In an oil motor launch the tendency of the weight of the motor is to steady the boat.

In conclusion, a word of warning may be given regarding low-priced engines. A reliable motor cannot be made cheaply, and an unreliable one will inevitably be a source of continual annoyance, and not improbably of danger, as it may at any time stop and leave the launch helplessly drifting on the rocks in rough weather.

IMPROVED COAL SHIPPING MACHINERY.

Various methods have been adopted for preventing the breaking of coals during shipment. In most cases each coal hoist is fitted with means by which a quantity of coal is deposited in the hold of the vessel. On the heap so formed the remainder of the coal is allowed to fall direct from the shoot, the pile formed preventing such breakage as would have occurred had the coal fallen from the first on the bottom of the hold.

A recent development in devices of this nature has for its object, as well as prevention of breakage of the coal, means whereby the coal can be delivered at any point in the length of the ship's hold under the hatchway and transversely across the ship's hold, and at any level, and has been brought out by Sir W. G. Armstrong, Whitworth and Co. Ltd. and R. Wright, of the Elswick Works. The illustrations show a plan and elevation only of the device.



Improved Coaling Arrangement for Ships.

The ordinary cradle *a* is adapted to carry a wagon *b*; *c* is the shoot, the butt end of which is connected to the cradle while the point is connected by two ropes *d* to a pair of drums *e*. If these drums are rotated in the same direction the point of the shoot is simply raised, but if they are rotated in opposite directions the point is slewed. The shoot may be provided with a door *f* operated by a rope *g* and gear *h*. Movable around pivots *i* at the point of the shoot is a telescopic spout *k* suspended by two ropes *l* from a jib *m* on the framing, these ropes passing over the rams of two cylinders *n* to a lifting cylinder *o*. When it is desired to raise or lower the spout the cylinder *o* is actuated, but when it is desired to tilt it the cylinders *n* are actuated in opposite directions. The doors *p* at the mouth of the spout are operated by a chain *q* in any ordinary way.

We are informed that the University of Cambridge has acquired the copyright of the Encyclopædia Britannica, and is about to publish at the University Press an entirely new (eleventh) edition of this well-known work. The eleventh edition of the work is a completely new and original survey of human knowledge down to the summer of 1910, and it has, for the first time in the case of any first-class work of reference, been constructed as a whole, and will consequently be published as a whole.

INJECTORS.

[SPECIALLY CONTRIBUTED.]

When Giffard in 1858 brought out the first injector, a stir was created in engineering circles on account of the seemingly paradoxical nature of the results obtained.

The appliance of Giffard, which had been well thought out, was an immediate success. There was, however, one great drawback to its use, namely, its working range was limited—if the steam pressure or the feed-water temperature varied beyond a certain amount, the appliance "knocked off" or refused to work. The object of the early inventors was to make the injector adjustable to work over a wide range of steam pressures and feed-water temperatures. This was first accomplished by Gresham, when he brought out the sliding combining nozzle. The next great step in connection with the injector was the provision of means for rendering it an automatic appliance, capable of starting and re-starting itself. This step was effected by Davies and Metcalfe, with their "flap" nozzle.

The later improvements have chiefly tended in the direction of making the injector more reliable and of extending its range of action.

In the case of the exhaust steam injector, the principles of which were first enunciated by Messrs. Davies and Metcalfe, it was until quite recently impossible to feed a boiler by the aid of exhaust steam only, if the boiler pressure exceeded about 75 lbs. per square inch, with the injector feed water at about 60 deg. Fah. The great difference existing between this limit and the theoretical limit (estimated from the momentum of the combined steam and water jet tending to enter, and of the water tending to leave, the boiler) has been attributed to hydraulic and like losses due to the (admittedly) bad form of the passages and chambers through which the delivery water passes. Within the last year or two, however, exhaust steam injectors have been made to feed against boiler pressures of 120 lbs. per square inch, with a feed-water temperature of 60 deg. Fah., and this when using exhaust steam only. The fact that the delivery temperatures with the old and the new appliances are practically the same is a clear indication that the ratio of steam to water in the appliances is also the same. The whole improvement has been obtained by alterations in proportions and in the arrangements of the steam and water jet inlets—the form of delivery pipes and chambers remaining unchanged. The inefficient parts which must have existed in the old appliance (though it did its work well) were obviously not apparent to the critic, seeing that for 30 years exhaust injector makers have been trying to obtain the present result. It is this difficulty in detecting sources of loss in injectors which makes the construction of high-class injectors a matter requiring great skill and experience. The whole success or failure of an exhaust injector depends essentially upon details of proportion and arrangement, and not so much upon the general construction.

In the case of the live steam injector, an effort has been made to enable high-pressure steam, such as is found in locomotive practice, to feed the high-temperature feed water usual in tropical climates. Apart from the question of proportioning of parts, an important point is that of the overflow arrangements, upon which the re-starting power of the appliance depends. Whilst there must be provision for a free overflow when starting the injector until the jet is sufficiently established therein, there must also be means for preventing an overflow when the injector is working normally, because there is always a pressure greater than atmospheric within the injector (when high-pressure steam and high-temperature feed water are being dealt with). The present method of control is by means of the pressure in the delivery chamber—if the injector is not working there is no pressure there, and the overflow valve is free. Another important detail is the question of the proportion of water which the steam must take up to ensure proper condensation of the steam jet. Obviously it will require less water at 60 deg. Fah. than at 120 deg. Fah. to condense a given quantity of steam at a certain pressure in a given period. There comes a point in the working of "hot water injectors" when the ratios of proportions of the steam and water inlets suitable for moderate temperature feed water are not satisfactory, and the steam jet does not receive sufficient water to effect its condensation. An overflow in the form of spray follows, indicating the water deficiency. It is not practicable to increase the water inlet area above a certain amount relatively to that of the steam inlet area, but the difficulty has been overcome by providing two water inlets—a main and a supplementary inlet—which deliver their water at the respective ends of the lifting or annular steam jets. A further difficulty with "hot water injectors" is that connected with raising the feed water. If the feed water is of high temperature, then when a partial vacuum is created in the feed pipe for water-lifting purposes the water vaporises, and therefore impairs the vacuum and consequently the lifting power of the injector. Injectors are now made to deal with steam at 200 lbs. pressure and feed water at 120 deg. Fah., with a lift of 6 ft. or 7 ft.

The proportioning of the parts of an injector does not appear to follow any well-defined laws, but to be based upon experience.

In the construction of injectors, the first size which has to be fixed is that of the delivery orifice or throat of the delivery nozzle. The factors for use in determining the size of the steam and water inlets are the proportion of steam to water, and the density and velocity of the same. But to obtain the best results, nothing but careful tests under actual conditions can be profitable, as so much depends upon the shape of the combining nozzle, the area for overflow, etc. It is one thing to make an injector work, but quite a different matter to produce the high-class appliances required to meet the heavy conditions of service on the railways both at home and abroad.

With the ejector condenser, which is based to some extent upon the principles of the exhaust injector, the condensation water is utilised first to produce a vacuum for causing the inflow of the exhaust steam (which of course has no velocity in itself relatively to atmosphere), and then to condense the steam and cause delivery from the ejector against the pressure of the atmosphere. In this way the use of steam and air pumps is obviated, whilst a vacuum of 27 in. is readily maintained. A centrifugal pump is usually employed for raising the condensation water to a height of about 15 ft. above the ejector. The ejector condenser is of greatest service when there is an abundant supply of condensation water.

BOILER EXPLOSIONS.

Abstracts from Recent Board of Trade Reports.

Explosion from a Cast-iron Steam Pipe.

Report of Preliminary Inquiry No. 1935.—The explosion occurred about 7 a.m. on Sunday, the 24th April last, at Denby Colliery, near Derby, owned by Mr. William Drury-Lowe. The pipe which failed was a right-angled bend made of cast iron, and formed part of the main steam range from the boilers to the winding engine. It was 10 in. in internal diameter. The pipe was fractured, making an opening 21 in. in length by the bore of the pipe, through which the contents of the steam pipe escaped into the engine house until the stop valve was closed. The explosion was caused by water-hammer action, brought about by opening the reversing engine stop valve, thus setting in motion the water of condensation which the main steam pipe contained. No person was injured by the explosion.

Explosion from a Boiler on Board the Screw Tug "Mabel."

Report of Preliminary Inquiry No. 1936.—The explosion occurred about 3 a.m. on Tuesday, the 22nd March last, when the tug was waiting to tow a vessel out of Burry Port Harbour. The vessel was owned by The Mabel Screw Tug Company Limited, New Dock, Llanelly. The boiler is of the single-ended marine type, and is made of steel. It is 9 ft. in length over all, and 9 ft. 6 in. in mean diameter. The shell is constructed of two courses of two plates, each $^{21}/_{32}$in. in thickness, the longitudinal edges being butted and fitted with double straps. There are two plain furnaces, each 6 ft. 4 in. in length, 36¼ in. in external diameter, and $^{17}/_{32}$in. thick, connected at the back ends to separate combustion chambers, the plates of which are ½ in. in thickness. There are two manholes 16 in. by 12 in., one on the top of the boiler and one in the lower part of the front plate between the furnaces. Two hand holes, 8 in. by 6 in., are also fitted, one at each wing. The usual mountings are provided, including two spring-loaded safety valves, adjusted for a working pressure of 100 lbs. per square inch. Some years ago, a patch about 19 in. by 24 in. by ⅜ in. was fitted to the port furnace and combustion chamber bottom. In August, 1909, a patch about 14 in. by 34 in. by ⅜ in. was fitted to the port combustion-chamber bottom. No other repairs appear to have been done to the boiler. The port combustion chamber commenced to leak, and water was observed running from the furnace mouth. This leakage gradually increased, until, about 11 hours later, a piece of the bottom combustion-chamber plate was blown out, leaving a hole which it is stated measured 1 in. by ⅜ in., through which the contents of the boiler escaped into the stokehold, and, as a consequence, the vessel was disabled. The pressure of the steam at the time was 80 lbs. per square inch. The explosion was due to the corrosion of the plate, which became so reduced in thickness that it could no longer withstand the working pressure. No one was injured by the explosion.

Explosions from two Heating Tubes in a Baker's Oven.

Report of Preliminary Inquiry No. 1937.—The explosion occurred about 9-30 a.m. on the 14th March, 1910, at Mr. W. M. Lloyd's, 68, Llandaff Road, Cardiff. Mr. W. M. Lloyd, the owner, was burnt about the face and had dust and soot blown into his eyes, necessitating medical treatment. The oven is described as a "two-deck brick steam oven," and consists of three compartments; the two upper ones, of similar size, are the ovens, the lower is the prover. The ovens are 6 ft. long, 4 ft. wide, and about 22 in. in height, inside dimensions; the prover is 7 ft. 6 in. long, 1 ft. 10 in. wide, by 2 ft. in depth. The oven is built of brick, with cast-iron fronts and sole plates. At the back of the two ovens, a sheet of wrought iron, about ⅛ in. thick, is fitted, with about 3 in. of silicate of cotton between it and the brick wall of the furnace. Heat is supplied to the ovens and prover by 59 iron tubes, hermetically sealed at each end, and each containing a small quantity of water. These tubes are butt-welded longitudinally, and the ends are closed by cup welding; they are 7 ft. 6 in. long, $1^{5}/_{16}$in. in external diameter, and ⅞ in. in internal diameter. There are three rows of tubes, 19 being in the upper, 16 in the centre, and 24 in the lower row, the lower row being utilised to form a firegrate. The front ends of the tubes rest on bearers, and the other ends pass through the brick wall forming the front side of the furnace, exposing about 7 in. of the tube to the heat of the fire. The furnace is about 4 ft. 4 in. long, and is formed of two vertical brick walls about 7 in. apart, extending from below the bottom row of tubes to a little above the upper row, the portion below the lower row forming the ashpit. A cast-iron fire door, an ashpit door, and a flue door are provided, and there is a damper for regulating the draught through the flue to the chimney. Above the flue a tank is fitted, to provide hot water, with a pipe and tap, a connection being led to the prover to supply a jet of steam when desired. A mercurial thermometer is fitted to each oven, and is graduated to 600 deg. Fah., with a red line at the 500 deg. mark to indicate the maximum temperature allowed. No means are provided for ascertaining or regulating the pressure in the tubes. The tenth tube from the furnace mouth, in the middle row, split for a length of about 1½ in. longitudinally along one side, commencing about 1 in. from the back end; this explosion was not of a violent nature. Almost immediately afterwards the adjoining tube, the ninth from the front, burst with a loud report; the fracture extended about 14 in. along the weld, across the back end of the tube, and along the side opposite to the weld for about 9¼ in., the distance between the torn edges being about 3½ in. at the end of the tube. The tube was displaced 3½ in. towards the front of the oven, and the flue door was blown out, the rush of hot gases and dust injuring Mr. Lloyd, who was about to close the damper. The water tank above also appears to have been slightly damaged. The explosions were due to the tubes becoming overheated, owing to the fire burning too brightly in the vicinity of the tubes that failed, and thus weakening the metal until it was unable to withstand the pressure generated.

SOME RECENT DEVELOPMENTS IN MACHINES FOR PICKLING STEEL SHEETS.

Improvements in pickling machines have recently tended, as in other mechanical appliances, toward the application of electricity where suitable for driving purposes. For the advantage of more economical working, manufacturers are prepared to pay for the more expensive electrical machinery.

In designing a mechanism for converting the rotary motion of a motor to the motion required by the pickling machine there are not only mechanical difficulties to be overcome, there is the difficulty presented by the formation of scum on the surface of the acid tank, which adheres to the plates when being lifted from the tank unless it is previously thoroughly broken up and mixed with the body of the acid mixture before the cradle is finally lifted. This is very conveniently done by the steam-operated machine, and herein lies practically the only valuable feature of this machine apart from its simplicity. It requires a man of more or less mechanical aptitude for the handling of the steam-operated machine, as the hand-operating mechanism used for the final plunging motion designed for the breaking of the surface scum is arranged to be worked quite independently and without interference with the automatic pickling mechanism of the machine. Careless using of this will soon loosen the joints of the superstructure and break up the machine. The less one dependes on the pickler, as regards the operating of the machine, the lower the bill of repairs may be expected to be.

A machine of an ingenious design, made by the Cross Foundry and Engineering Co. Ltd., of Gorseinan, South Wales, is shown in our illustrations, fig. 1 of which shows a side and fig. 2 a front elevation. The mechanism is designed to give an intermittent and reciprocatory motion between two given extremes, and with all motions controlled with only one hand lever, which can occupy three different positions as required. It will be observed that rotary motion is given to the crank disc A by mechanical means; the connecting rod B attached to lever C pivoted at D gives to the pawl E, which is attached as shown to levers C, a reciprocating motion between the points F and G. By engaging the pawl E with the ratchet wheel K in the manner described later on, and causing it to act as required in conjunction with the pawl L at critical periods, an intermittent motion of the cradle H containing steel sheets can be obtained between the already-mentioned extremes, and the cradle lifted out of, lowered into, or swilled with a reciprocating motion when in the tank at will. Overwinding is prevented by the simple provision of a raised side washer S on the outside of the ratchet tooth J, which does not allow of the pawl E engaging with it. Overlowering is rendered equally impossible by the simple expedient of so spacing the ratchet teeth and the circumference of the ratchet wheel K that on the termination of the last downstroke of the crank disc A the pawl E will fail to engage the ratchet tooth X. The other pawl L, which acts in conjunction with the pawl E at all times, is weighted so as to be normally in contact with the ratchet wheel. Both pawls are connected, as shown, to levers, which are operated by a cam M which slides on a feather key on the crankshaft. This cam is so placed in relation to the crank pin that, by rendering the pawls E and L inoperative at particular times, all the motions which the gear has been designed to make can be attained for only three positions of the cam along the feather key. An important feature of the gearing is that the stroke of the crank disc is made so long that the distance traversed by the point of the pawl E will be a little greater than the space between the equidistant teeth on the ratchet wheel K. This enables the load which is borne by pawl L at the termination of the lifting or lowering strokes to be taken off the pawl L by the pawl E engaging a ratchet tooth before the cam lifts the pawl L. There is thus no friction between the ratchet teeth and pawls, and practically no work for the cam to do, the resulting motion of the cradles being that required for economical pickling. The action of the pawls in lifting, lowering, and pickling at the end of the lowering stroke is as follows: During the lifting of the cradles out of the pickling tanks the cam is in one of its three necessary positions along the feather key, and both pawls, by virtue of their weighted ends, are kept against the ratchet wheel throughout their stroke, the cam being inoperative.

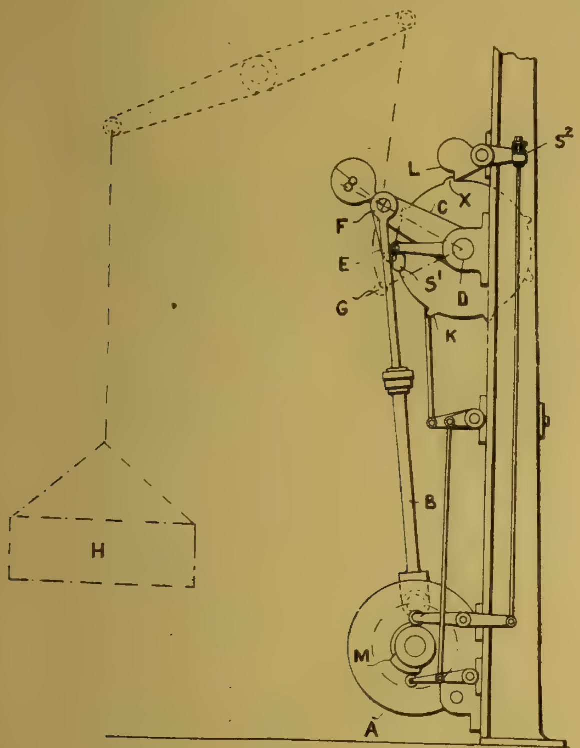


Fig. 1.

Overlowering is also automatically prevented. The termination of the lifting stroke pawl L supports the weight of the cradles and holds it until the pawl E engages a tooth on the ratchet wheel when the crank is nearly at the lowest point of its stroke. The weight is then slightly lifted and borne by pawl E, but is lowered back on L during the upstroke of crank, unless it is desired to lower cradles into tanks. If this is required the cam is moved by lever M to another of its three positions, and then lifts the pawl L over the ratchet tooth when the weight is borne by the pawl E. The upstroke of the crank then lowers the cradles into tanks, until pawl L, which, in the meantime, has been released by the cam, engages another ratchet tooth. Immediately this occurs the pawl E is lifted so as not to re-engage ratchet tooth on the downstroke of the crank. Just before the termination of the downstroke the pawl E engages another tooth, and the series of operations above described is repeated until the cradle is at the bottom of the tank, and the weight is borne by the pawl L, which therefore cannot be disengaged by the cam, the thrust of the cam being absorbed by a slight spring.

Overflowing is also automatically prevented. The continuous raising and lowering of the cradle in the tank, *i.e.*, the pickling motions, are obtained by placing the cam M in its third position along the feather key on crankshaft. The pawl is then lifted each time the crank pin nears the top of its stroke, and the pawl E, remaining in engagement with the ratchet wheel, gives a reciprocating motion to the cradles in the tank.

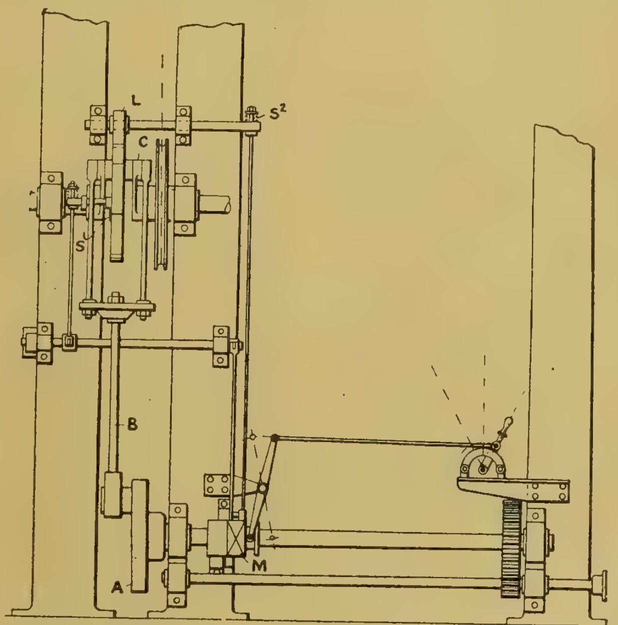


Fig. 2.

To summarise the above: To lift the cradles, the cam does not engage either pawl; to lower, the cam engages both pawls; to pickle, the cam engages only pawl L. The light springs R and S_2 on ends of the cam rods are arranged to absorb the thrust of the cam should this occur against a pawl when the weight of cradles is borne by that pawl, and when it would consequently be impossible to disengage it.

It will be seen that the pickling motion can be obtained at any of the stages of lifting the cradles from the tanks, and that by this means the scum formation on acid can be thoroughly broken up.

INDUSTRIAL BETTERMENT.*

(Continued from page 303.)

Now, let us see what is the best way to bring about industrial betterment to meet the requirements of the working organisation. In the first place, it is evident, owing to the varied conditions existing in different establishments, that in each case they must be studied in order to be understood, and that this study demands the application of the scientific method of investigation, which, although of recent origin, has now completely replaced the empiricism of the past, if we expect to trace the relationship between cause and effect, between acts and their consequences. To secure this information and to use it effectively requires intelligence of a very high type to begin with, in conjunction with a course of instruction in the art of management. By these means only a knowledge of competent managership can be secured.

Competent managership is what has to be learned from those who, by actual experience in the field of industry, have proven to be successful managers, and by this I do not mean merely successful financial management in the interest of the enterprise, but that broader successful management which takes into consideration the employee, the community, the State and the Nation.

In the first place, management has largely to do with the understanding of human nature, and this element of man does not vary much, whether we have under consideration a few or a large number of people. The same principles apply whether we are concerned with the management of a small group, such as is included in an industrial enterprise, or a larger one as embodied in an industrial town or a city, State or a Nation.

There are many industrial enterprises employing in a single plant from 5,000 to 15,000 men and women, who spend there the greater number of their waking hours. Each of these plants constitutes a good-sized town.

In all of these the same social laws prevail. These laws are man-made, and then enforcement is carried out by man. Civilisation advances, customs change, and as fast as laws enacted to meet certain conditions prove to be ineffective, they have to be changed to meet the exigencies of the new situation.

It is by the study of history and the analysis of action and reaction that we are able to note tendencies, and tendencies are prophetic, inasmuch as they indicate the direction in which we are going, and so give us foresight to determine whether we shall continue our course or change it.

Looking back over the history of nations, and studying the kinds of government which they have adopted, and observing their effects upon the people, we note that the tendency has been to change from absolute monarchy or one-man control, first to oligarchy, or control by the few, and finally towards representative government, *i.e.* government by the people themselves, or self-government.

In both of the former the service of the many was exploited for the benefit of the ruling element, while in the latter every man has a voice in determining what shall be done to him. Favouritism to the few in the former is replaced by equal opportunity for all in the latter.

Just so in the domain of industry, the factory organisation self-governed, when properly directed by competent management, has been proven to be the best managed organisation. But some employers say they would not trust their employees so far as to enlist their co-operation in a representative system of management. These are the employers who are having the most trouble with their men, because the latter in turn do not trust them, and when there is mutual distrust there can be no harmony or co-operation. Some employers say they cannot yield their authority to their organisation, or their responsibility will cease. This would be true if they yielded their authority, but they do so no more than a man yields the use of his legs when he uses a carriage. On the contrary, he uses both as vehicles to reach his destination.

These employers, ruling as absolute monarchs over their little realms, are relics of feudalism. They are so enamoured of their self-assumed right to rule that they assert it arbitrarily. Occasionally, when they are exceptionally overbearing and arouse the resentment of their subjects, they plead for co-operation, but expect the latter to do all the co-operating, and when one workman who, on account of his higher capabilities as a leader, is put forward by his fellows to present their grievances, he is at once selected as an agitator or disturbing element, and discharged. This man's inherent superior qualifications, which are recognised by his fellow workmen, are thus repudiated by the management. Just as by this process Russia has lost her ablest reformers, so are employers daily losing their most competent workmen.

Again, Dr. Eliot says, in his monograph on "Education for Efficiency": "The faculty for discerning and using conspicuous merit in other people distinguishes the most successful rulers, administrators, and men of business." Too many men, however, dislike or fear opposition, and endeavour arbitrarily to dispense with it. But wherever there are strong minds there is bound to be diversity of opinion, and it is this which, when given freedom of expression, brings about new ideas and advance and progress. It requires resistance to develop energy; autocratic suppression of it, as under absolute monarchic rule, engenders stagnation for a while, till fermentation develops and then comes the inevitable clearing up process, which is apt to be expensive.

This sort of absolute monarchical management of industrial establishments is an anachronism in the twentieth century. It is a condition of unstable equilibrium in countries where men are supposed to be free, but are by no means so during their waking hours; where thousands of these little feudal domains exist, with millions of serfs employed in them, all dominated by fear and each utterly helpless even to express his many grievances. It is not surprising, from our studies of history and our knowledge of human nature, that workmen who are daily being reminded of their right to a liberty which they do not possess have organised and are fighting through their unions to obtain that liberty.

First formed for defence, these unions grew large and powerful, and in the hands of the self-exploiting demagogue have frequently been a menace to individual industries, and a source of much suffering to their members, and expense to the public. The labour movement, if intelligently directed, might be of great benefit to all concerned; but, as Henry George, junr., writes on "The Dangers of Unionism," "large, unincorporated bodies of this kind, wielding great powers without responsibility, are seldom controlled by men of sound judgment and integrity. Where men get power for which they do not have to account, they become corrupted by it, and they abuse it, or else, resisting temptation and striving to use their power well, they are swept aside by the crafty and unscrupulous. Human nature remaining what it is, this must be the rule."

And the same statement applies to the average employer when vested with the supreme control of his employees.

The industrial betterment theories of the labour unions are in the main praiseworthy, and the results which they have permanently attained are undoubtedly meritorious. What they have secured, however, is far less than they have demanded and could have attained with a moiety of the effort expended. Their aggressive methods are as objectionable as the tyrannical methods of some employers, and a working organisation which is subjected to the disturbing influence of both is in a sad plight, and in no position to render efficient service. Fear is still the medium used by many to compel subservience, as it was in the dark ages, whereas in these enlightened days it is known that only by the absence of fear and its replacement by confidence can satisfactory results be obtained. If the unions would adopt an educational propaganda to induce employers to accept democratic ideas, instead of endeavouring to enforce their ideas by militant methods, they would accomplish their ends more rapidly and more effectively than they are now doing. But the unions will eventually drive industry to adopt democratic methods by a negative process, just as the evils of standing armies will compel nations to arbitrate their differences, or as the boss and the machine have driven municipalities to adopt government by commission. Thus will the unions accomplish their purpose, but by a method entirely unpremeditated and undesired by them on account of its disastrous reactive effect upon them; for when an industrial establishment is controlled by a representative management its members are in so much better condition than when dominated by a union that they are only too glad to drop the latter and be independent.

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* A lecture delivered by H. F. J. Porter before the Graduate School of Business Administration, Harvard University, Cambridge, Mass.

The tendency on the part of the governed under an absolute rule is to oppose the existing order of things, which they cannot understand and which they feel does not favour their interests, but exists for the purpose of conserving the interests of those who have brought it about. The tendency of representative government is to make everybody concerned do his part toward bettering the conditions which affect him and his fellows.

These two methods of government, therefore, draw their inspiration from opposite sources, ignorance and knowledge. One comes from suppression of information, and the other from publicity. One encourages revolution, the other evolution. Wrong thinking develops one, right thinking the other. No man need be feared who thinks right. Get met to think right and the rest will take care of itself. But right thinking requires freedom of personal initiative, or compulsion from within rather than from without. One through restraint discourages the establishment of enlightened public opinion, the other encourages it, and it has been found that where public opinion can be established on a basis of intelligence, there is no more potent element for safe progress, and the best way to establish public opinion is by a policy of publicity.

James Bryce, in his "American Commonwealth," says:—

"Towering over presidents and State governors, over congress and State legislatures, over conventions and the vast machinery of party, public opinion stands out in the United States as the great source of power, the master of servants who tremble before it. . . It grows up not in congress, not in State legislatures, not in those great conventions which frame platforms and choose candidates, but at large among people. It is expressed in voices everywhere. It rules as a pervading and impalpable power like the ether which passes through all things. It binds all the parts of the complicated system together and gives them whatever unity of aim and action they possess."

It would seem to be necessary, then, in order to secure substantial betterment in the domain of industry, that the basic principles of representative government should become dominant in it, and it is interesting to note in exemplification of this statement that whenever these principles have been scientifically applied there has been an immediate and remarkable improvement in conditions.

Theory has proclaimed their practicability. Frequent trial has demonstrated it.

What concerns us now, therefore, is the means by which these principles can be applied to an industrial organisation. How can they be instituted in a factory, and how do they accomplish what the ordinary form of shop government constructed on the monarchical plan has signally failed to secure in the past, *i.e.*, industrial peace, without which no shop can settle down to enthusiastic and effective work.

In the first place, the system of management must be a representative one, so constituted that the working forces have a recognised channel whereby the opportunity is extended of expressing their needs. This expression must be encouraged and consideration given to it by a permanently organised board or committee, composed of a representation of the working forces. This board must be inspired and authorised to act in accordance with its best judgment for the ultimate betterment of the business as a whole. For this reason, the more intelligent its personnel and the better informed it is, regarding the bearing of general matters on the business, from the standpoint of economics, the better will be the results obtained. It must, as much as possible, be free to reach its decisions unhampered by outside influences. For this reason the shop must be in every sense an open one, free from entanglements with labour unions.

(*To be continued.*)

TRADE NOTES.

THE Union Steamship Co., of New Zealand, have contracted with the **Campbeltown Shipbuilding Co.** for the building of a screw steamer of about 2,400 tons dead weight.

THE **Smoke Consumption Syndicate Ltd.,** who control the Cowper-Coles patents for the consumption of smoke, have recently erected a plant at Willesden for the manufacture of their "Caloriser" bricks. These bricks, which are made of a special material, are used as a lining for the flues at the back of the furnace, so as to obtain an increased temperature and at the same time consume the smoke. The company is now applying the "Caloriser" bricks to water-tube boilers as well as to Lancashire and Cornish boilers.

Messrs. Ferguson Brothers, Port Glasgow, have contracted to build a powerful screw tug for the Clyde Shipping Co. Ltd. This vessel will be similar in dimensions to the Flying Cormorant, built by the same firm, and is the seventh tug which Messrs. Ferguson Brothers have built for the Clyde Shipping Co. within the last six years.

Indian Engineering of 6th August notifies that tenders are invited by the Commissioners of Gaya Municipality for the carrying out of a water works scheme for that town. The contract includes the supply and installation of steel suction pipes, cast-iron and steel distribution pipes, steel rising main, two circular reinforced concrete reservoirs, etc. Sealed tenders, which must be made out on the proper forms, will be received by the Chairman of the Gaya Municipality, Gaya, up to 4 p.m. on 3rd October. Drawings may be seen and specifications and forms of tender obtained at the office of the Bengal Sanitary Engineer, 1 and 2, Old Court House Corner, Calcutta, or at the Municipal Offices, Gaya, on deposit of a sum of 50 rs. (£3 6s. 8d.), which will be returned on receipt of a *bonâ fide* tender.—*Board of Trade Journal.*

THE Tees Conservancy Commissioners have placed an order with **Messrs. Fleming and Ferguson,** Paisley, for a bucket dredger of special design. The vessel will be able to dredge close up to quay walls. This is the second order placed by the Commissioners with the Paisley firm.

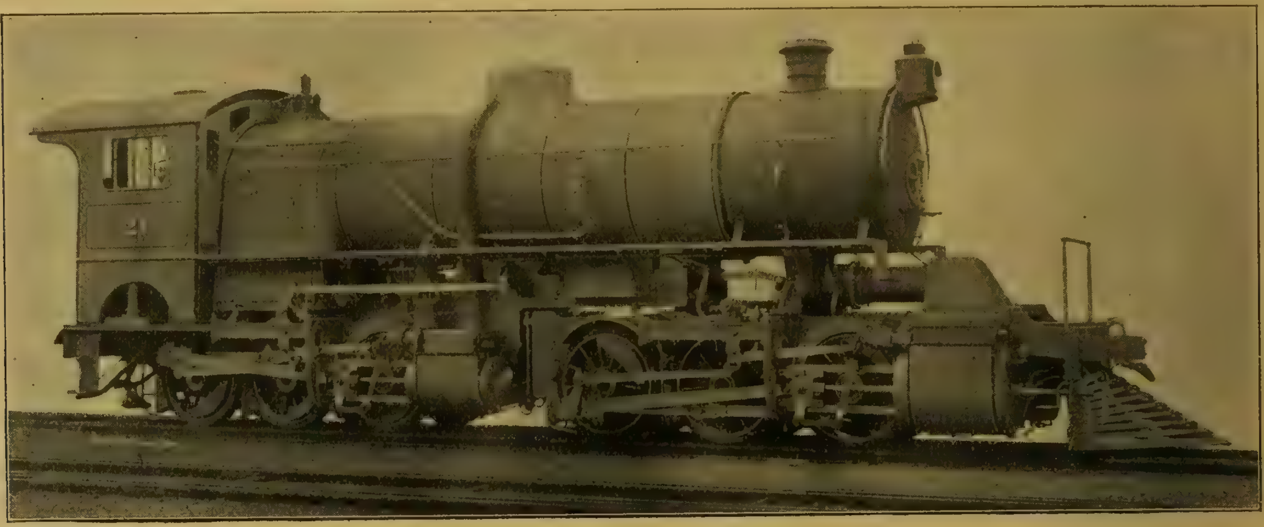
THE first order in the United Kingdom for a new type of steamer has been placed with **Messrs. Osbourne, Graham and Co.,** Sunderland. The vessel is to be constructed from Ayre and Ballard's patent, which takes the form transversely of an arched trunk superimposed on the normal moulded depth, and constituting an integral part of the hull. It is claimed that the plan increases the size and capacity with possesses some novel features. Briefly, it consisted of an ordi- reduced weight of material. The vessel is for Messrs. Groquist and Co.

Messrs. W. P. Butterfield, Ltd., Shipley, inform us that the further extension of their works, to cope with the increasing demand for galvanised goods, is approaching completion. This will enable them to take 3, 6, 9, or 12 months' contracts, and to hold a standing stock to customer's own specification for immediate despatch on receipt of wire. The firm have now a floor space of over four acres, which can be disposed of for storage for the above-mentioned purpose.

LARGE BRITISH-BUILT LOCOMOTIVES FOR CHINA.

Mallet Articulated Compound Locomotives, Imperial Peking-Kalgan Railway.

For service on the new lines of the Imperial Peking-Kalgan Railway of North China, there has recently been constructed by the North British Locomotive Company Ltd., Glasgow, four Mallet articulated compound locomotives, as illustrated herewith. These locomotives have been designed for hauling heavy train loads over sections of railway where gradients 1 in 30 are encountered, and curves of 500 ft. radius. The axle load is approximately 16 tons, and the total weight available for adhesion 96 tons. The salient features of the Mallet type of locomotive are well known, the chief one being the flexible wheelbase construction, there being two distinct groups of driving wheels, each group operated independently. The wheels of the hind or main carrying frame are driven by two high-pressure cylinders, and the wheels of the front or motor-truck frames are driven by two low-pressure cylinders. The boiler is rigidly attached to the hind frames at the high-pressure cylinders, thus obviating the necessity for any flexible high-pressure pipe joints, and is further supported at the front end by a prolongation of the hind frame, which, in transferring part of the weight to the front truck, thereby relieves the boiler from all stress. The weight at this point is carried on a sliding bolster fitted with vertical buffer springs. Suitable provision is also made at the front and back ends for the support and free expansion of the boiler. The front truck is connected to the main frame through a hinged joint formed by the cast-steel frame cross stays. To accommodate the movements of the front truck relative to the hind frame the receiver pipe between the high-pressure and low-pressure cylinders is provided with a ball and socket joint at the hinged end, and a telescopic joint at the front end. There are also ball and socket and telescopic connections provided between the low-pressure cylinders and the blast pipe. The lateral movements of the front frame are controlled by a horizontal side check spring arrangement attached to the underside of the smokebox, and so arranged that it also forms an emergency bolster for meeting any abnormal stresses due to unevenness of the track or in case of derailment. The two high-pressure cylinders are 18 in. diameter by 28 in. stroke, fitted with Richardson balanced slide valves and anti-vacuum valves. The two low-pressure cylinders are 28¾ in. diameter by 28 in. stroke, also fitted with Richardson balanced slide valves, anti-vacuum valves, and water-relief valves on each end at the bottom. Both sets are provided with steam-actuated draining valves. There are no intercepting or change valves used for starting purposes, the Mallet method being adopted, viz., a small auxiliary steam valve placed in the cab and operated by the driver is connected by a pipe to the receiver. The valve motion for both high-pressure and low-pressure cylinders is of the Walschaert type, the details being interchangeable throughout. Suitable adjustments are provided for varying the relative cut-off periods in the high-pressure and low-pressure cylinders. Reversing is effected by a steam gear. One handle only is required to distribute the steam in the reversing cylinder, and to lock or unlock the cataract valve on the water cylinder. The engine is fitted with the Westinghouse automatic, and also with the Westinghouse non-automatic or straight air brakes. Air pressure is used to operate the sanding devices, the use of compressed air for this purpose obviating all trouble from condensed steam in the sand ejectors and traps. The total wheelbase of the engine is 29 ft. 4 in., but only 9 ft. 8 in. in fixed wheelbase. The centre of the boiler above rail is no less than 10 ft. The cylinder lubrication is provided for by oil pumps and Furness lubricators, and the boiler feed by two injectors. The grate is of the finger-bar type, and is operated by steam gear. The safety valves are of the "Pop" type. It will be noticed that the running boards provided are of the American pattern, this being in accordance with the North British Locomotive Company's practice for the standard-type engines of the North China Railways. The gauge is 4 ft. 8½ in., the boiler heating surface 2,351 square feet, grate area 45 square feet, and working pressure 200 lbs. per square inch. The tenders for these engines have been built at the railway workshops in China.


MALLET ARTICULATED COMPOUND LOCOMOTIVE.

VARIABLE SPEED INDUCTION THREE-PHASE MOTOR WITH FIVE-SPEED STEPS.

The reduced efficiencies which result from the speed regulations of three-phase motors where resistances are employed in the rotor circuits has rendered the advantageous use of pumps of the ram, centrifugal, and turbine types, fans, etc., very limited where the source of power happens to be in a three-phase current. The variable-speed three-phase motor and controller shown in fig. 1 of our illustrations has, however, overcome the difficulty, and admits of a commercially successful application of this type of motor being made to such purposes as have been above indicated.

The motor, which is known as the Oerlikon variable-speed induction motor, is manufactured by the Maschinenfabrik Oerlikon, in Switzerland, whose London offices are at Oswaldestre House, Norfolk Street, Strand, W.C. They claim for this motor, which is of the five-speed step type, a greatly extended field of usefulness, and it is stated to be especially suitable for driving haulage gears, main fans, pumps, and other machines used in mining work. Hitherto the makers have been limited to the four-speed step type of variable-speed induction three-phase motor, and they have only succeeded in perfecting the above five-speed step type of machine and similar machines with six-speed steps comparatively recently, as the result of lengthy experiments.

The five-speed step motor shown is one of 100 B.H.P. used for operating a three-stroke ram pump employed for mining purposes, and this installation affords a very good example of a successful practical application of this type of motor. The motor is constructed to run at five speeds, viz., 105, 360, 485, 725, and 970 revolutions per minute, giving at these speeds respectively 10, 34, 48, 70, and 100 B.H.P. on the spindle shaft. It will be understood that the motor could be designed, if desired, to give any other particular range of output, or, if required, to give a constant output of 100 B.H.P. at all five speeds. The current supplied to the motor is a three-phase one of 2,200 volts between phases, with a frequency of 50 cycles. The diameter of the rotor is 35·25 in., and the active iron of both rotor and stator has a width of 10 in., with an air gap of about $^1/_{16}$ in. One hundred and forty-four half-open slots measuring in section 0·455 × 2·55 in. are provided in the stator, and 213 similar slots measuring 0·195 in. × 1·02 in. in the rotor. Fig. 2 is a diagram showing the connections of the controller. Three independent sets of drum windings divided equally in the slots are provided on the stator. The first winding is for the lowest speed, and has 48 poles. The two other windings are arranged for two sets of poles with a ratio of 1 : 2 ; that is respectively, 16 and 8 poles, and 12 and 6 poles. The first winding has per slot 55 turns, 0·043 in. diameter, the second winding has 24 turns of 0·075 in. diameter, and the third winding has 18 turns of 0·0857 in. diameter. The 16 and 8 poles have windings formed of eight sets of coils, and the 12 and 6 poles have windings formed of six sets of coils, these being connected in series for the higher number of poles, and in parallel for the lower number of poles. The rotor and pole change-over switches are of the simplest possible design. The first has a squirrel cage winding of uninsulated copper bars, cast-on brass rings being provided at each end for short-circuiting. The controller drum has the contact pieces so arranged that no crossing of the leads takes place beneath the individual contact pieces, thus ensuring perfect insulation of the individual contacts as regards the drum and each other. The number of contact fingers is 20, of which 17 are required for the pole-changing device, and the remaining three for the leading-in wires.

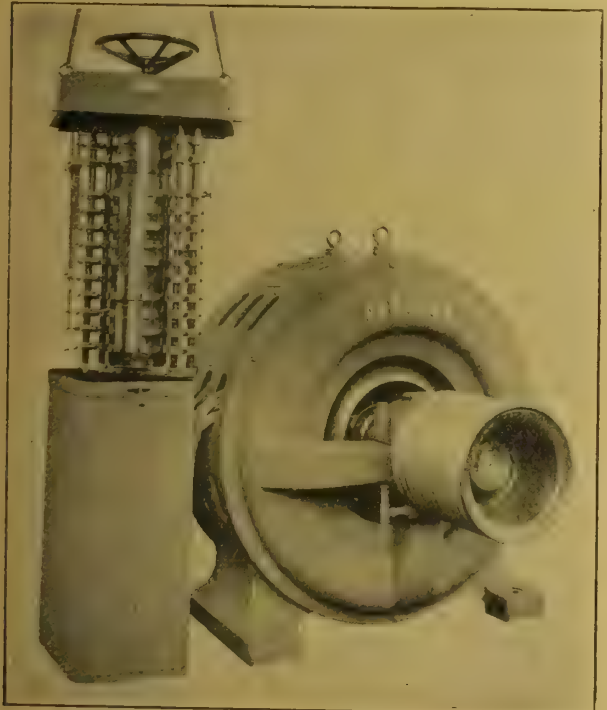


Fig. 1.—Variable Speed Induction Three-phase Motor with Five-speed Steps.

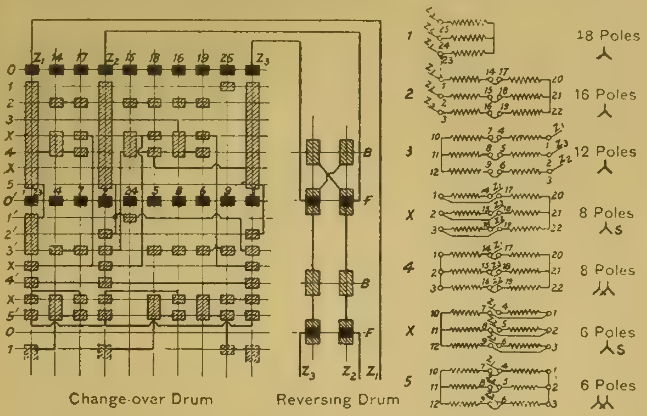


Fig. 2.—Diagram of Connections of Oerlikon Controller.

A ratchet device, which provides seven distinct positions, is provided on the contact drum. Five of these positions correspond to the five different speed steps, the intermediate positions, which are known as the "transition positions," being from 12 to 8 and from 8 to 6 poles. A reversing drum is provided in connection with the change-over switch, this drum being arranged to revolve freely on the main drum shaft, but such interlocking being provided that only when the main drum stands at the zero position—that is to say, when the stator is disconnected—can the reversing drum be operated.

TABLE II.—Torque Tests.*

Position.	No. of poles	Amps.	Volts.	Torque.
1	48	6·5	2,200	1·58 × 45 kg. (corresponding to 10·5 H.P. at 105 revs. per minute)
2	16	28·0	2,200	1·58 × 45 kg. (corresponding to 35 H.P. at 360 revs. per minute).
3	12	20·0	2,200	1·58 × 45 kg. (corresponding to 48 H.P. at 484 revs. per minute).
4	8 series	25·0	2,200	1·58 × 20 kg. (corresponding to 33 H.P. at 724 revs. per minute).
5	8 parallel	42·0	2,200	1·58 × 45 kg. (corresponding to 71 H.P. at 724 revs. per minute).
6	6 series	30·0	2,200	1·58 × 20 kg. (corresponding to 43 H.P. at 960 revs. per minute.)
7	6 parallel	45·0	2,200	1·58 × 45 kg. (corresponding to 100 H.P. at 968 revs. per minute).

* Starting torque tested by Prony's brake. Lever, 1·58 m. long. 45-50 kg.

The entire change-over and reversing gear works in an oil bath, and the life of the apparatus is found to be exceptionally long; indeed, we are informed that pole change-over drums with motors of the above type have been in use for periods of five years without renewals of the contacts being called for.

Another point to be noted is that the motor can be started up, by means of the above-described pole change-over device, very smoothly and gradually, as will be seen

TABLE I.—TESTS ON 100 B.H.P. 3-PHASE VARIABLE-SPEED OERLIKON MOTOR, 2,200 VOLTS, 50 PERIODS.

Load, H.P.	Revs. per min.	Volts.	Amps.	Losses.				Input.		Efficiency per cent	Power factor.	Stator resistance per phase.	No. of poles.
				Iron and friction losses.	Copper losses, stator.	Copper losses, rotor.	Total.	K.v a.	Kw.				
				Watts.	Watts.	Watts.						Ohms.	
..	125	2,200	4·95	1,300	1,500	..	2,800	18·8	2·8	..	0·15	..	..
5	119	2,200	5·15	1,300	1,800	180	3,280	19·5	6·98	53·0	0·355	22·75	48
10	108	2,200	6·7	1,300	3,200	480	4,980	25·5	12·36	60·0	0·485	..	..
..	375	2,200	7·0	2,000	900	..	2,900	26·6	2·9	..	0·11	.	..
17	369	2,200	8·2	2,000	1,050	200	3,250	31·0	15·75	79·5	0·51	5·2	16
34	362	2,200	10·4	2,000	1,700	1,200	4,900	39·2	29·9	84·0	0·76	..	..
..	500	2,200	7·5	2.600	600	..	3,200	28·5	3·2	..	0·112	..	..
24	492	2,200	9·7	2,600	1,000	280	3,880	37·0	21·7	81·5	0·59	3·5	12
48	484	2,200	13·8	2.600	2,000	1,130	5,730	52·5	41·13	85·5	0·79	..	..
..	750	2,200	8·0	4,200	400	..	4.600	30·5	4·6	..	0·15	1·37	8
35	738	2,200	11·3	4,200	530	420	5,150	43·0	30·85	83·5	0·72	..	..
70	724	2,200	18·5	4,200	1,400	1,800	7,400	70·0	58·9	87·5	0·84	..	..
..	1,000	2,200	8·4	7,000	200	..	7,200	32·0	7·2	..	0·225	..	..
50	984	2,200	15·0	7,000	600	550	8,150	57·2	44·65	82·0	0·78	0·9	6
100	968	2,200	25·0	7,000	1,700	2,350	11,050	95·0	84·65	87·0	0·89	..	..

by reference to the table giving the figures which were obtained on brake tests made with this motor. The high efficiency of the motor at all speeds and at all outputs, as well as its very high average power factor, are indicated in Tables I. and II., the latter table, which gives the torque tests by Prony's brake, showing that the current required for starting up the machine at the normal full load torque, which corresponds to each speed, is very small indeed.

Persons interested in this motor can obtain any further particulars desired, or tenders for equipments, from the Manager and Chief Engineer, Mr. Wüthrich, at the address given above, which is the Irish, British, and Colonial office of the Company.

BOILER FAILURES.

THE number of boiler failures that are reported seems to indicate considerable slackness. The cursory inspection or mere looking over of a boiler that some people seem to consider an inspection is not sufficient. The boiler should be completely opened out and the examination be carefully and thoroughly made. A note should be taken of all outlets and their connections traced. A minute examination of all joints should be made for any signs of leaks, which if found should be immediately rectified. The flues should be traced and the measurements of all the flues, grates, and heating surfaces, etc., carefully verified. A length should be removed from each of the pipes communicating with the boiler, and blank flanges be bolted on to prevent any possibility of water gaining access to the boiler without first passing through the measuring apparatus. And the safety valves and fittings should be seen to, and, if necessary, be made tight to prevent any waste taking place.

An important fact, which scarcely seems to receive the attention it should, is that large numbers of cylindrical boilers are now constructed of steel plate, and that practice shows that such plates do not in practical working deteriorate evenly, and that crystallisation is more liable to occur than in the old charcoal iron plates formerly employed for making boilers. The result of the above is that, in a boiler to all appearance perfectly sound, there may exist a hardened spot which, if subjected to any stress of an uneven nature, will in all probability go like a piece of glass. The flange of a flue head is a part which not infrequently is found to have become deteriorated in this manner and to have attained the dangerous brittle condition above indicated, and the rear head of a return tubular boiler is also especially liable to become so affected.

A correspondent of our American contemporary "*Power and the Engineer* gives the following valuable points on the reasons of many boiler failures, which are the result of his own practical experience, and which may prove interesting to many of our readers: "We find," he says, "many boilers in which the ends of the tubes have partly rusted away. Now, a tube may be considered as a stay, and it will hold in exact proportion to the shear on the bead; therefore, when the beads are gone the stress comes on the diagonal brace supporting the head. Frequently this brace is in a corroded condition, or perhaps the base of the brace is cracked and the slot has become worn until the brace pin becomes loose, allowing it excessive play. A loose brace pin is a dangerous thing for any boiler, and especially if the boiler is otherwise weakened. To illustrate this point, consider an elevator cable which will hold a car in ordinary service, but should the car drop a few storeys the cable would probly snap. This is true of a boiler head if the flues are rusted away and the brace has play; a slip of the head is apt to cause an explosion. With the brace pin tight this would not happen.

"This condition is more pronounced at the top head on upright boilers, and especially so on boilers that have no hood over the smoke stack to prevent rain from coming down. A wire brush should be used on the tube heads to remove the scale, in order to see the exact condition of the tube sheets. Many of the accidents are from small boilers that have no regular inspection. Merely looking over a boiler does not mean that it is receiving a careful inspection. Brace cracks are found only by close observation, and often a brace foot will be almost gone before the crack can be easily seen."

THE ENGINEERING STANDARDS COMMITTEE.

WE have received from the above committee Report No. 51 dealing with British standard specification for wrought iron for use in railway rolling stock ("Best Yorkshire" and Grades A, B, and C). In classifying the various grades of iron dealt with in the specification, the committee did not consider it desirable to use such terms as "treble best," "best best," or "best," as applied to Staffordshire iron. They were of opinion that it was preferable to indicate the best practice by suitable tests for each grade of iron rather than to perpetuate the use of trade expressions which have in most cases ceased to possess their original meaning, and the four standard grades of wrought iron for use in railway rolling stock are accordingly to be known as "Best Yorkshire," "Grade A," "Grade B," and "Grade C."

Five standard qualities of wrought iron have now been recommended by the Engineering Standards Committee, the tests for the fifth quality, "Grade D" wrought iron of smithing quality for shipbuilding, having been issued in a separate specification published in September, 1909 (Report No. 48).

It is interesting to observe that in view of the extent to which the British standard specifications are being used for orders from abroad the committee have deemed it necessary to insert a note at the foot of the tables of tensile tests to the effect that the ton referred to in the tables contains 2,240 lbs., so as to obviate confusion with the American short ton.

INTERCHANGEABLE INVOLUTE GEARING.*

By Wilfred Lewis.

After more or less unsatisfactory experience with cycloidal gearing, I investigated about 25 years ago the subject of involute gearing with the object of determining upon a system for the firm of Wm. Sellers and Co. with which I was then connected. The conditions imposed called for a system applicable to any number of teeth between a 12-toothed pinion and a rack, without change in the Sellers addendum which had always been made 0·3 pitch for the cycloidal teeth, hitherto used almost exclusively by them.

I found that the involute forms then in vogue were confined to obliquities of 14½ deg. and 15 deg. with an addendum equal to the modulus, or about 0·32 pitch. This long addendum with such small obliquities naturally gave rise to interference between racks and pinions of less than 30 teeth, and rather than modify the involute form I finally recommended the adoption of a pressure angle of 20 deg. At the same time I was well aware of the fact that even this obliquity was not sufficient to prevent interference between a 12-toothed pinion and a rack, but for such pinions and the gears of 60 teeth or less, with which they are commonly engaged, I believed the interference would not be noticeable in practice. I was strongly tempted to go further and fix upon an obliquity of 22½ deg., but 20 deg. then appeared such a radical departure from common usage that the advantages of the greater angle were dismissed as being possibly more theoretical than real.

The 20 deg. system with an addendum of 0·3 pitch has now been in use by Wm. Sellers and Co. for 25 years and has given satisfaction in a general way, although the interference referred to has been more or less noticeable on 12-toothed pinions. I reviewed this matter 10 years ago in a paper read before the Engineers' Club, of Philadelphia, advocating an obliquity of 22½ deg. and suggesting as a much needed reform in engineering practice the consideration of uniformity interchangeable gearing. I then pointed to the action of the Franklin Institute more than 30 years earlier, which inaugurated a standard system of screw threads and expressed the hope that by the interchange of opinions an agreement among engineers might be reached leading to the gradual disappearance of needless diversity in the forms of gear teeth.

Nothing in this direction had been done, however, when the subject of interchangeable involute gear tooth systems was brought to the attention of The American Society of Mechanical Engineers in a paper by Ralph E. Flanders presented in December, 1908. A number of systems in general use were analysed and their merits discussed from various points of view and the desire expressed that the council be petitioned to appoint a committee to investigate the subject of interchangeable involute gearing, and, if found desirable, to recommend a standard or standards.

In response to a circular letter which was sent out to manufacturers of gears and gear cutters, pointing out that a committee had been appointed to consider the subject of standards for interchangeable involute gear, and asking for their views on the matter, about 100 answers were received, expressing more or less interest in the subject and giving more or less conflicting preferences and conclusions.

One correspondent said he would hail with delight any system whereby complete interchangeability could be attained on gears running without noise up to 1,000 ft. a minute, as among automobile manufacturers noiseless gearing was always the chief end in view.

It is undoubtedly true, as pointed out by other correspondents, that perfect cutters do not necessarily produce perfect gears and that close attention must be paid to the setting of the cutter, proper indexing, speed, feed, etc., and from the extent to which the present 14½ deg. system is established it has been argued that even if the pressure angle of 14½ deg. were not the most desirable it would be better for the sake of the established practice to let it alone. Quite a number share this opinion and argue against the recommendation of a standard which may simply add another system to those already in use.

It may be said in reply that the chief advantages of involute gearing over cycloidal gearing, which it has pretty generally displaced, are the comparative simplicity of the involute curve and a slight variation in centre distances not permissible in any other system of gearing. Despite the difficulty of securing general recognition for any system of interchangeable gearing, I believe the committee should investigate and report upon some ideal standard or standards.

Attention was also called by a number of correspondents to the increasing number of gears cut by the hobbing process and the difficulty of making such gears interchangeable with certain cut gears, thus indicating the hobbing principle as the first principle to which all cutters should conform, the rack being the basis of all generated gears. It is admitted that hobbed gears can be used interchangeably with gears cut by certain other processes, but some doubt is expressed of the possibility of realising an interchangeable system using pinions with a small number of teeth and teeth of reasonable length without resorting to some modification of the involute curve. The opinion is freely expressed that if such modification becomes necessary the method should be known and clearly defined, so that makers of gears can adopt it and, if necessary, make their own cutters.

The most desirable quality in gearing and the one by which it is almost universally judged is quietness and smoothness of running. Next to this come strength, durability, and permanence of form, and upon the last, of course, depend continued quietness and smoothness of action. Friction and journal pressure are of less importance, but still worth considering, and before reaching any conclusions from theoretical considerations alone we propose to determine if possible, in a practical way, the relative advantages of some of the systems in common use and, with these, other systems to which we are disposed to give favourable consideration.

In some experiments an attempt was made to measure the friction loss between the teeth of a pair of spur gears, but the apparatus used, made originally for testing the friction of worm gearing, was not delicate enough for the purpose and the errors introduced exceeded in some cases the net result.

The possibility was then suggested of so dividing one of the pair of spur gears to be tested as to make the load on the teeth self-contained. The apparatus which has been designed embodies this idea, thus making it possible to run gears under heavy loads at high speeds with a very small consumption of power. There is also provided in the apparatus an adjustment of centre distance and means to measure the thrust between centres while the gears are running. Of course, the thrust between centres can be estimated very closely for involute gears from the pressure angle on the teeth, but results are anticipated somewhat in excess of this on account of the excess in friction of approach over that of excess, and, if any but involute gears are tested, it will also be interesting to compute from experimental data the effective obliquities of other systems.

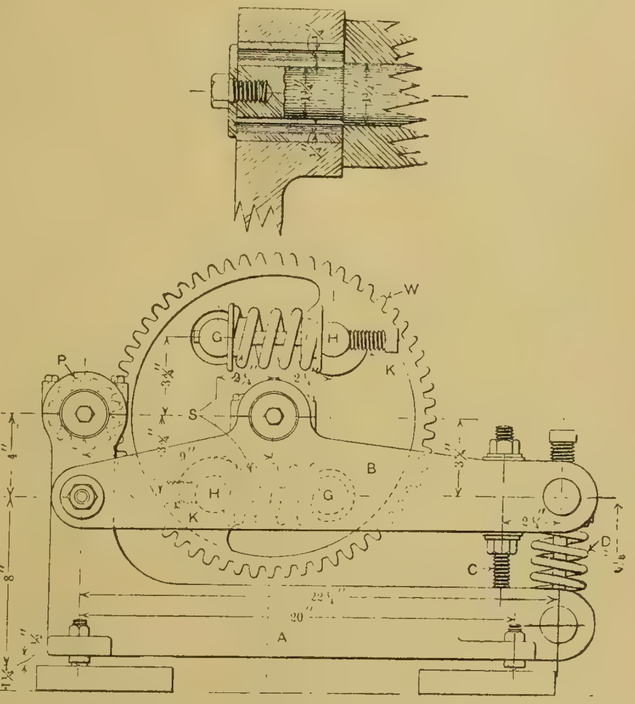


Fig. 1.

It is proposed to determine the friction loss under various speeds and pressures for wheels and pinions cut to the Brown and Sharpe 14½ deg.. standard, the 20 deg. stub tooth, and a 22½ deg. tooth with addendum of ⅞ module or about 0·278 pitch. These gears will be tested at normal centre distance and also at distances about 1 per cent or 2 per cent of the pitch greater or less than this, and an effort will be made to record graphically the noise produced under these different conditions.

Accuracy and permanence of form can thus be given their proper influence on the reduction of noise. It may take some time to determine the effect of wear, but from the method of loading the teeth and the small amount of power consumed some indication of the tendency of wear can be obtained. All gears tend to wear out of shape, and involute gears more so than cycloidal, but we recognise as a possibility that this tendency may be checked by the deformation itself and also that the loss in friction at different parts of a gear tooth is practically incalculable on account of the variations in friction for different velocities of sliding.

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* Abstract of paper read by W. Lewis at the joint meeting of the American Society of Mechanical Engineers and Institution of Mechanical Engineers, July 1910.

The apparatus used in making these experiments is shown by drawing, fig. 1, which gives some of the principal dimensions and shows the knife edges on which the machine rests. The machine consists of a frame A designed to carry a pinion shaft in roller bearings at one end and a frame B pivoted to it and designed to carry the gear wheels W engaging with a wide-faced pinion P on the pinion shaft. The frame B is held to the frame A at its outer end by an adjustable clamping bolt C, and provision is made to measure the thrust on centres by means of the spring D acting between the frame A and an adjustable abutment on the frame B. The gear wheels to be tested consist of a central gear with a wide face and two side gears with narrow faces. The central gear carries two heavy cross pins G which pass through clearance holes in the side gears, and the side gears carry two heavy pins which pass through clearance holes in the central gear. Between the projecting ends of these pins G and H heavy helical springs S are inserted upon which pressure can be applied by means of the set screws K.

The pressure of these four springs S is resisted by the gear teeth, the middle gear pressing against one side of the pinion teeth and the side gears pressing against the other side. The pinion thus becomes simultaneously a driver and a driven gear and the power required to turn it when loaded in this way is only that required to overcome the friction of the teeth and whatever resistance there may be in the gear journals. The latter presumably is very small indeed, but provision has been made to measure it by substituting plain cylinders without teeth for the gears and pinion and running these under the same journal pressures. By deducting the resistance due to journals from the total resistance with running gears the friction of the teeth alone can be determined.

In operation this machine is driven by an extension to the pinion shaft carried to bearings several feet distant to permit of ample flexibility. The knife edge directly beneath the pinion rests upon a permanent support, and the other knife edge is carried upon the platform of a small platform scales. The driving moment in the pinion shaft will therefore be measured by the scale reading at the end of an arm 20 in. long, and by reversing the direction of motion given to the pinion shaft the effect of any initial lateral strain in the driving shaft can be eliminated.

(*To be continued.*)

LAUNCHES AND TRIAL TRIPS.

Boyne.—The steamer Boyne left the Wear recently to undergo her official trial trip. She was constructed by Messrs. Jos. L. Thompson and Sons Ltd., of the North Sands Yard, Sunderland, to the order of the Mercantile Steamship Co., of London. The principal dimensions are: Length, about 388 ft.; breadth, 51 ft. 6 in.; and depth moulded, 28 ft. 9 in. The propelling machinery had been constructed by Messrs. Blair and Co. Ltd., of Stockton-on-Tees. The trial trip was most successful in every way, the average speed of 12½ knots being easily maintained.

West Wales.—The steel screw steamer West Wales, which has been built to the order of Messrs. Gibbs and Co., Cardiff, was successfully launched from the yard of Messrs. Bartram and Sons, Sunderland, on August 26th. The principal dimensions are: Length, 355 ft.; breadth, 51 ft.; and depth, 28 ft. 2in.; and she is designed to carry 7,350 tons dead weight on 24 ft. draught of water. The propelling machinery is by Messrs. J. Dickinson and Sons Ltd., Sunderland, the cylinders being 25 in., 42 in., 68 in., by 48 in. stroke, and two boilers, 16 ft. 6 in. by 11 ft. 6 in., 180 lbs. pressure. The vessel is of the single-deck type, with long bridge, deep frames, and holds clear of all obstructions, and is built to obtain the highest class in Lloyd's Registry.

Kulambangra.—Messrs. Napier and Miller, Old Kilpatrick, launched on August 25th the twin-screw steamer Kulambangra, built to the order of Messrs. Lever Brothers, Port Sunlight. The dimensions of the vessel are: Length, 265 ft.; breadth, 37 ft.; depth, 26 ft. 3 in.; with a gross tonnage of about 2,000 tons. The vessel has been constructed to Lloyd's highest class. The vessel, which is intended for trading in tropical climates, is fitted with refrigerating plant and large cold storage chambers. The machinery will be supplied by Messrs. J. G. Kincaid and Co., Greenock.

Preussen.—Messrs. John Brown and Co., Clydebank, launched on August 25th the single-screw cargo steamer Preussen, built for the Eastern trade of the Hamburg-America Line. The principal dimensions of the vessel are: Length, 470 ft.; breadth, 58 ft.; depth to upper deck, 36 ft. 3 in. She is of about 8,000 tons gross, and has a dead-weight capacity of about 12,000 tons.

Broompark.—The Greenock and Grangemouth Dockyard Co. launched from their Greenock yard on August 25th a steamer for the Denholm Line, Greenock. The dimensions of the vessel are: Length, 245 ft.; breadth, 37 ft.; depth, 17 ft. 5 in.; with a carrying capacity of 2,200 tons. The machinery will be supplied by Messrs. Dunsmuir and Jackson, Glasgow.

John G. Watson.—Messrs. Hall, Russell, and Co., Aberdeen, launched on August 25th a steam trawler, built to the order of Messrs. Richard Irvin and Sons, Aberdeen. The vessel is of the following dimensions: Length between perpendiculars, 115 ft.; breadth, 22 ft.; depth, 12 ft. 6 in. A steel boiler and triple-expansion engines will be supplied and fitted by the builders.

There was launched from the yard of the Sunderland Shipbuilding Co. Ltd. a steel screw steamer, 346 ft. length between perpendiculars by 50 ft. 10 in. broad by 25 ft. 6 in. deep, having poop, bridge, and top-gallant forecastle, classed 100 A1 Lloyd's under special survey. The vessel is of the single-deck type, and her dead-weight carrying capacity is 6,350 tons upon a light draught of water. A large marine type donkey boiler is supplied for driving the deck machinery, which consists of six steam winches, steam steering gear, and direct steam windlass. The main engines are by the North-Eastern Marine Engineering Co. Ltd., Sunderland, having cylinders 24½ in., 40 in., and 66 in., by 45 in. stroke, steam being supplied by two large boilers working at a pressure of 180 lbs. per square inch. The vessel has been built on London account, and was most successfully launched.

Lingfield.—This vessel, built to the order of Messrs. Woods, Tylor, and Brown (the Woodfield Steamship Co. Ltd.), London, by Messrs. Irvine's Shipbuilding and Dry Docks Co. Ltd., West Hartlepool, proceeded on her official trial trip in Hartlepool Bay on August 24th. The vessel is of the single-deck type with poop, long bridge, and forecastle, and has a carrying capacity of 7,500 tons on a light draught. Her dimensions are: Length, 380 ft.; breadth, 51 ft. 4½ in.; depth, 28 ft. 4½ in. She is classed Lloyd's 100 A1, and is constructed with deep bulb-angle frames and longitudinal stringers, giving clear holds for the stowage of bulky cargoes. Nine steam winches are provided worked from a multitubular donkey boiler. A powerful quick-warping steam windlass is fitted forward, steam steering gear amidships, hand screw gear aft, and a steam ash hoist is also fitted. The propelling machinery, which worked most efficiently throughout the trials, has been supplied by Messrs. Richardson, Westgarth, and Co. Ltd., Hartlepool, the sizes of cylinders being 26 in., 42½ in., and 70 in., by a 48 in. stroke, with three large boilers working at a pressure of 180 lbs. per square inch. The trial trip was in every way satisfactory, a mean speed of 13 knots being easily maintained on the measured mile.

Bandon.—The Bandon, the latest addition to the fleet of the City of Cork Steam Packet Co. Ltd., of Cork, was launched on August 24th from the Neptune Works, Newcastle-on-Tyne, of Messrs. Swan, Hunter, and Wigham Richardson Ltd. The steamer is a finely-modelled steel screw steamer 266 ft. in length by 37 ft. beam, and has been constructed to obtain the highest class in Lloyd's Registry. She is being fitted with a set of triple-expansion engines, designed to propel her at a speed of 15 knots, and supplied with steam by two boilers fitted with Howden's system of forced draught. Both engines and boilers are being constructed at the Neptune Works. There is electric lighting throughout. The auxiliary machinery is most complete, including one electric and four steam cranes and steam windlass.

Beverley.—This twin-screw tug, built and engined by Messrs. Ferguson Brothers, Port Glasgow, for the Port of London Authority, carried out successful speed and towing trials last week. The mean of four runs on the measured mile resulted in a speed of over a knot in excess of the contract.

NAVAL NOTE.

Alarm.—Messrs. John Brown and Co., Clydebank, launched on August 29th the torpedo-boat destroyer Alarm, which they have built for the British Government. The vessel, which is of the Acorn class, is the second of the type launched by the firm. She is of 800 tons displacement, and will have turbines of about 18,000 I.H.P.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 1st September, 1910.

BELFAST.—*First class:* A. Robertson. *Second class:* A. Evans, J. Moneypenney.

CARDIFF.—*First class:* G. Day, O. Clarke, D. J. Mordecai, A. T. Gibson. *Second class:* L. W. Jenkins, G. H. Oliver, C. Pollard, W. Watts.

GLASGOW.—*First class:* J. Anderson, R. Abbott, E. Ternan, A. B. Loch, J. Campbell. *Second class:* B. Fiddes, H. A. Henderson, J. S. McIntyre, L. G. Neilson, J. Skeoch, D. Wright.

LEITH.—*First class:* T. Gibb. *Second class:* R. S. Carruthers, J. E. Cole, A. McLeggan, W. B. G. McLaren, J. N. Rennie.

LIVERPOOL.—*First class:* A. E. Smith, J. S. Southward, S. J. Barron, W. G. Tait, T. S. Croft, A. L. Webb, T. Jones. *Second class:* W. E. Harper, W. R. Jones, J. Neale.

LONDON.—*First class:* J. Mackinnon. *Second class:* F. Gordon, M. T. Montgomery, H. N. Prentice, J. C. Robinson, S. M. Saybolt.

NORTH SHIELDS.—*First class:* F. Marshall, J. W. Roche, J. E. Cowper, C. D. Caird. *Second class:* T. C. Alderson, N. R. Douglass, P. W. Ruddock, G. R. Storey.

SOUTHAMPTON.—*Second class:* M. C. J. Collis, M. Kypriadis.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2272. Young's Modulus.—Having some steel and brass wire, of which I wish to know Young's modulus, should be glad to hear of simple method of finding same. State precautions to be observed, and give any hints, data, etc., likely to help to accurate result.—MODULUS.

Answer.—A very good and simple method of determining Young's modulus for a wire, and one which I have often used with satisfactory results is as follows: Referring to fig. 1, a length of wire D D (6 ft to 10 ft.) of the material to be tested is suspended from a suitable beam B near the ceiling of the test room. The lower end of D D is clamped in a groove at the back of the light wooden vernier block V, and continued downwards to the weight hook H. Two fine steel wires A A, C C are also attached to B, and run parallel to D. These wires carry the stationary scale S, which must be heavy enough to keep A A, C C taut, otherwise there is danger of its height varying during the experiment. During the ensuing test great care must be taken that D D is not stretched beyond its elastic limit. To obviate this danger it is well to place a small safety peg on V (see fig. 2) so as to prevent D being stretched more than a predetermined amount. A small weight is then attached to H to take up all slack in the test wire D D. The length l of D D, between the fixed point on B and the clamping screw on V, is then carefully measured (by a yard rule, say). The diameter of D D is measured by a micrometer gauge at, say, ten roughly equidistant points along l, and a mean value for the sectional area a of D D is thence calculated. The position of V is noted, and a known extra weight w is added to H; w should equal $\frac{1}{5}-\frac{1}{10}$ maximum permissible load (see below), and should be added quite gently to H. If the weight be dropped on to H, the impactive stress produced in D D will probably exceed the elastic limit of the wire, and a fresh sample will have to be used. The fresh reading of V is noted, and w is further increased, V being again read. This is repeated till the maximum load is reached. It is then well to decrease w steadily, noting the contraction of D D, as indicated by V, at each step.

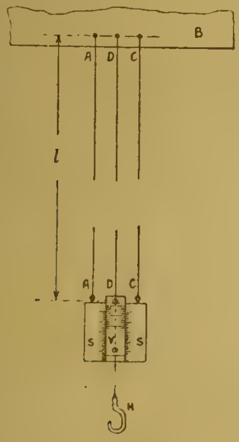


FIG. 1.

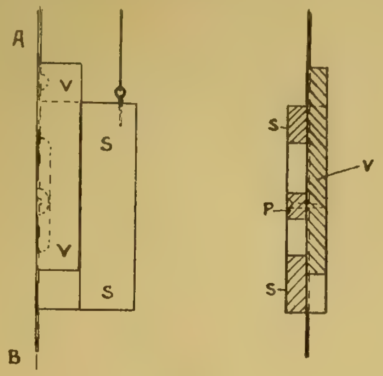


FIG. 2.

From the data so obtained a graph can be plotted between the load on D D and its extension. This will be found to be linear, if the elastic limit has not been exceeded. Should the latter have been overstepped, either a fresh set of data must be taken, rising to a less maximum load, or only those points on the graph corresponding to the linear relationship between load and extension must be used in determining the desired line. From the $w-\mathrm{E}x$ line so obtained, a closely accurate value for the extension (x'') per pound of load on D D can be deduced, and hence a value of Young's modulus (E) for the wire calculated for—

$$\mathrm{E} = \frac{\text{stress}}{\text{strain}} = \frac{\frac{w}{a}}{\frac{x}{l}} = \frac{1}{a} \cdot \frac{l}{x} = \frac{l}{a\,x} \text{ lbs. square inch}$$

in the present case. (l = inches, a = square inches, x = inches). Within reasonable limits, the greater l the more accurate the value of E, since x is greater for a given stress, and therefore more easily read on V. A wire of reasonably large area (say 0·0003 square inch) should be used.

In a certain test which I recently carried out, l = 113 in., d = 0·01466 in.; $\therefore a$ = 0·0001688 square inch; the average extension of the wire per pound load = 0·03965 in. Hence

$$\mathrm{E}\left(=\frac{l}{a\,x}\right) = \frac{113}{0{\cdot}0001688 \times 0{\cdot}03965}$$

$$= 16{,}900{,}000 \text{ lbs. per square inch (approximately).}$$

The material used in this instance was copper. The above method is obviously equally applicable to any metallic wire, suitable values for the length, area, and maximum load to be used for the test wire in each case being easily determined from a preliminary rough determination of E, and an observation (from the load extension curve) of whether the elastic limit was exceeded in the preliminary test.—L. C.

[A similar reply has been received from H. S. M.—ED. *P. E.*]

2273. Grindstone Formula.—Please explain how the ($0{\cdot}031\,w\,v^2$) grindstone formula is obtained from first principles. Is the formula reliable? What speeds and stresses can I allow in millstones? Show how to calculate the energy stored in same.—K. T.

Answer.—Imagine a ring of the grindstone material, as shown in fig. 1. Let this be of depth w and width t (t must be very small). Now, the bursting stresses on any section X Y of such a ring may be considered as concentrated into two resultant tensions T T, which together make up the centrifugal force C F, as shown in the vector triangle. From the latter—

$$\frac{\mathrm{C\,F}}{2} = \mathrm{T} \sin \frac{d\,\theta}{2} = \mathrm{T}\,\frac{d\,\theta}{2} \text{(very nearly, since } d\,\theta \text{ is small),}$$

$$\textit{i.e.,}\ \mathrm{C\,F} = \mathrm{T}\,d\,\theta \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

$$\text{But C F also} = \frac{\text{weight of block } a\,b\,c\,d}{g} \times \frac{v^2}{r}$$

$$= \frac{p\,w\,t\,d\,l}{g}\;\frac{v^2}{r} \quad \ldots\ldots\ldots\ldots \quad (2)$$

where p = density of material, v = peripheral velocity feet per second, r = radius of ring. Again

$$d\,l = r \sin d\,\theta = r\,d\,\theta \text{ (very nearly).}$$

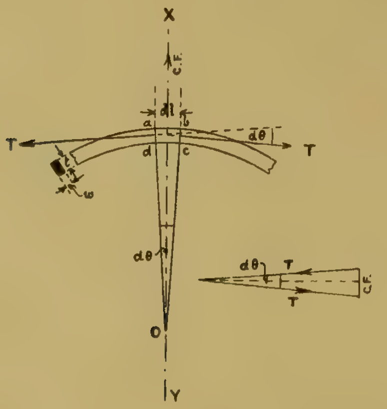
$$\therefore \mathrm{T}\,d\,\theta = \frac{p\,w\,t\,r\,d\,\theta}{g}\;\frac{v^2}{r}$$

$$i.e., \frac{\mathrm{T}}{w\,t} = \frac{p}{g}\,v^2 \quad \ldots\ldots\ldots\ldots \quad (3)$$

or, tension per square foot of rim section (due to centrifugal force)

$$= \frac{p}{32{\cdot}2}\,v^2 = 0{\cdot}031$$

× weight of material per cubic foot × (peripheral feet per second)^2. This formula is quite reliable, and may safely be used in grindstone, flywheel, and similar designs, so long as the centrifugal stress so calculated gives a liberal factor of safety on the ultimate tensile strength of the material. Assuming a millstone weight of 144 lbs. per cubic foot, and an ultimate tensile strength of 800 lbs. per square inch (average figures), the bursting speed of the wheel is given by—



$$\mathrm{V}^2 = \frac{(800 \times 144) \times 32{\cdot}2}{144} = 25800$$

$i.e.$, V = 160 ft. per second approximately.

For a factor of safety of K—

$$\mathrm{V} = \frac{160}{\sqrt{\mathrm{K}}} \text{ feet per second ;}$$

$i.e.$, for K = 4 ; V = 80 ft. per sec.; $i.e.$ = 4,800 ft. per min.;
T = 200 lbs. per sq. inch.
= 8 ; = 57 ,, ,, $i.e.$ = 3,420 ft. per min.;
T = 100 lbs. per sq. inch.
= 10 ; = 51 ,, ,, $i.e.$ = 3,060 ft. per min.;
T = 80 lbs. per sq. inch.

A factor of safety of 10 is desirable in this case, $i.e.$, V should not exceed 50 ft. per second (3,000 ft. per minute). This value is usual English practice (Sheffield grinderies). Emery grinding wheels are, however, run up to 4,000 or 5,000 feet per minute.

Energy stored.—The energy stored by a rotating disc, such as a grinding stone, is given by

$$\text{Kinetic energy} = \frac{1}{2}\,\mathrm{I}\,w^2,$$

where I = polar moment of inertia of the disc, and
w = angular velocity of the disc.

Suppose that a 6 ft. stone, 1 ft. thick, runs at a peripheral speed of 20 feet per second, then—

$$\mathrm{I} = \frac{\mathrm{W}}{g}\cdot\frac{r^2}{2} = \frac{(\pi \times 9 \times 1) \times 144}{32} \times \frac{9}{2} = 571 \text{ lb. ft. units,}$$

$$\text{and } w\left(= \frac{v}{r}\right) = \frac{20}{3} \text{ radians per second,}$$

$$\text{therefore, K E stored} = \frac{1}{2}\,.\,571\,.\,\frac{400}{9} = 12{,}730 \text{ ft.l-bs.}$$

W. M.

— —

2274. Pulley Blocks.—Please explain the principle of the Weston pulley block. State power of same and why this is different up and down. Give an expression for the efficiency of the blocks, state usual value, and compare with other blocks.—K. T.

2275. Centrifugal Pump.—I have a centrifugal pump, direct driven by steam engine through flanged coupling. I wish to find a simple formula for calculating the strength of bolts in the coupling, to enable same to withstand the B.H.P. given off by the engine shaft when driving the above pump. Is not this generally termed the "tractive effort"?—GRATEFUL.

MISCELLANEA.

ACCORDING to the *Matin* some pattern of explosion engine may be used for the new 23,000-ton battleships provided for in the new Naval Estimates which are about to be laid before the French Parliament.

REFRIGERATED barges have been placed in service to carry perishable produce from the railroad docks at Weehawkin, or at Sixtieth Street, New York City, direct to the warehouses or to the steamers. Five such barges are now in use, and more will probably be fitted up next year.

THE cruiser Roxburgh has, we hear, been ordered to wait at Portland in order to test Engineer-Commander Metcalfe's new invention for coaling ships at sea. In order that the trial to which the invention is subjected may be as exhaustive as possible, it is not to take place until bad weather.

THERE were 139 coal-cutting machines in use in the Liverpool and North Wales district in 1909, that is eight more than in 1908. The output in 1909 reached 1,033,237 tons, as compared with 834,273 in the previous year. The use of electrically-driven machines has decreased, whilst that of compressed air machines has increased, the latter being found in the long run quite as economical, whilst possessing other obvious advantages.

RAILWAY EXPERIMENTS.—The London and North-Western and the Great Western Railways are conducting an interesting series of experiments to learn whether further economies can be effected in the working of their locomotives. One of the latest type of North-Western engines is being attached to the Great Western Cornish express from Paddington to Plymouth without a stop, and a Great Western engine is running the Manchester and Liverpool express from Euston to Crewe without stopping.

THE Nelson Steam Navigation Co. have acquired the nine steamships which were recently built or are building for the Nelson Line (London) Ltd. Each vessel will be able to carry about 2,700 tons of chilled meat. The steamships have been built by Messrs. Russell and Co., of Port Glasgow, and Messrs. Cammell, Laird, and Co., of Birkenhead; the refrigerating plant supplied by the Liverpool Refrigerating Co.; and the insulation work carried out by Messrs. Bell and Burnie Ltd., of Bootle.

IT is stated that the principal warship builders of this country and abroad have received an invitation from the Chilian Government to tender for the construction of two battleships. The ships are to closely resemble the English Super-Dreadnoughts of the Orion type, and are to be of about 24,000 tons displacement, with a speed of 23 knots. The engines are to be of the Parsons marine turbine type, and the armament will consist of ten 12-in. or 13·5-in. guns, together with an auxiliary armament of 4·7-in. guns in batteries. There will also be the usual complement of torpedo tubes and smaller guns.

ACCORDING to a Reuter telegram the Prime Minister of New Zealand informed the House of Representatives that he had concluded arrangements with the Union Steamship Co., of New Zealand, for the establishment of a subsidised mail service between New Zealand and San Francisco by way of Raratonga and Papeete. The service is to start from Auckland on October 22nd, crossing the Pacific Ocean in 22 days and making the total journey to London in 32 days. The Government desired to obtain a Vancouver service, for which Canada had been asked to send tenders. If a Vancouver service was established the San Francisco contract, if satisfactory, would probably be extended, with Wellington as the terminal port.

EVERY now and then some inventor makes another attempt to produce a practical type of road vehicle driven by wind power. The latest invention in this direction seems to be by an American genius who has produced a "wind car" which possesses some novel features. Briefly, it consisted of an ordinary motor car which had its gear box and differential removed, and an 8 ft. wooden propeller mounted at the rear on a spindle, to which was keyed a pinion, and this pinion was connected by a chain to a chain wheel on a spindle which drove the rear wheels of the car. The weight of the car complete was 1,800 lbs., and the motor was 40 H.P. It is said that at a trial held recently a speed of five miles in 5 mins. 20 secs. was obtained, with the propeller revolving at 750 revolutions per minute.

PATENTEES' CHRONICLE
OF
Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

AUGUST 29th, 1910.

20049 Erasers. Day.
20050 Tubes. Martin and anr.
20051 Swivels. Butler and anr.
20052 Lamps. Buckley.
20053 *Motors. Pieper.
20054 Computing machines. Schooling and anr.
20055 *String holders. Walker.
20056 Brakes. Foster.
20057 Signalling apparatus. Ludlow.
20058 *Fermented liquids. Fleming.
20059 Furnace fittings. Downie.
20060 Securing wheels. Brown.
20061 Tread guides. Burtinshaw.
20062 Fire escapes. Allen.
20063 Drying malt. Lambert.
20064 Packings. Gauldie.
20065 Gauge. Triag.
20066 Buffer. Triag.
20067 Building ties. Byarre.
20068 Amusement. Monk.
20069 Internal-combustion engines. Fielding.
20070 Kites. Motoin.
20071 Vehicles. Crutchley and anr.
20072 Gas turbines. Dod.
20073 Pipe. Walker and anr.
20074 Amusement. Lambert.
20075 Submarine motor. Massey.
20076 Hairpin. Collins and anr.
20077 Glass movements. Jones and anr.
20078 Window fastenings. Layland.
20079 Boxes. Chalmer.
20080 Aerial machines. Daress and anr.
20081 *Measuring instrument. Roch and anr.
20082 Drip catcher. Storie and anr.
20083 *Gas lamps. Hubess.
20084 *Gas lamps. Hubess.
20085 Stoppering. Anspach.
20086 Integrating instrument. Whiting.
20087 Talking machines. Thomassin.
20088 Golf. Abbott.
20089 *Switches. Siemens Bros. and anr.
20090 *Valves. Siemens Bros. and anr.
20091 *Internal-combustion engines. Remfry.
20092 Sheep shearing machines. Massey.
20093 Glove. Parslow and anr.
20094 Boots. Rickmann and anr.
20095 *Musical instruments. Clark.
20096 Dyestuffs. Newton.
20097 *Boots. Ashley.
20098 Wheels. Mawson.
20099 Bandages. Falk.
20100 *Gramophones. Pergolizzi.
20101 Dredges. Holins.
20102 *Lathes. Ludw. Loewe Akt.-Ges., Christoffer Munthe and anr.
20103 *Tool slides. Ludw. Loewe Akt.-Ges., Christoffer Munthe and anr.
20104 *Guide. Hoeffert.
20105 *Aeroplanes. Hyde and anr.
20106 Discs. Leese.
20107 Electric cranes. Allen, West and Co. Ltd. and anr.
20108 Distributing cards. Price.
20109 Oxidation product. Imray.
20110 Dyestuff. Imray.
20111 Perforator. Carpentier.
20112 *Doors. Macdonald and anr.
20113 Fasteners. Cobley, junr., and anr.
20114 Hairpins. Mazine.
20115 *Metal ores. Berglof.
20116 Dampers. Flavel.
20117 Pickling plates. Jenkins.
20118 Lifts. Walker and others.
20119 Guns. Dawson and anr.
20120 Hubs. Lake and others.
20121 *Making infusions. Bréjeux.
20122 Drying machines. White.
20123 *Bottles. Lussen.
20124 Internal-combustion engines. Pearce.
20125 *Aeroplanes. Schaef.
20126 Ploughs. Sims and others.
20127 Ammonia. Johnson.
20128 Springs. The Avon Rubber Co. Ltd. and anr.
20129 Guns. Dawson and anr.
20130 *Tyres. Rondeau.
20131 *Denitrating nitrose. Salessky.
20132 Boilers. Hindley and others.
20133 *Iron, etc., ores. Savelsberg.
20134 *Tyres. Planke.
20135 Gas retorts. Adridge.
20136 Seasoning for foods. Houston and anr.
20137 *Pipe cleaner. Edmonds.
20138 *Cutting tool. Prend homme.
20139 Lighting. Fenner.
20140 Lamps. Anthony.
20141 Glass. Pilkington.
20142 Cleaning gauze. Turpy.
20143 *Motors. Bertrand.
20144 *Coke ovens. Hoppers.
20145 Flying machine. Williams.

AUGUST 30th, 1910.

20146 Castors. Ellis.
20147 Displaying goods. Fowler.
20148 Internal-combustion engines. Douglas.
20149 Mixing concrete. Twineberrow.
20150 Slicing machines. Exley.
20151 Chains. Turner.
20152 Disinfector. Cox and anr.
20153 Oven. Jones.
20154 Door, etc., frames. Johnson.
20155 Hinges. Johnson.
20156 Ceiling roses. Maxwell.
20157 Brakes. Goold.
20158 Wheels. Auger.
20159 Game bags. McKnaight.
20160 Steam engines. Muhsul.
20161 Wave motors. Harmon.
20162 Spinning, etc., frames. Lord Bros. Ltd.
20163 Carding engines. Lord Bros. Ltd. and anr.
20164 Heating and ventilating apparatus. Iliff.
20165 Steam engines. Neukomm.
20166 Wringing and mangling machines. Tongshon.
20167 Insulation. Mackay.
20168 Presses for garments. Litly.
20169 Stearing for automobiles. Austin Motor Ltd.
20170 Safes. Withers.
20171 Shuttles. Murphy.
20172 Making ice. Barr.
20173 Heating. White.
20174 Safety pins. Baker.
20175 Syringes. Greaves.
20176 Treatment of flour. Hogarth.
20177 Variable speed gearing. Jeffares.
20178 Jacks. Benstead and Aron.
20179 Slide valves. Pinckney.
20180 Anodes. Beach.
20181 Plant supporter. Moore and Brown.
20182 Drill. Bluelt and Burcher.
20183 *Internal-combustion engines. Saunders, Rupprecht, and Grant.
20184 Aeronautical machine. Grant.
20185 Sock. Bainbridge.
20186 *Utilisation of sulphur, etc. Wedekind.
20187 Mattresses. Marshall.
20188 *Motor cars. Boult.
20189 Mirror. Gulliver.
20190 Toe clips. Marshall.
20191 Capsuling bottles. Webb.
20192 Manf. of tyre gaiters. Buxton.
20193 Tyres. Buxton.
20194 App. for mixing tobacco. Goldbourne and Lilleywhite.
20195 Chain links. Hiscox.
20196 Transport protector. Cooper.
20197 Tyres. Fraser.
20198 Dynamos. Stevens.
20199 Remedy for mange. Bivan.
20200 Alarm clocks. Earnshaw.
20201 Fuel economiser. Graham.
20202 Brake mechanism. Ashby.
20203 Knives. Blyth.
20204 *Paying machines. Société Generale Francaise de Cuivres Payeuses et de Contrâle Systemè Janik.
20205 *Explosive motors. Rotter.
20206 Wearing apparel. Goldman.
20207 *Steam superheating. Mills, English and Co. Ltd. and King.
20208 Transport vehicle. Braggins and Braggins.
20209 Steam superheating. Mills, English and Co. Ltd. and King.
20210 Lathe appliances. Topley.
20211 Colliery tubes. Hale.
20212 Targets. Whitney.
20213 Purses. Vining.
20214 Fastening hooks. Maxa.
20215 Setting out lines. Fletcher.
20216 Dyestuffs. Bloxam.
20217 Dyestuffs. Bloxam.
20218 Railroad ties. Morgan.
20219 Combustion motor. Lamplough.
20220 Converting reciprocatory into rotary motion. Lamplough.
20221 Firing mechanism. Mauser.
20222 Wheels. Harding.
20223 *Matrix setting and casting machines. General Composing Co. and Degener.
20224 Reservoir pens. O'Malley.
20225 Collapsible mandrels. Hansen.
20226 Collapsible mandrels. Hansen.
20227 Tube machinery. Hansen.
20228 Hollow-ware. Hansen.
20229 Working tools. Pinsky.
20230 *Displaying pictures. Florent.
20231 Measuring fluids. Wilson.
20232 Gramophones. Clifford and Lockyer.
20233 *Perforating, etc., machines. Weber.
20234 Distributing apparatus. Ruppel.
20235 Vehicle wheel. Weber.
20236 Suction cleansers. Honegger.
20237 *Railway coupling. Leslie.
20238 Drying machines. White.
20239 Scaffolding. Frankland.
20240 *Furnaces. Raimén.
20241 Bottles. Drake.
20242 Stropping devices. Burns.
20243 *Submarine boats. Sea Salvage Co. Ltd.
20244 *Composing machines. Walker.
20245 *Purifying gas. Folding.
20246 Musical instruments. Lake.
20247 *Kilns. Ramen.
20248 *Cableways. Weike.
20249 *Spinning machines. Eborall and Brown-Boveri Co. Ltd.
20250 *Windows. Aron.
20251 *Bearings. Newmann.
20252 *Lubricant. Rolyat.
20253 *Transom adjuster. Brazier.
20254 Shoes. Tracy.
20255 *Vacuum cleaning apparatus. Bünte and Remniley.
20256 Motor. Brox.
20257 Switches. Leitner.
20258 Optical call. Simpson.

AUGUST 31st, 1910.

20259 Coal receptacles. Lawrence.
20260 Reversing gear. Alquist.
20261 Couplings. Samuel.
20262 Tobacco cartridge case. Mesnard.
20263 Vesicating charges. Hughes.
20264 Flour packer. McDonell.
20265 Internal-combustion engines. Brown and Brown.
20266 Propellers. Geoghegan.
20267 Fastener. Goodly and Goodly.
20268 Tap attachment. Downs.
20269 Sanitary appliance. Bradley.
20270 Wheels. Menzies.
20271 Utilising solar heat. Whiting.
20272 Advertising. Atherton.
20273 Tube bending machine. Bourne.
20274 Air pumps. Bailey and Collins.
20275 Air pumps. Bailey and Collins.
20276 Folding baby car. Bomand.
20277 Internal-combustion engines. Albion Motor Car Co. Ltd. and Murray.
20278 Folding gates. J. Watt.
20279 Superheaters. Woodroffe and Blythe.
20280 *Sifters. Gaskell, Morriss, and Beardmore.
20281 Tobacco pipes. Butler.

20282 Railway signals. Rae.
20283 Treating flax. Thompson.
20284 Automatically locking doors. Mallalieu and Sullivan.
20285 Aerial machines. Whatton.
20286 Knotting hair nets. Walker.
20287 Cycles. Bowden.
20288 Fastenings. King.
20289 Electric heaters. Byng and Archer.
20290 Transformer. Maude.
20291 Manf. of rubber compounds. Killen.
20292 Waterproof boots. Bryan.
20293 App. for handling invalids. Skeffington.
20294 Mattresses. Skeffington.
20295 Rain box. Bull.
20296 Calendars. Emanuel.
20297 Turbines. Mead.
20298 Letter box. Smith.
20299 Safes. Patrick.
20300 *Furnaces. Thomas.
20301 Steam traps. Ogden.
20302 Tyre valves. Wright.
20303 Window fastenings. Williams.
20304 Talking machine horns. Houghton Ltd. and Simeons.
20305 Embrocation. Liberios.
20306 *Ignition apparatus. Sagaer.
20307 Boiling water. Mackay.
20308 *Wax-feeding device. Herzog and Loeser.
20309 *Wheels. Graab and Lenhardt.
20310 *Safety water device. Knappich.
20311 *Shutter. Klover and Schrading.
20312 Kites. Gillman.
20313 Typewriter. Underwood Typewriter Co. and Cooper.
20314 Typewriter. Underwood Typewriter Co. and Cooper.
20315 Passenger cars. Curwen.
20316 Passenger cars. Curwen.
20317 Folding horn. Topping.
20318 Saws. Wickstead.
20319 Wheels. Motor Engineering Works Ltd. and Fellows.
20320 Matrix presses. Foster, Dow, and Smith.
20321 Lamps. Russell.
20322 Self-oiling rollers. Osborn and Co. Ltd. and Carnegie.
20323 *Fruit receptacle. Hubert and Hubert and Co. Ltd.
20324 Indigo. Imray.
20325 *Making nitrogen-oxygen compounds. Kainer.
20326 *Railway signals. Siemens Bros. and Co. Ltd.
20327 Internal-combustion engines. Adams.
20328 Internal-combustion engines. Adams
20329 Propellers. Belk.
20330 Pulleys. Hayslep.
20331 *Softening meat. Coffini.
20332 *Utilisation of waste substances. Smith.
20333 Manf. of peat board. Pearson and Storeham.
20334 *Azo-dyestuffs. Bayer and Co.
20335 Safety razors. Smith and Peddie.
20336 Separators. Jeffrey.
20337 *Alloys. Cowing.
20338 Dyes. Johnson.
20339 Reduction of metals. McNitt.
20340 Wheels. Koenig.
20341 Clotted cream. Newton.
20342 Road vehicles. Dowdeswell.
20343 Gas burners. Mansfield.
20344 *Sealing composition. Taliaferro.
20345 *Jacks. Liebermann.
20346 *Horns. Tengneur.
20347 *Cushions. Debal.
20348 *Cushions. Debal.
20349 *Musical instruments. Menzenhaüer.
20350 Gearing. Alcock.
20351 Handles. Barton.
20352 Musical instruments. Lake.
20353 *Stone working machine. Smith.
20354 *Necktie. Bloomfield.
20355 Mixing machine. Mayer and Dugon.
20356 *Eyelet. Senn.
20357 *Potato planting machine. Plagens.
20358 *Pumps. Muller.
20359 Brakes. Jardine.
20360 *Musical instruments. Lake.
20361 Pumps. Viola.
20362 *Door holder. Bioletti.
20363 *Water cycle. Cracroft.
20364 Nutlocks. Lafleur.

SEPTEMBER 1st, 1910.

20365 Boilers. Tyson.
20366 Sawing machines. Howarth.
20367 Small arms. Whiting.
20368 Loose-leaf books. Martin.
20369 Testing machines. Denison.
20370 Cranks. Ruckstull.
20371 Animal traps. Potter and Potter.
20372 Bleaching. Sutherland.
20373 Gyroscope. Barr and Stroud.
20374 Magnets. Hookham.
20375 Saturating water with carbònic acid gas. Kitchener.
20376 Roundabouts. Dickinson.
20377 Ventilating apparatus. Phillips.
20378 Electric lamps. Smith.
20379 Caps. Knowles.
20380 Pointing pencils. James.
20381 Furniture. Lojk.
20382 Moulding machines. Berry.
20383 Billiard cues. Peck.
20384 Measuring apparatus. Smith.
20385 Fumigator. Sharratt.
20386 *Metals. Heys.
20387 Combing machine. J. Hetherington and Son Ltd. and Tomlinson.
20388 Shells. Shannon.
20389 *Drilling. Darling.
20390 Staple driving appliance. Allen and Brown.
20391 Sealing wires. Hulton.
20392 Collars. Cheney.
20393 Windows. Harrison.
20394 Range finder. Weston.
20395 Lamps. Coxon.
20396 Gauge. Hogarth.
20397 Door knobs. Morlton and Co. Ltd. and Gonks.
20398 Filing cabinet. Kallenborn.
20399 *Sound magnifying device. Lamkin and Pace.
20400 Cooking utensils. Lamkin and Pace.
20401 Heating device. Lamkin and Bridge.
20402 Pipe cartridge. Hull.
20403 Bottles. Churchill.
20404 *Furnaces. Ruthenburg.
20405 *Tin opener. Loewenstein.
20406 String cutters. Evans.
20407 Extinguishing fires. Garforth.
20408 Massage spray. Whelan.
20409 Purifying. Taylor.
20410 Sparking plugs. Williams.
20411 *Clutch. Blum.
20412 Propeller. Zahikjanz.
20413 Corner fittings. Zeltzer.
20414 *Vitrifiable substances. Demongeot.
20415 Firegrates. Trotman.
20416 Internal-combustion engines. Tanner.
20417 *Casting machines. Gursch.
20418 Toys. Spain.
20419 Internal-combustion engines. Tangyes Ltd. and Robson.
20420 *Casting machines. Gursch.
20421 *Carburetters. Boult.
20422 *Sprinkler. Stener.
20423 Fastening. Smith.
20424 Wheels. Richardson.
20425 Valves. Trier.
20426 Carburetters. Trier.
20427 Elbow joints. Siemens Bros. and Co. Ltd. and Ireland.
20428 Joint. Elford.
20429 Trousers. Finke.
20430 Dyes. Bloxam.
20431 Aeroplanes. Imray.
20432 Boilers. Davies.
20433 Couplings. Money.
20434 Powder boxes. Yates.
20435 *Packings. Rudolph.
20436 Destroying bacteria. Recklinghausen.
20437 *Beds. Tatchell.
20438 Concrete structures. Peto.
20439 Number plates for motors. Waldron.
20440 *Engine. Zetétlein.
20441 *Wireless telegraphy. Marconi's Co. and Round.
20442 *Water heaters. Warner and Lichty.
20443 Rheostat. Medway.
20444 Door lock. Medway.
20445 Furnace setting. Campbell.
20446 *Meter. Allegemeine Elek. Ges.
20447 Electric heaters. Spagnoletti Ltd. and Holmes.
20448 Fireballs. Little.

SEPTEMBER 2nd, 1910.

20449 Parallel rule. Clark.
20450 Brake. Vickery.
20451 Anti-skid device. Bird.
20452 Tobacco pipes. Porter.
20453 Mis-cue preventer. Hebden.
20454 Firelighter. James.
20455 Electric motor. Laxton.
20456 Aero navigation. Bell.
20457 Self-locking nuts. Moore.
20458 Bolt and nut securing device. Clarke.
20459 Castors. Williamson.
20460 Switch app. Howard and Allen.
20461 Tyres. Holding.
20462 Windows. Matthias.
20463 Manf. of tubes. Jackson, Lloyd, and Murrell.
20464 Nail driving app. Schofield.
20465 Grinding machine. Dymock.
20466 *Cowl. Clayton.
20467 Toilet rolls. Parsons.
20468 Ambulance dressing. F. Longdon and Co. Ltd. and Anderson.
20469 Sharpening app. Partington.
20470 Machine for making seals. Green.
20471 Weaving machines. Smith and Smith.
20472 *Skylights. Hart.
20473 *Shoes. Eatough and McAuley.
20474 *Bottle stoppers. Nixon.
20475 *Spectacles. Zeiss.
20476 *Furnaces. Dickson.
20477 *Hemmers. Alexander.
20478 Memoranda books. Branson.
20479 Hatpins. Turner.
20480 Skates. Carruthers.
20481 Wheels. Lusty.
20482 Amusement apparatus. Firth.
20483 *Knife. Rayne.
20484 *Manf. of bolts. Fries.
20485 Motor cars. Bedford.
20486 Knifes. Cormell.
20487 Necktie retainers. Anderson.
20488 *Metallurgical furnaces. Delattre.
20489 *Manf. of beverages. Kuhn.
20490 *Typewriter. Fortoni.
20491 *Dynamos. Siemens Bros. Dynamo Works Ltd.
20492 Lamps. Evans.
20493 *Manicure app. Nickrentz.
20494 *Explosive. Polster.
20495 Reaping machine. Mackeprang.
20496 Bicycles. Martin.
20497 *Steering gear. Brunsmann.
20498 Flying machines. Brunsmann.
20499 Skates. Neumann.
20500 Curtains. Neumann.
20501 Couplings. Bowden Wire Ltd. and Larkin.
20502 *Moulding. Burckhardt.
20503 Furnaces. Ison.
20504 Recorder. Overton.
20505 *Casting machines. Boult.
20506 *Typewriters. Ranzler-Schreibmaschinen Akt. Ges.
20507 Motor cars. Lumley.
20508 Engines. Knight.
20509 *Furnaces. Brown.
20510 *Internal-combustion engines. Rundlöf.
20511 Pencil holders, etc. Hymans.
20512 Building article. Smallwood.
20513 Cars. Auger.
20514 *Clamp. Steghöfer.
20515 *Brushes. Culmer.
20516 *Film feeding mechanism. Hirsch.
20517 Safes. Botteley.
20518 Manf. of metal strips. Strange.
20519 *Manf. of alkali metals. Johnson.
20520 Manf. of sauces. Ransford.
20521 Manf. of liquors. Ransford.
20522 *Carburetter. Couffinal.
20523 Safes. Botteley.
20524 *Wheels. Barker.
20525 *Wheels. Rutherford.
20526 *Typewriter. Fischer.
20527 *Firelighters. Lux.
20528 *Dampers. Arnold.

SEPTEMBER 3rd, 1910.

20529 Propulsion and steering of ships, etc.
20530 Wheels. J. Ford.
20531 Internal-combustion engines. B. R. Raggett.
20532 Eenvelopes. A. B. Vanes.
20533 Miners' picks. J. C. Wade.
20534 Receipt register. R. C. Tye.
20535 Consoles. P. Knifton.
20536 Luggage carriers. J. Parkes.
20537 Heat production. P. B. O'Callaghan.
20538 Weaving wire netting. J. Simpson.
20539 Apparatus for removal of dirt, etc. H. Beech.
20540 Stair rod edges. J. J. James.
20541 Steam rod edges. J. J. James.
20542 Games. T. A. Jarman and anr.
20543 Cycles. W. G. Alexander.
20544 Weaving. T. Booth.
20545 Draught regulator. Francis Helm Ltd. and anr.
20546 Boxes for carrying incandescent mantles. A. A. Brown.
20547 Embrocation. J. Munn.
20548 Sewing machines. H. Smith.
20549 Gauges. T. Quiney.
20550 Detachable rims. L. A. Turner.
20551 Weighing instruments. T. Finney.
20552 Pencil sharpener. J. J. Falconer.
20553 Moulding butter. W. R. Walkey.
20554 Receptacle. W. Newbigging.
20555 Weighing apparatus. D. K. Fairweather.
20556 Cash check tills. A. H. Gledhill.
20557 Flour milling. R. Buchanan.
20558 Heating apparatus. G. E. Brown.
20559 Removing scale. R. J. Butler.
20560 Treating bamboo. S. Milne.
20561 Recording apparatus. J. K. Stalker.
20562 Pressure gauges. Schaffer and Budenberg Ltd.
20563 Tyres. J. Rimmer.
20564 Water jacket. V. H. Pankhurst.
20565 Rheostats. W. F. Perry.
20566 *Gas holders. Ofenbau Gesellschaft.
20567 Hinges. H. C. Wall.
20568 Bottles. H. Grunert.
20569 *Lamps. J. Hubers.
20570 Internal-combustion engines. C. W. Higgs.
20571 Gas mantles. D. Dickie.
20572 Regulating flow of gas. F. Weller.

20573 Metallic mirrors. L. O. C. Coles.
20574 Reflectors. L. O. C. Coles.
20575 Wheels. Lees.
20576 Saws. J. H. Barker.
20577 Bottles. J. A. Hardcastle and anr.
20578 *Lamps. J. Phillips.
20579 Fasteners for metallic strips. E. E. Flora.
20580 Fasteners for metallic strips. E. E. Flora.
20581 Ranges. J. Green.
20582 Lace machines. E. Jardine.
20583 Mattresses, etc. J. E. Marshall.
20584 *Brake cylinders. J. R. Hardy.
20585 Electric contacts. F. H. Varley.
20586 *Legging. D. T. Harris.
20587 Garment. F. Moore.
20588 Aeroplanes. D. J. Oyler.
20589 Vehicles. F. Walton.
20590 *Steam accumulators. W. Schwarz.
20591 Windows. H. A. Pertwee.
20592 *Artillery pyrograph. K. L. Mackinnon.
20593 Metal cans. W. S. Gill.
20594 *Steel. T. Levoy.
20595 *Wearing apparel. W. Vorwerk.
20596 Reinforced concrete. R. Erchberg.
20597 *Pipe dampers. W. Kennedy.
20598 Ammunition hoists. Sir Andrew Noble.
20599 Switchback railways. J. Woodford.
20600 Railway vehicle couplings. W. Rundle.
20601 Alloy. G. Jacquier.
20602 *Safety razors. H. J. Gaisman.
20603 Rheumatic tyres. W. M. Edwards.
20604 *Steam turbines. C. Gilsbach.
20605 *Towing hooks. A. A. V. Hulle.
20606 Aeronautical apparatus. T. T. G. Evans.
20607 Aeronautical aparatus. T. T. G. Evans.
20608 Envelopes. W. Mabeiyn.
20609 Pen or pencil attachment. C. W. Copland.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to October 10th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

5055 Thomas: Bye-pass gas regulator. [Post-dated July 31st, 1909.] 10164 Price: Processes for the manf. of nitrous and nitric acids, nitrate, nitrite, or sulpho-nitrate or sulpho-nitrite of lime, soda, or potash.

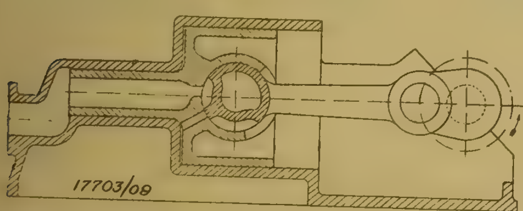
10314 Warwick Machinery (1908) Co. (General Electric Co.): Meters for measuring the flow of fluids.

Relates to instruments for measuring the flow of elastic fluid through a conduit, in which a device adapted to create a pressure difference that bears a definite relation to the rate of flow of the fluid to be measured is used a vessel having chambers of dissimilar size containing a body of heavy fluid that is deflected from one chamber to another by changes in pressure difference due to said device, and consists in providing movable means in one of the chambers, the position of which changes with deflections of the heavy fluid, indicating mechanism operated by said means, and a manually adjusted pointer adapted to be brought to a certain relative position with regard to the indicating mechanism to give a reading.

10328 Brown: Machine for making sand moulds. 10496 Gauntlett: Rolling metal sheets. 10665 Allgemeine Elektricitats Ges.: Alternating electric current commutator machines having two working and two exciter windings. [Date applied for under International Convention, May 6th, 1908.] 12915 Maul: Process of and apparatus for treating fuel. 14387 Sampson: Means for locking the stop rod of machines, especially of self-acting mules. [Post-dated September 1st, 1909.] 15299 Wallace and Morton: Artificial production of indiarubber or caoutchouc. 15429 Schroder: Moulding presses. 17611 Serpek: Method of producing pure alumina. [Date applied for under International Convention, April 10th, 1909.] 17655 Laroche and Juillard: Rendering mixtures of fatty matters and other organic materials, such as solvents, soluble in water and in the product obtained. 17673 Blackall and Newman: Mechanism for operating semaphore signals and the like. [Post-dated August 28th, 1909.] 17676 Baker: Mixing machines. 17684 North: Hydraulically-driven planing machines. 17696 McMillan and Carey: Reversible turbines. 17700 Rendel: Sea-angling boom.

17703 Reavell and Co., Reavell and Jones: Fluid-pressure engines, pumps, or exhausters and compressors.

This invention relates to that class of piston engines, pumps, and compressors in which the oscillating motion of the connecting rod and gudgeon is utilised for periodically opening and closing one or more ports formed in the reciprocating piston, the gudgeon being adapted to act as an oscillating valve, the ports being formed in the cylindrical valve seat, and the cylinder being provided with an axial rear extension in which moves a pilot piston. The present improvements have for their principal object to construct the piston and gudgeon in such a manner that the gudgeon acts not only as a suction, but also as a delivery valve, and that separate valves are entirely dispensed with. It comprises a fluid-pressure engine, pump, compressor, or exhauster having a reciprocating piston provided with a pilot piston and an oscillating piston rod connected with the piston by a gudgeon adapted to act as an oscillating valve, a piston having ports, one of which leads from the valve seat to the rear of the piston, while another leads from the valve seat through the interior of the pilot piston to the pilot cylinder, and a gudgeon having in its circumference recesses adapted to establish communication alternately between the ports and between one of the ports and the atmosphere or a port leading to the side of the cylinder.

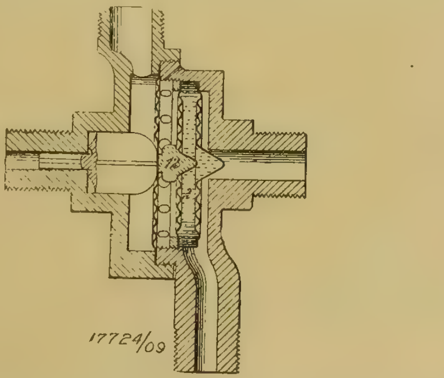


17703/09

17715 Steward and Weaver: Lasting of boots, shoes, and the like, and apparatus therefor.

17724 Still and Adamson: Steam heating systems.

Refers to steam heating systems of the type wherein a thermostatic device which is subject to the temperature at some part of the radiator, usually at or near the outlet, is adapted to close both the steam inlet to the radiator and the outlet therefrom, so that whilst the pressure in the radiator can never rise materially above atmospheric pressure escape of steam through the outlet is prevented. Now in a steam heating system of the type according to the present construction the inlet and outlet valves of a radiator are so arranged as to be in communication only through the pipes of the heating system and are controlled by a single thermostatic device interposed between these valves, and preferably consisting of a capsule or like expansible receptacle containing fluid sensitive to the action of heat, this thermostatic device acting on the inlet valve through, say, a steam-tight diaphragm. By this construction compactness and simplicity combined with increased sensitiveness of operation are attained, all risk of a short steam circuit arising between the inlet and outlet is obviated, and springs, tubing, and the like are eliminated.

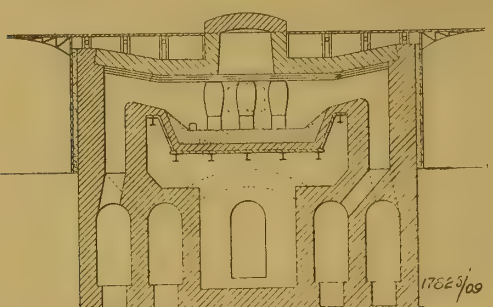


17724/09

17739 Taylor and Scotson: Automatic regulation of dynamo electric machines. 17745 Robertson, Atkinson, Lee, and Hutton: Hames for harness collars of draught animals. 17774 Brown, Judd, and Hardie: Electric telegraphy. 17778 Van Buren, Krupp, and Herman and Co.: Ditching machines. 17792 Land: Tool or device for turning and screwing metal.

17825 Chenhall: Furnaces.

This invention relates to an improved furnace, the object being to construct on the regenerative principle an open-hearth furnace such as would be suitable for the treatment of steel and which may be also used for crucible metal fusion. According to the invention the regeneration flues are carried in the usual manner beneath the hearth, which latter is built upon an iron framework disposed in bridge fashion between the regenerative chambers, the space beneath the hearth bridge being preferably that used for the entering air. The hearth is constructed at a lower floor level at a suitable height from which is disposed the usual rabble and tap holes. The gas and air flues communicate with the hearth preferably from opposite sides through vertical flues from the regenerative chambers below. The roof of the hearth is hung from a bow string or other girder supported from the sides, the top of the roof forming the upper floor line when the furnace is used for crucible smelting. An aperture is formed in the hearth roof and fitted with a cover, the sides of such aperture being splayed outwards for greater convenience in handling the pots. The operation of this invention is as follows: The furnace is heated in the usual manner, suitable valves or switches being provided in the regenerative chambers for the purpose of changing the air and gas ducts. If the furnace be used for open-hearth steel production or allied purposes, the lower floor is the level at which the process is conducted, but should crucibles be employed the operator works from the upper floor, placing the crucibles and stands on the furnace hearth through the roof aperture conducting the operation at this level throughout.

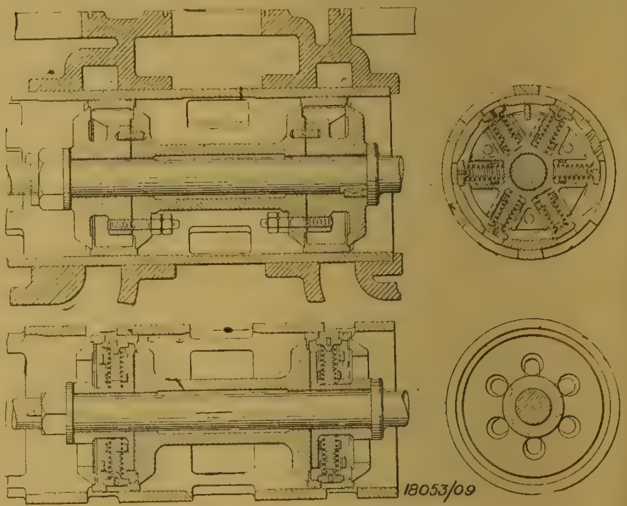


17850 Boult (Forrester and Little): Machines for filling cans and the like receptacles with liquid. 17861 Crompton and Crompton and Co.: Gun sights. 17888 Webber, Webber, and Webber: Electric driving mechanism for clockwork. 17889 Schuster: Regenerative coke ovens. 17895 Jukes-Browne: Electric switches applicable for flash lighting. [Cognate Application. 1276, 1910.] 17904 Siemens Bros and Co., and Bradley: Twin projectors or searchlights. 17910 Barber: Axle trucks of rail vehicles. 17998 Kenny: Safe indicator and control for electric lifts. 17999 Kenny: Metal moulding for encasing electric wires and applicable for supporting pictures. 18024 Collins: Gas-fired kilns for burning bricks and other articles. 18025 Boult (United Shoe Machinery Co.): Machines for rounding or trimming the heel seats of boots and shoes. 18051 David Brown and Sons (Huddersfield), and Brown: Attachment or machine for grinding after hardening, relieved formed milling cutters, gear cutters, hobs, worms, and the like to eliminate distortion due to hardening.

18053 Hughes: Devices for preventing excessive compression in the cylinders of steam engines. [Cognate Application. 2767, 1910.]

This invention relates to distribution valves and cylinders for steam engines constructed with compression-relieving devices adapted when a pressure exists in the cylinder in excess of that in the steam chest due, for example, to excessive compression or accumulation of water, to relieve such pressure by permitting the steam or liquid to escape to the exhaust receiver or steam chest, and comprises a flat slide valve for cylinder of steam engines constructed with a central or base portion, having auxiliary ports or passages and control valves (of ball or other form) fitted therein, and with a buckle or strap fitted thereon to form a cap or stop for the control valves.

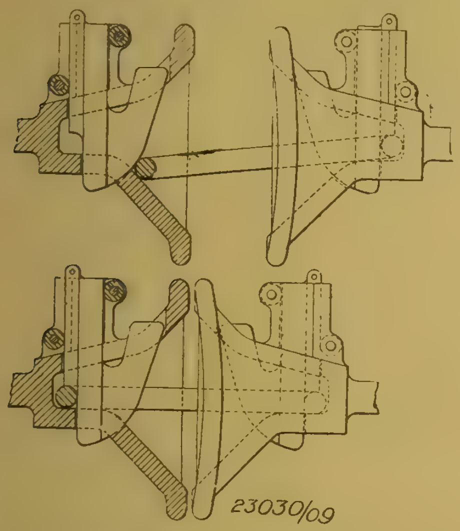
18115 Birkbeck (European Regenerator Co.): Steam regenerative accumulators. 18117 Imray (Farbwerke vorm. Meister, Lucius, and Bruning): Manf. of new vat dyestuffs. 18146 Goldthwait: Stocking supporters or suspenders. 18162 Furber: Blacking or staining machines for finishing the heels and soles of boots and shoes and other articles. [Date applied for under International Convention, August 7th, 1908.] 18163 Brothers: Machines for pulling over and lasing uppers of boots and shoes. [Date applied for under International Convention, August 7th, 1909.] 18207 Wolf: Condensing systems. [Date applied for under International Convention, August 7th, 1908.] 18222 Alquist: Friction gearing. 18260 Helps and Pateman: Mouthpieces of gas retorts and the like and the lids or closures therefor. 18270 Brothers: Machines for pulling over and lasting uppers of boots and shoes. [Patent of Addition to 18163, 1909.] 18285 Olivetti: Typewriters. [Date applied for under International Convention, August 8th, 1908.] 18305 Slocomb: Leather-staking machines. 18310 Clements: Electric advertising signs. 18311 Stern: Disc for sealing purposes. 18314 Abbott: Change-speed and reversing gear for motor vehicles and other purposes. 18338 Valentin and Zerreiss: Production of printing plates. [Date applied for under International Convention, August 21st, 1908.] 18359 Kettering and Chryst: Cash registers. [Date applied for under International Convention, May 4th, 1909.] 18435 Edwards: Apparatus for controlling a conduit for gas or other fluid. 18469 Lewis: Electrodes for arc lamps. 18580 Linley, Owensmith, and Edwards: Burner for petroleum and the like. 18643 Foden: Means for securing pneumatic or other elastic tyres to the wheels of road vehicles. 18835 Willis (McLean): Stove pipes. 18922 Marconi, and Marconi's Wireless Telegraph Co.: Receiving apparatus for wireless telegraphy. 19028 Dupuis: Manf. of opaque cinematographic images for projection by reflected light. [Date applied for under International Convention, August 29th, 1908.] 19127 Cumming: Screwed stoppers for bottles. 19135 Ainley: Method of and means for treating with liquids textile piece goods, warp yarns, and the like. 19203 Matear, Kenney, and Woodhouse: Recording and indicating of the working of hydraulic and electric lifts or hoists. 19230 Hollingworth (Crompton and Knowles Loom Works): Automatic weft-replenishing looms. 19481 Crook: Chimney tops and ventilators. 19503 Hinderlich: Stands for window display. 19539 Von Alpenburg and Von Alpenburg: Process of making prepared sheets from the cores of palm trees. [Date applied for under International Convention, August 27th, 1908.] 19547 Chappell and Chappell: Auxiliary rims for attachment in emergency to pneumatic-tyred wheels. [Patent of Addition to 24252, 1908.] 19675 Schmidt: Liquid-distributing or spray-producing devices for cooling apparatus. 19797 Bowdler: Lock and hasp fastening for gates, doors, cans, boxes, and the like. 19821 Bray: Holder or frame for interchangeable cards or tickets. 19978 Cruce: Apparatus for superheating steam. 20434 Hepworth and Mellors: Game of skill for the travelling showmen. 20614 Thompson: Metal receptacles for holding liquids, powders, and the like. 20671 Hill: Disconnecting portable prayer desk. 20736 Hildesheimer, Hildesheimer, and Planck: Stiffeners for packets of cigarettes. 20911 Kuess: Process for the production of pulp for the manf. of paper and for other purposes to which such pulp may be applied. [Date applied for under International Convention, September 15th, 1908.] 21075 Ellis and Connell: Cane carpet switch or beater. 21145 Cooper, and Economic Patents Co.: Steam separators. 21189 Potter: Vessels for aerial navigation. 21193 Sir W. G. Armstrong, Whitworth, and Co., and Wright: Coal-shipping machinery. 21256 Hutton: Internal-combustion engines. 21257 Donald: Coal savers for domestic grates. 21363 Prescott Patent Ticket Punch Ltd., and Prescott: Ticket-punching apparatus. 21380 Wareham: Cheese cutters. 21414 Price: Reversible fluid-pressure turbine. 21514 Hollingworth (Crompton and Knowles Loom Works): Dobbies for looms for weaving. 21523 Trevor: Envelope. 21528 Spurgin: Paper carriages of typewriters. 21597 Booth: Loom shuttles. 21630 Underwood Typewriter Co., and Cooper: Typewriting machines. 21644 Nunneley: Means for carrying golf bags or the like upon cycles. 21704 Charles H. Pugh Ltd., and Bull: Shaking barrels for cleaning, polishing, and like purposes. 21791 Jackson, Midgley, and Midgley: Locking arrangements for circular box looms. 21828



Kruse and Larsen: Internal-combustion engines. 21840 Lieberkneckt: Grinding mills. [Date applied for under International Convention, September 24th, 1908.] 21874 Pursell: Method of and means for supporting a flag or banner. 21882 Dawson (Fraser): Ball bearings. [Post-dated March 17th, 1910.] 21979 Thos. Norman and Son, and Norman: Carrying bags made of paper or other soft material. 22058 Gibson: Epicyclic gear for use in roving frames for flax and like fibres. 22118 Cowper-Coles: Manf. of bricks, coverings, and the like for furnaces. 22540 Samuelson and Backhouse: Pneumatic separators for granular substances. [Application for Patent of Addition to 9407, 1909.] 22602 Anschutz and Co., and Anschutz-Kaempfe: Gyroscopes. [Application for Patent of Addition to 10382, 1908. Rights under Section 91 of the Act not granted.] 22872 Crone: Douche for use in administering hydrotherapeutic treatment. 22933 Laffly: Motor-driven road-sweeping machine. [Date applied for under International Convention, October 10th, 1908.]

23030 Universal Patents Bureau Ltd. (Du Plessis-Paton Automatic Coupler Syndicate Ltd.): Combined buffer and automatic coupling for railway, tramway, and other vehicles.

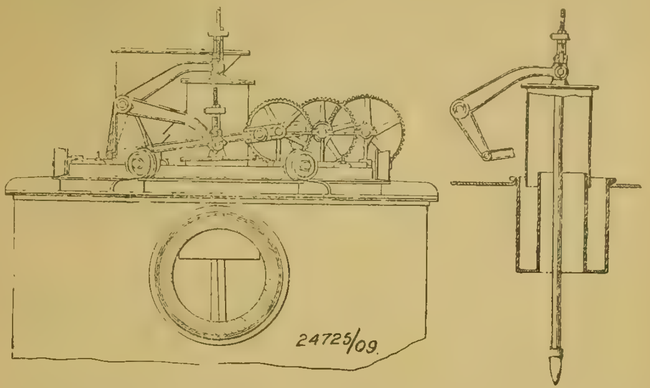
Relates to combined buffer and automatic couplings for railway, tramway, and other vehicles that are coupled together in service, and it is directed to that class wherein the buffer head is made of a bell, box, or like shape to receive and support the coupling elements which comprise a drag link and a drop pin passed through slots in the opposing parts of the buffer head to engage and disengage the drag link. According to the present invention the drop pin consists of two lateral portions and one central portion, one of which lateral portions operates in the upper slot in the buffer head and abuts upon the drag link in the coupled condition, whilst the other lateral portion operates in both the upper and lower slots in the buffer head and has an inclined face for co-acting with the drag link in the act of coupling, and the central portion operates in both slots in the buffer head and has shoulders for engaging corresponding shoulders in the said slots.


23030/09

23077 Barron: Point protectors for ladies' hatpins. [Post-dated April 6th, 1910.] 23173 Welch: Head coverings. [Post-dated November 2nd, 1909.] 23191 Fuller: Shirts. 23248 Schofield, Sims, Bygott, Sykes, and Sykes: Educational hand-power looms. 23374 Gray, and T. Cooke and Sons Ltd.: Instruments for directing the fire of guns. 23487 Schaefer: Tables for games and for storing accessories of the games. 23524 Appleby and Appleby: Bowls or guide pulleys as employed on yarn-winding frames and like machinery. [Cognate Application. 1282, 1910.] 23629 New (Weichert): Manf. of bleach liquors. 23659 Howard-Flanders: Couplings for wire rods and other articles. 23753 Turner: Composition or compound for killing worms in golf greens, lawns, and the like. 23835 Bruff: Afternoon tea sets. 23874 Johnson (Badische Anilin and Soda Fabrik): Reduction of indigo colouring matters. 23875 Johnson (Badische Anilin and Soda Fabrik): Manf. and production of vat colouring matter. 240[illegible] Du Thil: Producer gas plants. 24081 Bunn: Locking joint for motor car wind screens and for other purposes. 241[illegible] Hollingworth (Crompton and Knowles Loom Works): Self-threading loom shuttles having automatic thread-cutting or parting mechanism combined therewith. 24192 Pepling: Machines for winding cops. 24271 O'Grady: Draught and dust excluder. 24302 Evans-Jackson (Hiorth): Electric induction furnaces. 24416 Argent: Locks. 24485 Marks (Toledo Computing Scale Co.): Weighing scales. 24514 Broomell: Submarine mines. 24606 Jobling: Flying machines. 24647 Chapman: Cigarette.

24725 Sheldon: Gas producers.

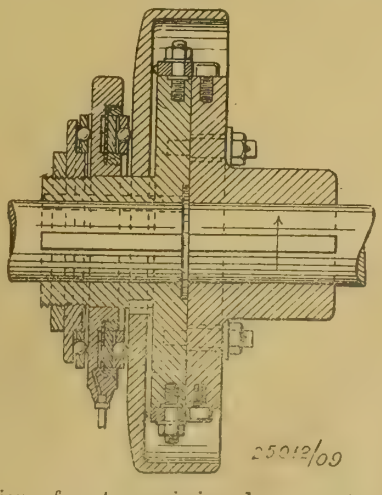
This invention relates to improvements in gas producers, and more specifically to improvements in poker-actuating mechanism by which the pokers are operated to stir or agitate the fuel during combustion, and also to a novel means of supporting and driving the rotative top wall plate of a gas producer upon which the poker-actuating mechanism is mounted. The invention consists essentially of the provision in a gas producer of a rotative top, a poker or pokers eccentrically arranged with respect to the top and projecting therethrough, and a rising and falling member or members for supporting and actuating the poker or pokers and mounted on the rotative top, the member or members being adapted to support the poker or pokers so as to permit the lower end or ends to swing and to maintain a vertical position by gravity when freed from the fuel bed. Also of an annular track supported by the producer wall, supporting wheels for the rotative top which rest and roll on the track, shafts carrying the wheels and extending inwardly from the plate, and means carried upon the rotative top for actuating one or more of the wheels for tractive purposes; a vertically rocking lever pivoted on the rotative top, means for rocking the lever, a collar surrounding the poker stem provided with lateral lugs, and bearings carried by the lever in which the lugs are mounted; a collar slidable on the poker stem and connected to the actuating member, a cross plate fixed to the poker stem, and means for adjusting the distance between the cross plate and the collar; and a water seal between the rotative top and the poker stem comprising an upwardly opening water trough attached to and depending from the rotative top, and a bell or casing surrounding the poker stem and movable therewith, extending downwardly into the trough.


24725/09

24789 Ackermann: Step-by-step rolling mills. 24870 Crawford: Crowning and filling and crowning machines.

25012 Kenerson: Transmission dynamometers. [Date applied for under International Convention, December 19th, 1908.]

This invention relates to torque-measuring apparatus employing liquid means to give a measure of the couple transmitted from a rotating shaft, and consists in a novel construction of a transmission dynamometer of the kind employing liquid means to measure the torque of a rotating shaft, comprising a primary or driving member,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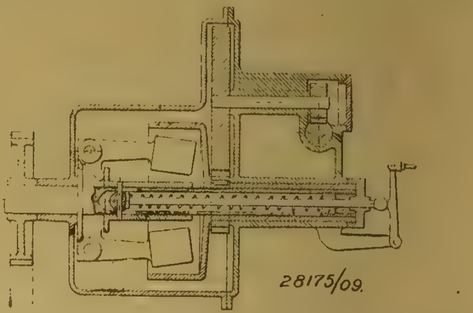
a stationary element provided with an annular chamber for containing a fluid, and a non-revolvable annulus-shaped diaphragm adapted when in use to compress the fluid in the chamber, means operatively connected with the driving member for transforming the torque exerted by the shaft into lateral pressure upon the diaphragm, suitable means being connected with the fluid-holding chamber for designating the torque; also of a secondary coupling member, and means connecting the driving and secondary members whereby they are maintained in normal relation to each other longitudinally and are prevented from endwise separation, said means also allowing a little play or movement transversely between the members, at the same time permitting the secondary member to be driven by the driving member, these means consisting of a plurality of bolts arranged to fit loosely in enlarged holes in the driving member and to screw into the secondary member; also a pair of driving and driven power-transmitting members adapted to be secured to the adjacent ends of independent shafts, and a plurality of peripherally disposed three-armed lever elements pivoted to one of the members and continuously engaging pins on the other member whereby both the members are adapted to rotate concurrently the lever elements extending tangentially of the rim of the member to which they are pivoted and being in continuous contact with a disc-shaped member forming part of the pressure-conducting means. The invention has a distinct advantage, inasmuch that the fluid (adapted to operate a suitable pressure gauge and to indicate the turning effort of the shaft being tested), the fluid chamber, the operating diaphragm, and the immediately contiguous members are all stationary; therefore there is no centrifugal force generated to affect the working fluid, and the readings on the gauge are unaffected by changes in speed of the shaft. Other advantages are that no slip joints or packings are employed, thereby avoiding leakage of the fluid. Moreover, no special recessed shaft is necessary and the apparatus is adapted for taking readings with shafts rotating in either direction.

25100 Auster and Auster: Joints of wind screens and other folding or adjustable fittings of automobiles and other vehicles. 25110 Barker (Tait): Paper covers, letter cards, and wrappers for papers, sheet music, and the like. 25125 Cole and Odell: Collapsible cots. 25165 Johnson and Bull: Key or key cover for typewriting machines or the like. 25279 Myers and Myers: Temporary binder for loose-leaf books, letter files, and the like. 25360 Simonin: Process for the utilisation of materials employed for purifying illuminating gas. [Date applied for under International Convention, November 5th, 1908.] 25424 Mackay (Darling): Belt shifter. 25460 Pettigrew: Saturator for sulphate of ammonia and other salts. 25474 Glasgow: Water-gas apparatus. 25531 Schoenfeld: Embroidery machines. 25561 Palmer: Steam clothes presses. 25562 Ablett: Folding supports for furniture and like. 25602 Morris and Adamson: Horseshoes. 25609 Hogan: Apparatus to facilitate playing golf and like games. 25648 Triumph Cycle Co., and Burroughs: Cut-outs of internal-combustion engine silencers and the like. 25818 Ballantine: Gas-fired furnaces for re-heating iron and steel. 25926 Mather: Potato diggers. 25956 Martin, Bartholomew, and Schaaf: Process or method of curing and ageing tobacco. [Date applied for under International Convention, November 30th, 1908.] 25978 Ellis: Brushes. [Date applied for under Rule 13, August 25th, 1909. Application for Patent of Addition to 17583, 1908.] 25986 Newton (Farbenfabriken vorm. Friedrich Bayer and Co.): Manf. and production of new vat dyes of the anthracene series. [Samples furnished under Section 2.] 26015 Bottcher: Integrating apparatus for steam engine and like indicators. [Date applied for under International Convention, November 11th, 1908.] 26023 Mazzolini: Compressed air operated devices. 26079 Blades: Adjustable device for safely securing infants in cots and beds. 26152 Lee and Brown: Rotary engines, pumps, and meters. 26242 Burns: Safety hatpin. 26267 Gail: Apparatus for buffing metallic tubes or the like. 26365 Durafort: Fire extinguishers. 26774 Rennie: Portable passenger luggage and cargo conveyer. 26811 Levi: Ladies' earrings. 26884 Lang: Roller steady for use on lathes. 26922 Jones: Means for heating compressed air for motive power purposes. 26967 Gavin: Glass frames or lights for horticultural purposes. 27061 Axmann: Pattern-moulding machine for pulleys and the like. 27072 Vouga: Transmission and change-speed gear for motor vehicles. [Date applied for under International Convention, November 21st, 1908.] 27118 Baker, jun., and Fox: Centrifugal speed indicators and the like. 27119 Hutchison: Attachment of pneumatic tyres to wheel rims. [Date applied for under International Convention, November 20th, 1908.] 27458 Siemens Bros. and Co. (Siemens and Halske Akt.-Ges.): Automatic telephone exchanges. 27580 Kammerer: Belt fastenings. 27616 Martin: Side delivery rakes, swath turners, and the like. 27674 Petersson: Method of charging electric resistance furnaces. [Date applied for under International Convention, January 7th, 1909.] 27858 Young: Letter or document files.

28175 Renault: Speed-governing mechanism for motor vehicles. [Date applied for under International Convention, December 19th, 1908.]

This invention relates to means for limiting the speed of automobile vehicles. Appliances of this kind have been previously proposed in which a centrifugal governor controlled by the speed of the vehicle wheel acts first upon a valve in such a manner as to reduce the admission of gases to the motor and in the case of the speed still increasing actuates a clutch to bring the brakes of the vehicle into operation. In the present invention the governor first of all reduces the admission of gases to the motor and then the rotating masses of the governor engage with a drum which by the intermediary of reducing gear controls the brake or brakes of the vehicle. The clutch thus constituted requires but little power owing to the high speed of rotation that can be imparted to the shaft carrying the governor and to the high ratio that can be adopted for gearing down. Thus in the case of a steam engine the governor closes the admission; in the case of a petrol motor it closes the carburetter or interrupts the ignition or effects both operations successively, and finally in the case of an electric motor it interrupts the circuit either suddenly or gradually.



28346 Mitchell: Fasteners for blouses, bodices, and other like garments. 28488 Plant: Apparatus for applying adhesive to strips of canvas or the like. 28639 Droitcour: Flexible printing plates and means for securing such plates to type beds and cylinders of printing presses, and for keeping the plates under tension during the taking of impressions. 28666 Hall: Strengthened or reinforced inner tubes for pneumatic tyres. [Cognate Application. 29157, 1909.] 28715 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new pharmaceutical products. 28719 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new pharmaceutical compounds. 28902 Roddier and Douroux: Handle for surgical instruments, tools, or articles of cutlery. [Date applied for under International Convention, December 15th, 1908.] 29090 Siemens Bros. Dynamo Works (Siemens Schuckertwerke Ges.): Working of single-phase commutator dynamo electric machines. 29157. *See* 28666, 1909. 29194 Fuller: Plugs for tobacco-pipe mouthpieces. 29246 Amborn: Spanner wrenches. 29321 Adam: Cableway conveyer for the transport of loads, especially suitable for loading ships. 29370 Homme, Vollen, and Isaacson: Scissors, shears, and analogous cutting devices. 29446 Siemens Bros. Dynamo Works (Siemens Schuckertwerke Ges.): Regulating gear for winding engines and other machinery having recurring working cycles. 29466 Otto: Reacher or long arm. [Post-dated March 10th, 1910.] 29534 Parkhurst and West: System of treating liquids during the processes of fermentation. 29771 Langrehr: Safety device for the filling and emptying apertures of vessels containing combustible liquid. 29866 Froment: Method of improving the quality of wheat and other granulous or leguminous products which have not been well harvested or have been damaged. 29983 Kilker: Apparatus for handling matte and like products from blast furnaces, smelters, and other reduction works. [Date applied for under International Convention, January 2nd, 1909.] 30151 Blake and Smart: Driers of kilns for the revivification of animal charcoal and the like. 30181 Boult (Wahl): Manf. of fermented hopped beverages. 30329 Boult (Universal Postal Machine Co.): Stamp-cancelling or the like machines.

1910.

202 Berthier: Cartridge extractors for firearms. [Date applied for under International Convention, September 19th, 1908. Originally included in 21383, 1909.] 236 Wiesen: Aeroplane machines. 401 Thorne: Wrenches. 476 Mijnssen: Acetyl cellulose foils. [Date applied for under International Convention, January 9th, 1909.] 770 Wiberg: Temporary binders. 827 Soc. D'Electricite "Nilmelior," and Colas:

Electrically-operated indicating, registering, and controlling devices. [Date applied for under International Convention, January 13th, 1909.] 861 Bouton: Method of and apparatus for testing structures. 863 Fletcher: Knives. 1198 Campe and Regener: Lamp globes made of transparent glass. [Date applied for under International Convention, February 8th, 1909.] 1199 Pottier: Apparatus for drying any desired substances. 1231 Sefton-Jones (Hans Reisert Ges.): Process and apparatus for purifying water. 1276. *See* 17895, 1909. 1282. *See* 23524, 1909. 1286 Muller: Discharging machine with jointed ram for horizontal and inclined coke ovens. 1329 Parr: Calorimetric processes and apparatus. 1349 Hammarlund: Transmission or reducing gear. 1416 Happel: Filters. [Rights under Section 91 of the Act not granted.]

1432 Akt.-Ges. Brown, Boveri, et Cie.: Marine turbine installation having two or four shafts. [Date applied for under International Convention, October 18th, 1909.]

> This invention relates to a marine turbine installation having two or four shafts, and consists in a marine turbine installation driving one or two pairs of separate shafts, a high-pressure ahead turbine having a reaction part preceded by an action part arranged on one shaft of each pair of shafts, no portion of either of the parts being isolated under any circumstances, and a low-pressure ahead turbine arranged on the other shaft of the same pair of shafts.

1461 Hartman: Apparatus for purifying liquids by electricity. 1462 Hartman: Apparatus for purifying liquids by electricity. 1468 Wilson, Landale, and Cockshoot: Medicinal preparation for human use. 1498 Mackenzie: Horse collars. 1784 Sandow Ltd.: Corsets. [Date applied for under International Convention, August 4th, 1909.] 1882 Lake (Gummiwarenfabrik S. Herz): Outer covers for pneumatic tyres. 1916 Kennedy: Chain device suitable for use as non-skidding attachment for vehicle tyres. 2137 Schwan: Clocks. 2236 Moller: Telescopes. 2349 Kitsee: Telegraphic relays. 2425 Pentecost: Surface condensers. 2526 Brown: Cricket and hockey balls. 2534 Graham: Nut locks. 2624 Cheney: Machines for setting lacing hooks. [Date applied for under International Convention, February 6th, 1909.] 2767. *See* 18053, 1909.

2887 Reuleaux: Gas producers.

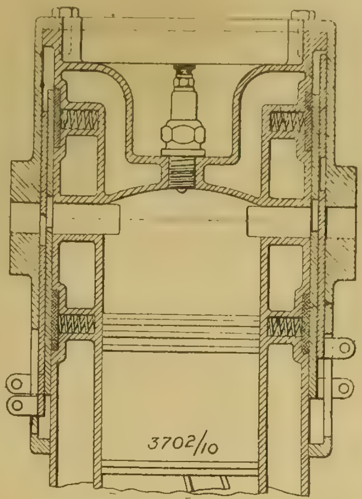
> The primary object of this invention is to provide in a gas producer simple and highly efficient means for effectively stirring or agitating the fuel bed and breaking the clinkers, and consists in a gas producer having a stationary ash hopper, a stationary grate, a rotary water trough forming a seal for the hopper in providing means for agitating the fuel bed revoluble over the grate concurrently with the rotation of the water trough.

2946 Selby and Bishop: Apparatus for indicating the deflection of objects under stress. 2952 Graham and Graham: Signals for assisting vehicular traffic. 3089 Lake (Goss Printing Press Co.): Folding mechanism for printing presses. 3122 Kauffmann: Method and apparatus for renovating used engine cleaning and like waste. 3263 J. H. Riley and Co., and Riley: Dyeing machines. 3366 J. H. Riley and Co., and Riley: Dyeing machines. 3432 Ramel: Automatic device for controlling the balancing and vertical steering planes for flying machines. [Date applied for under International Convention, February 13th, 1909.] 3506 Loutzky: Aeroplanes. 3643 Keyt: Apparatus for removing tarnish from metals. 3645 Hauer: Turbines.

3702 Cripps and Little: Fluid-pressure engines.

> Relates to fluid-pressure engines having sliding plate valves, its object being to provide simple and efficient means for preventing leakage. According to this invention the plate valve is engaged by a stationary ring which lies flat against it, the hole through the ring embracing the valve portion. The ring is backed up by springs so that a tight joint is always maintained. The spring packing ring described may be applied to single or multiple sliding valves. These may be either curved or flat, the shape of the ring being modified to suit the shape of the valve. Spring engaged packing rings of a somewhat similar type have been previously proposed for the slide valves of steam engines.

3746 Francis: High chair go-carts. 3810 Bernard-Schmolle: Syphons. 3848 Wainwright: Medical syringes. 3860 Cosset: Cycle frames. [Date applied for under International Convention, October 21st, 1909.] 3934 Williamson and Williamson: Optical lanterns used for the projection of lantern slides, kinematograph films, and the like. 3939 Pierpont, and Lanston Monotype Corporation Ltd.: Machines for grinding or sizing type matrices or other bodies. 3942 Blass: Air filter. 4069 Hiby: Coke ovens. 4177 Overbeck: Process for obtaining alcohol from distillers' wort. 4302 Shannon: Soothing teats. 4329 Dondey and Testro: High-pressure filter. [Date applied for under International Convention, March 6th, 1909.] 4619 Hunt: Sprinkler bottles for liquid or powder. 4676 Aktiebolaget Ljungstroms Angturbin: Method of manufacturing blade rings for turbines. [Date applied for under International Convention, February 26th, 1909.] 4951 Klaber and Whitehead: Pencil sharpeners. 4999 Nobel's Explosives Co., and Hodge: Means for polishing cylindrical articles especially suitable for polishing cartridge cases. 5361 Basset: Manf. of caustic soda or sodium salts. [Date applied for under International Convention, March 4th, 1909.] 5510 Phillips-Woodey: Electric fire and burglary alarm contact. [Cognate Application. 8573, 1910.] 5683 Crowell: Indicating, recording, and integrating dynamometers. [Date applied for under International Convention, March 5th, 1909.] 6294 Hollingsworth: Appliances for folding paper. 6352 Pintner: Greasing trolleys, bushed pulleys, wheels, and the like.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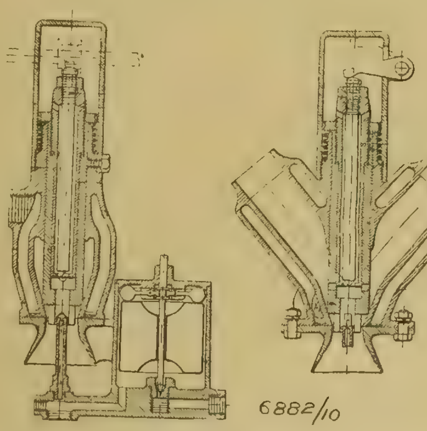
6882 Soc. Anon. des Automobiles Peugeot: Carburetters for explosion motors. [Date applied for under International Convention, March 22nd, 1909.]

> Relates to improvements in carburetters for explosion motors of the kind provided with a regulating device constituted by a hollow controlling piston in which the mixture is formed and which can be displaced axially with regard to the delivery nozzle for the petrol so as to regulate the action of the carburetter. In the carburetter of the present invention the controlling piston caps the nozzle only during slow running of the motor, and has at its lower extremity radial slits and a reduced annular passage concentric with the petrol nozzle through which the air enters the piston. The admission of additional air can be regulated by means of a central rod to correct the carburation when it is influenced by the temperature or the altitude. During slow working the entrance of the air continues to take place concentrically with the nozzle, but by a more reduced inlet the air and the combustible liquid mix in the interior of the piston itself, and the mixture can only flow out through small orifices provided for this purpose in the wall of said piston, the size of which orifices can be regulated by means of a plug; further, the additional air passing into the piston assists the intimate mixing of the components of the mixture. By suitably predetermining the size of the air inlet channels made in the lower part of the piston and by regulating the position of the plug and of the central rod the proper proportions of air and of fuel can be ensured for slow working.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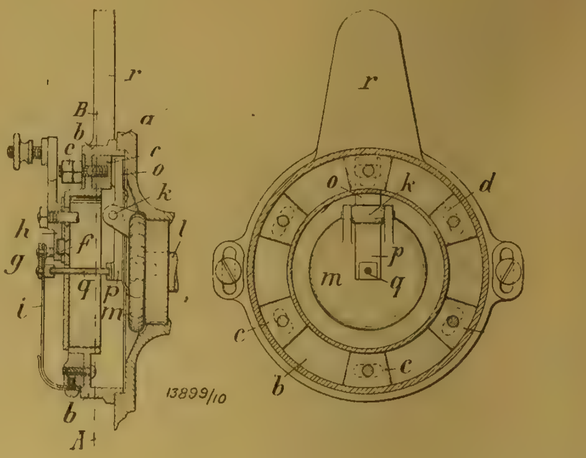
7080 Wachter and Hugle: School box for facilitating learning to read, write, and calculate. 7296 Macgregor: Syringes for fire-extinguishing and other purposes. 7717 Franks: Joints for gas and water mains. 7804 Haarmann: Folding tables. 8085 Freedman: Convertible garments. [Date applied for under International Convention, January 15th, 1910.] 8311 Horn and Bohme: Process for the production of raised pictures from level pictures or pictures in low relief. 8573. *See* 5510, 1910. 8686 Harvey: Attaching hinged lids to pots or bottles for use in containing ink. 8702 Salisbury: Stop motions for looms. 8760 Wakefield: Acetylene generators. 8795 Stadward: Coupling devices for railway vehicles. 8796 D. B. Harris and Son, and Harris: Buckles of belts for personal wear. 8821 Weule: Azimuth instruments. 8831 Jellinek and De Tovaros: Suspension of electric trolley wires. [Date applied for under International Convention, July 19th, 1909.] 8939 Akt.-Ges. vorm. Seidel und Naumann: Typewriting machines. [Date applied for under International Convention, February 5th, 1910.] 8962 Clouard: Reeds for motor horns and the like. [Date applied for under International Convention, April 17th, 1909.] 9176 Newlands and Parkinson: Preparation to be employed in making electrolyte for primary batteries. [Application for Patent of Addition to 11926, 1909.] 9179 Gilardoni: Nut locks. 9339 Stiles and Stiles: Rind-removing attachments for machines for slicing meat and the like. 9979 Mikorey: Dumb bells. 9982 Herzog: Apparatus for use in bleaching yarn, yarn bobbins, cops, and the like. [Date applied for under International Convention, April 28th, 1909.] 10228 Armaturen-und Maschinenfabrik "Westfalia" Akt.-Ges.: Distributing devices for compressed air tools, rock drills, and the like. [Date applied for under International Convention, August 23rd, 1909.] 10399 Hughes: Shop counter display stand with device for subdividing bulk butter, cheese, or like substances. 10413 Henry Pooley and Son, and Dobson: Weighbridges and weighing machines. 10555 Lachman: Metal wheels. [Date applied for under International Convention, April 29th, 1909.] 10584 Savory: Devices for excluding dust and the like from corners. 10755 Price: Processes for the manf. of nitrate, nitrite, or sulpho-nitrate or nitrite of lime, soda, or potash. [Date applied for under Rule 13, April 29th, 1909.] 10771 Adams Manufacturing Co. (Cutler Hammer Manufacturing Co.): Electric circuit breakers. 10939 Staines: Rack or tray for collecting and drying crockery. 11033 International Salt Co., and Royston: Manf. of salt. [Date applied for under Rule 13, May 4th, 1909.] 11042 Muller: Brooch, charm, pendant, or the like. 11160 Vereinigte Uhrenfabriken von Geb. Junghans und Thomas Haller Akt.-Ges.: Gong supports for clocks. [Date applied for under International Convention, February 22nd, 1910.] 11421 Lasvignes: Billiard tables. 11566 Belcher: Drive chains. [Date applied for under International Convention, May 13th, 1909.] 12002 Abbott-Brown: Wheels for vehicles. [Application for Patent of Addition to 15817, 1909.] 12230 Damaizin and Pujos: Change-speed gear. [Date applied for under International Convention, June 10th, 1909.] 12370 Morton: Apparatus for the manf. of tufted fabrics. 12416 Firm Adolph Saurer: Frame for motor cars. [Date applied for under International Convention, March 4th, 1910.] 12631 Naeder: Packing rings or collars. [Date applied for under International Convention, June 5th, 1909.] 12732 Traher: Loose-leaf binders. 13589 Firm Robert Bosch: Manf. of an improved bent lever for interrupters such as are used in connection with ignition devices in internal-combustion engines. [Date applied for under International Convention, February 4th, 1910.] 13604 Hoffmann: Grinding mills. [Date applied for under International Convention, April 27th, 1910.] 13803 Bruggemann and Wirsich: Glove and like fasteners.

13899 Firm Robert Bosch: Apparatus for electrical ignition in internal-combustion engines. [Date applied for under International Convention, August 18th, 1909.]

On the side plate *a* of the magneto electric ignition machine the ring *b* of the adjusting lever is so arranged that it can be adjusted within certain limits relatively to the armature of the ignition machine in order to adjust the time of ignition in the internal-combustion engine. For the purpose of adjusting the time of ignition in each cylinder cams *c* are arranged on the ring *b* in number corresponding with the number of cylinders or combustion chambers of the engine. These cams *c* are adjustable in slots *d* in the ring *b* so that their positions relative to each other can be varied, and they are held in position after adjustment by the nuts *e*. The current interrupter, which consists of the contacts *f* and *g* is connected with the stationary ring *b*. The contact *f* is fixed to a plate *h* insulated from ring *b*, whilst contact *g* is mounted on the interrupter spring *i*. The current interrupter *f*, *g* is operated by a lever centred at *k* on a disc *m* mounted on the distributor shaft *l* and rotating with it. One arm *o* of this lever comes in contact with the cams *c* as it rotates, and the lever is turned thereby, so that the other arm *p* separates the interrupter contact, being connected with the spring contact *g* directly or through a pin *q*. A lever *r* which turns the ring *b* serves in the usual manner to effect the general adjustment of the time of ignition of the engine. The essence of the invention is that stationary distributing cams actuate by means of a rotating intermediate member a stationary interrupter, so that no brushes which cause a loss of current need be used to transmit the current.



14575 Firm Robert Bosch: Method of constructing magneto electric ignition machines for internal-combustion engines. [Date applied for under International Convention, July 19th, 1909.] 15063 Aeschlimann: Veneer presses. [Date applied for under International Convention, July 2nd, 1909.] 15977 Lewis: Electrodes for arc lamps. [Date applied for under Rule 13, August 10th, 1909.] 16289 Fowler and Pardy: Cigar and cigarette holders. [Date applied for under Rule 13, March 17th, 1910.] 16732 Soc. Industrielle de Celluloid: Floating doll. [Date applied for under International Convention, July 20th, 1909.]

Complete Specifications Open to Public Inspection before Acceptance, under the Patents Act, 1907.

1910.

638 Liebe-Harkort: Elastic tyres for motor road vehicle wheels or the like. 950 Besnard, Maris, and Antoine: Portable heating apparatus burning petroleum, petroleum spirit, gas, or alcohol. 3120 Von Lossau: Steam pressure gauges and devices for measuring the speed or volume of steam. 5026 Snyder: Rolls for wool-thread machines. 5660 Malachowski: Electric arc lamps. 9201 Akt.-Ges. Brown, Boveri, et Cie.: Operation of pumps and compressors. 9638 Polyphon-Musikwerke Akt.-Ges.: Sound-reproducing and talking machines. 10665 F. Krupp Akt.-Ges.: Field gun road carriages. 12642 A. S. Bergens Mekaniske Vaerksted: Fire-tube boiler. 14364 Farbenfabriken vorm. Friedrich Bayer and Co.: Production of pressed or shaped cellulose compounds from cellulose esters. 14933 Frager: Explosion mine. 15051 Harris: Acetylene generators. 15538 Orr: Embossing appliances. 15539 Renault: Transmission gear. 15541 Optische Anstalt C. P. Goerz Akt.-Ges.: Apparatus for the solution of triangles. 15836 Mahoney: Braking systems for electric motor-driven vehicles. 16141 Dassy: Removal of household or other refuse. 16342 Siemens and Halske Akt.-Ges.: Frequency meters for direct reading of or recording the frequency in alternating-current circuits. 16713 Fanning: Propelling means for vessels. 16841 August Schwarz Bogenlampenfabrik: Electric arc lamps for two or more pairs of electrodes. 16916 Klatte: Manf. of seamless metal chains. 16927 Metall-Industrie Winter and Adler Akt.-Ges.: Safety razor. 17054 Proudfoot: Safety cage for protecting the manipulator of railway couplings. 17143 Consortium F. Elektrochemische Industrie Ges.: Production of indoxyl, its derivatives, or homologues. 17253 Mery: Controlling device for the change-speed and reversing mechanism of automobiles. 17263 Seignol: Process for destruction of hairs, horse hairs, finger nails, and horny, gelatinous, and the like substances contained in floss and waste silk in general. 17274 White: Apparatus for feeding anti-fuling compounds to steam generator boilers. 17438 Burrows: Nut locks. 17607 McFeely: Shoe-forming machines. 17615 Farbwerke vorm. Meister, Lucius, and Bruning: Manf. of bluish-green colour lakes. 17639 Bartel: Treatment of tar for the obtainment of oils containing a high percentage of

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bitumen. 17640 Bartel: Preservative treatment of wood, stone, and other porous bodies. 17650 Helfenstein: Electric furnace with a receptacle for the charge arranged on the enlarged furnace chamber. 17744 Dutordoir: Speed indicator with alarm bell. 17749 Goettel: Apparatus for airing or ventilating grain, seeds, and other materials. 17776 Penteado: Aeroplanes. 17809 Carl Zeiss: Mixtures disengaging oxygen when heated. 17882 Shue: Fenders. 17971 Farbenfabriken vorm. F. Bayer and Co.: Manf. and production of azo dyestuffs. 17999 Ringelmann: Suspension of vehicles on their axles. 18056 Von Mach: Process for protecting balloons against fire. 18076 Eichengrun: Method of producing coatings from acetylcellulose. 18091 Goddu: Machine for inserting fasteners. 18203 Hartmann: Machine for ringing bells.

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AERONAUTICS AND ENGINEERING.

THE report that has been published of the Advisory Committee for Aeronautics, which was appointed by the Government in 1909 in connection with the advice that was to be given in the matter of taking steps towards placing the Government departments for aerial navigation on a more satisfactory footing, is of great value alike to the science of aeronautics and the practice of engineering.

The investigations that have been made by the committee have been conducted by men chosen for their special technical knowledge; consequently the report may be taken as being for the moment the last word in matters pertaining to definitions concerning the solution of the problems of flight.

The engineer will be much interested in the development of aeronautical science only if he recognises that the strains that are set upon the machines that are constructed are varying and in no measure constant, due to the change of position in which the machine must necessarily be guided and the different air pressures that are to be overcome during either the progress forward or the ascent or descent of the aeroplane or airship by mechanical motors.

The development of the industry relating to the construction of airship casings, frames or members, has had an important effect upon firms interested in the production of light alloys, the comparative weakness and softness of pure aluminium having led to the production of a considerable number of alloys in which other metals have been incorporated with aluminium in quantities small enough to leave the density of the alloy very nearly as low as that of the pure metal, while yet imparting increased strength and hardness to the material. While it is known that pure aluminium, when employed for chill castings, has an ultimate strength of 5·2 tons per square inch and the cold-drawn metal 8·7 tons per square inch, alloys have been produced, composed of aluminium, copper, and manganese, in which the casting has an ultimate strength of 12 tons per square inch, and the cold-drawn metal of 20 tons per square inch. Thus, apart from the value of the introduction of a metal useful for a specific purpose an impetus has been given to investigators in metallurgical alloys such as must become of universal value and of increasing importance to mechanical science generally.

The difficulty in constructing motors for aeronautical purposes is one chiefly of weight rather than of power, but in considering weight frequently auxiliary attachments and necessary adjuncts to the engine have counted as part of the engine, so that designers of motors will do well to have regard to the necessity of producing a motor in which such items as exhaust silencers, radiators, coolers, together with reservoirs, are reduced to the minimum.

In many cases of engines with several cylinders, the heavy flywheel becomes of less importance than is the case with single or two-cylinder engines. Thus the multiplication of the cylinders, while producing power, may give the constructor an opportunity of reducing weight by the discarding of the usual flywheel upon the motor.

An engine cannot run for any considerable period without having serious provision made for the storage alike of oil and petrol; hence the provision of reservoirs is one of considerable importance as adding to the weight that is inseparable in connection with the employment of petrol motors. The arrangement of a reservoir, therefore, is advised to be preferably considered in relation to the art of making a tank rather than as being an attachment connected with the engine or motor iteslf.

Mr. F. W. Lanchester, the contributor of the preliminary report having reference to the weights and horse power of petrol motors for aeronautical purposes, very aptly states that the reservoirs for oil and petrol should, in fact, be dealt with and treated as related to the fuel rather than the engine when considering the weight that is to be carried.

When providing for short runs petrol economy is advised as being comparatively unimportant, whereas for long runs it becomes a matter of extreme importance, so much so that the most suitable motor will depend upon the purpose for which it is to be used; thus for long-distance air propulsion a highly economical motor becomes preferable, if not essential, even at the expense of the initial weight.

From a number of motors that have been selected and carefully scheduled and tested, there appears to be no difficulty in obtaining serviceable and reliable motors in which the weight per brake horse power varies from 4·1 lbs. to 9·1 lbs., but in the results of the tests that have been made it appears that the weight of petrol per brake horse power is lowest with the heaviest type of motor.

Water Power.—It is popularly supposed that water power is necessarily cheap, and that in particular Niagara power is to be obtained at a remarkably low figure. According to a paper by Mr. Spalding, the charge for Niagara power in Buffalo, 18 miles away, is over £5 10s. per horse-power year in the alternating-current form. According to Mr. Pring, slightly lower prices are charged in the immediate neighbourhood of Niagara Falls. Figures as low have probably been obtained with steam and gas power plants burning coal, although usually the cost would be somewhat higher. Under specially favourable conditions large gas-power plants with ammonia recovery will generate a horse-power year at about £3, or even less. Probably the Niagara charges would be less for works with large, steady demand, and situated close to the falls. In the case of water powers capital outlay is the chief factor in determining the price at which power can be sold, and hence plants situated close to the falls are usually at a very considerable advantage over those more distantly situated.

Railway Costs.—Professor Dalby, in his presidential address to the Engineering Section of the British Association at Sheffield, gave some interesting figures showing the average costs per train mile for running our trains in 1908, the costs on the London and Birmingham Railway in 1840, and also the average for all British electric railways in 1908, which are as follows:—

	Pence per train-mile.		
	Steam. 1908.	Steam. 1840.	Electric. 1908.
Locomotive power	12·07	23·2	8·40
Repairs and renewals carriages and wagons	3·60	—	1·50
Maintenance of permanent way	6·37	27·2	2·40
Traffic expenses	12·78	25·9	5·22
General charges	1·68	4·5	1·52
Rates and taxes	3·05	4·5	2·36
Government duty	0·22	7·65	0·09
Compensation	0·47	0·35	0·12
Legal and miscellaneous	1·39	—	0·75
Total	41·63	93·30	22·35

In the figures for 1840 traffic expenses include repairs to carriages and wagons, whilst general charges also include legal costs. In making a comparison between steam and electric operation, the conditions are widely different in the two cases. Steam trains are of all classes, whilst the electric trains are principally very short passenger trains working on suburban routes. The train mile is therefore not a very satisfactory basis of comparison.

According to the London correspondent of the Liverpool *Journal of Commerce*, three of the most prominent ship-owning companies of Great Britain have been considering a joint scheme of far-reaching importance for the further development of the South American passenger and cargo trades. The basis of the project, which still requires to be ratified, is the building of ten liners at the cost of nearly two millions sterling. Five of these will be high-class passenger carriers to run between Liverpool and the River Plate in conjunction with an existing line, and in further conjunction with the new railway across the Andrea. The other five steamers will be of the highest type of refrigerating liners, with great carrying capacity and high speed, and, according to existing proposals, they will run between London and the River Plate. As final arrangements have not yet been agreed upon, the names of the companies concerned and the actual nature of the relationship have not yet been disclosed.

Large Cold Storage Barge.—Perhaps the largest cold storage barge built is now being towed to Buenos Aires from the Mersey. The barge, which has been built by Messrs. Cammell, Laird and Co. for the La Blanca Co., has been named the La Blanca. The length between the perpendiculars is 207 ft., breadth moulded 36 ft., and the depth moulded 22 ft. She is built to Lloyd's scantlings, with two complete steel decks divided by bulkheads into two large holds, which are fully insulated and equipped in the latest manner as regards runner rails, meat hooks, etc. A special chamber for loading is provided in the centre which extends to the bottom of the vessel. Large insulated doors are fitted to each hold. The vessel has also five watertight compartments, and a large fore peak tank is provided for trimming purposes, which can be filled and emptied from the engine room. The insulated spaces have a capacity of 80,000 cubic feet.

Radium.—An announcement of importance has been made by Mme. Curie, the widow of Pierre Curie, who shares with him the distinction of having first studied radium salts. Among the correspondence received by the French Academy of Sciences, the Secretary found a letter from her, informing him that, in collaboration with another chemist, M. Debierne, she had succeeded in obtaining pure radium. Hitherto only radium salts, bromides, chlorides, etc., had been discovered. By an electrolytic process Mme. Curie and M. Debierne have succeeded in isolating radium. They obtained, and now possess in a sealed vacuum tube, a minute particle of pure radium. This the communication describes as a white metal, of 226 atomic weight, which oxidises rapidly in air, adheres to iron, burns paper, and decomposes water. The process by which the radium was isolated was as follows: An amalgam of mercury and radium was obtained by an electrolytic treatment of a radium salt. The substance was placed in a quartz tube, and distilled in hydrogen under pressure. The tube was heated to 700 deg. Cen. The mercury having disappeared, a thin coating of a brilliant metal was left. This was pure radium.

New Shipyard.—The Newcastle City Council recently considered and adopted a request from their Estate and Property Committee recommending the leasing of about 35 acres of land to Messrs. Armstrong, Whitworth and Co. for shipbuilding purposes at Walker. The Board of Directors of the Elswick firm have resolved to proceed immediately with the construction of a shipyard on a site previously obtained, together with that now agreed to be leased to them by the Corporation and a large portion of land which has been purchased from the Newcastle and Gateshead Gas Co., the total site extending to over 70 acres, with a river frontage of half a mile. The conversion of this site into ground suitable for a shipyard will entail a considerable amount of excavation. The large acreage obtained, together with the river frontage, will allow the construction of the biggest sized battleship, and the enterprise about to be carried out will place the yard in a superior position to any other shipyard in the country, and probably in the world, for carrying out the requirements of the British or any foreign Government for the building of warships.

Travelling Crane.—A description of an interesting installation of a travelling crane built by Messrs. Unruh and Liebig at Liepzig is given in *Der Praktische Maschinen Konstrukteur*. The apparatus was put up at a gas works in Leipzig for handling the coke, and consists essentially of a traveller, the rollers of which run on two rails supported at suitable intervals by metal columns. On the traveller a crane of ordinary construction is so mounted as to be capable of making a complete revolution, so that the gib can be brought to any point where the material to be handled may happen to be. This arrangement could also be utilised on public works for the removal of earth.

Troubles in the World of Labour.—Both at home and abroad the labour world is in a state of restlessness. A few days back things here looked very black indeed, and the labour troubles had grown to alarming dimensions, the coal-mining, shipping, shipbuilding, and railway industries were all in an agitated condition, and strikes were threatened for securing to the workers better conditions as regards the hours of labour, the rates of wages, and the employment of men not trade unionists. Altogether the outlook appeared sufficiently gloomy, and even as things stand at present, although the railway strike appears to be averted, at least for the moment, the state of affairs is sufficiently menacing, and it looks as if a bad industrial crisis was imminent independent of the stoppage in the shipyards.

THE PRINCIPLES OF IRONFOUNDING.

By Prof. A. Humboldt Sexton, F.C.S., F.I.C.

(Continued from page 262.)

Moulding Sands.—*Continued.*

Permeability and Porosity.

It is not at all easy to test these properties, but a rough estimate can be made by weighing a known volume of sand dry (dried at 100 deg. Cen.), and then saturating it with water; from the amount of water used the pore space can be judged. The only reliable method is to determine the specific gravity of the sand.

The specific gravity is the weight of a given volume of the sand itself (that is exclusive of pore space) compared with the weight of the same volume of water. This is most accurately determined by means of a specific gravity bottle, fig. 82. This is a small glass bottle with a perforated stopper graduated to contain a definite weight of water, usually 50 grammes. The bottle is thoroughly dried inside and out, and weighed. The weight will be the weight of the dry bottle. Some of the dried sand is put into the bottle and it is weighed. This gives the weight of sand taken, and the bottle is nearly filled with water and well shaken to liberate any air entangled in the sand. It is then filled quite up with water, the stopper is put in, the outside of the bottle is carefully dried, and it is weighed again. This gives the weight of the bottle with the sand and the remaining water, and the difference between this and the weight of the bottle full of water plus the sand is the weight of the water displaced by the sand, which is, of course, equal in volume to that of the sand.

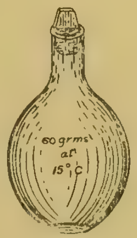


Fig. 82.—Specific Gravity Bottle.

Five weights have been obtained by determining W^3, W^4, and W^2.

W = the weight of the bottle full of water,
W^1 = the weight of the sand,
W^2 = the weight of the bottle + sand + remaining water,
W^3 = the weight of the dry bottle,
W^4 = the weight of the bottle + the sand.

$$\therefore W = W^3 + 50, \text{ and } W^1 = W^4 - W^3.$$

$$\text{The specific gravity, } S = \frac{W^1}{W + W^1 - W^2}$$

For example—

	Grms.
W^3, weight of bottle	= 25·125
W^4, weight of bottle + sand	= 35·130
$W^1 = W^4 - W^3$, weight of sand	= 10·015
W = weight of bottle full of water	75·125
W^2 = weight of bottle + sand + residual water	79·140

If there had been no water expelled the weight of the bottle + sand + water would have been 75·125 + 10·015 = 85·140 grms., so that weight of the water expelled is

$85{\cdot}140 - 79{\cdot}140 = 6$ grms. $= 6$ c.c., and the specific gravity,

$$S = \frac{10{\cdot}015}{75{\cdot}125 + 10{\cdot}015 - 79{\cdot}140} = \frac{10{\cdot}015}{6{\cdot}000} = 1{\cdot}67.$$

The determination may be made roughly by using a pint or quart measure in place of the bottle, remembering that a pint of water weighs 20 ozs.

The next thing is to determine the weight of a volume of the sand with the air spaces. The exact weight will depend somewhat on how the sand is packed. A vessel of known volume is taken and weighed, the sand is then allowed to run into it in a steady stream, and the vessel is gently tapped till it ceases to shrink, more sand being added to fill the measure.

Then if S = true specific gravity of the sand,
V = volume of the vessel in cc.,
W = weight of sand,

so that $W \div V = D$ = density or apparent specific gravity; then the percentage of pore space (or porosity)

$$= \frac{(VS - W)\,100}{VS}.$$

$$= \left(\frac{S - D}{S}\right) 100.$$

Perhaps the simplest form of apparatus for determining the specific gravity and porosity is the Armstrong volumeter, shown in fig. 83. It consists of a burette connected to a wide bottle with a ground glass cap, out of which projects a capillary tube with a graduated mark. In the top of the burette fits a rubber cork and piping, which can be closed by a pinch-cock P. Water is run in from the burette to the partially-filled bottle until the water rises to the mark; then the burette reading is noted.

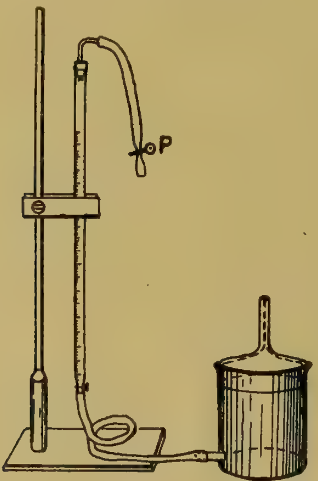


Fig. 83.—Armstrong's Volumeter for Determining Specific Gravities.

Withdrawing some of the water to the burette by suction and opening the pinch-cock, the stopper of the bottle is removed and a definite volume of dry sand, of which the weight has been taken, is introduced. The cap is replaced and water allowed to run in until it again rises to the mark. The difference in the burette readings gives the volume of water displaced, and so we can calculate. Thus, for example, 50 c.c. of Belfast red sand were taken, found to weigh 75 grammes, and by the volumeter method displaced 28 c.c. of water. Hence the true specific gravity $S = 75 \div 28 = 2{\cdot}68$, and the density or apparent specific gravity $D = 75 \div 50 = 1{\cdot}5$; hence the porosity

$$= \left(\frac{2{\cdot}68 - 1{\cdot}5}{2{\cdot}68}\right) 100.$$

$$= 44 \text{ per cent.}$$

As already remarked, the ultimate analysis of a sand does not give much information as to its qualities for moulding purposes, but such analyses are useful and instructive, and three are appended from an American source. They are given according to the quality of the work for which they are used:—

	Light iron work.	Medium iron work.	Heavy iron work.
Silica	82·21	85·85	88·40
Alumina	9·48	8·27	6 30
Iron oxide	4·25	2·32	2·00
Lime	—	·50	·78
Calcium carbonate	·68	·29	—
Magnesia	·32	·81	·50
Soda	·09	·10	—
Potash	·05	·03	—
Manganese	—	Trace	·25
Combined water	2·64	1·68	1·73
Organic matter	·28	·15	·04
Specific gravity	2·652	2·654	2·63

The silica is mainly present as free silica, and, so far as it is in this condition, it tends to make the clay refractory and open. It is, of course, not all present in this condition—part is combined with the alumina in the clay, and part with the other substances present in the form of complex silicates.

The alumina is mainly present as clay, but it may also be present in the form of other aluminates. The combined water is to a certain extent a measure of the quantity of clay which is present, but not absolutely, as there may be other substances which contain combined water. Taking the analysis No. 1, assuming all the alumina to be present as clay, the clay would contain about 11·08 of silica and 3·5 per cent of water chemically combined, so that in this case probably a small proportion of the alumina was either not present as clay or had become dehydrated; so that, calculating from the combined water present, the analysis might be written: Clay, 19 per cent; silica (free), 73·4 per cent; alumina (dehydrated), 1·96 per cent; impurities, 5·64 per cent. The iron may be present in various forms, and is always obtained in the analysis as ferric oxide. If present as ferric hydrate, a very common form, it will give the clay some shade of yellow or red, the exact tint depending more on the form in which the iron is present than on its actual amount, as yellow sands and red sands often contain nearly the same quantity of iron. The iron may be present in other forms, rarely as carbonate, in which case it will have little effect on the colour till it weathers, when it will make it yellow, or more usually as dark coloured hydrated silicates, frequently double silicates, and these are often very fusible.

Lime and magnesia may occasionally be present as carbonates, but as a rule they and the alkalies will be present as silicates, usually more or less fusible; a trace of soda may be present as salt. Organic matter is very often present; it gives the sand a dark colour, but is not deleterious, as it burns away when the sand is heated.

Origin of Sands.

Sands have all been produced by the disintegration of rocks, of which the earth's crust is composed, the disintegration having been brought about both by chemical and mechanical means.

Exposed to the action of air and moisture, many minerals which appear stable are slowly decomposed, some portion being often carried away in solution, and other portions left. When this takes place the residue is often in an extremely fine state of division, because every molecule of the mineral is attached and broken up. This is the case with clay which is produced by the decomposition of some of the varieties of felspar. When a rock consists of several minerals, some of which are easily decomposable and others are not, the decomposition of the decomposable portion leaves a residue of the more stable materials, which, being now more or less incoherent, is washed away by water. This is the case with granite, which consists typically of quartz, mica, and felspar. The felspar is weathered down into clay, leaving a mass of quartz and mica to be acted on by the rain and running water. Many other rocks which contain felspar or similar minerals behave in a similar manner.

When the rain falls it washes the partially decomposed rocks into the streams, and by them it is carried down till, for some reason, slackening of the speed of the current, by the widening of the river or otherwise, it is deposited on the banks as mud or silt.

The river, of course, effects something of a sorting action; in places the heavier material will be deposited, forming a gravel or a sandy silt, in others only the finer particles, forming a clayey silt or fine mud, but the sorting is very imperfect and uncertain, because the rate at which the stream flows is constantly varying; in times of "spate" it will carry the fine material far down, and then when there is less water it will deposit fines where previously only the coarser silt had been deposited, so that river sands tend to be very irregular in composition, and to consist of layers of coarser and finer materials, which are of very different composition. Changes also go on after deposition, the finer material tending to aggregate into masses, or nodules, and thus in a bed of sand one frequently finds nodules of clayey material. As the finer material is likely to contain iron minerals, it is often grey or bluish in colour, and on exposure to the air these oxidise, the iron passing into the condition of ferric hydrate and colouring the clay yellow or brown. Very frequently, therefore, clays are streaked with yellow or brown. It follows that no analysis or sample of a sand is of the slightest use unless it is so taken as to give a fair average of the mass. In river sands the amount of attrition is comparatively small, and the fragments of the silica and harder materials retain to some extent their crystalline or regular form. The angles may be rounded or worn off, but the particles are not reduced to the condition of rounded granules.

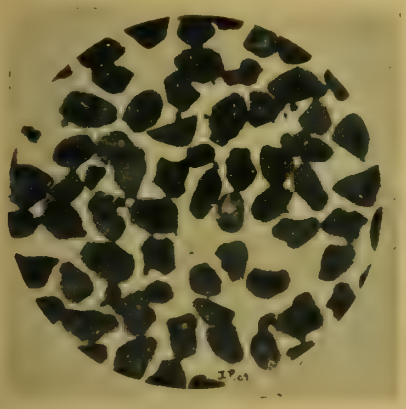


Fig. 84.—Photomicrograph of Sea Sand. Magnified 30 diams. Showing rounded grains and no fine clayey particles to give "bond."

When the material is carried out to sea the sifting and sorting is far more complete; the constant action of the waves in shallow waters prevent the settlement of the finer materials, and these are therefore carried out to greater depth and ultimately deposited, forming beds of clay or shale. The coarser particles are thrown up on the shore, and, being deprived of the clayey particles, yield the siliceous non-binding sea sand. As the attrition is almost constant, the particles rub over one another until the edges are worn away, and the rounded sand grains result (see fig. 84). Sea sands are of very little use for foundry work; they are too siliceous, and therefore do not bind, whilst the rounded particles make them weak if there is sufficient clay to bind them, and they often contain salt.

(*To be continued.*)

AUTOMATIC LUBRICATION OF DIRECT-ACTING PUMPS.

Difficulty has always been experienced in obtaining a drive for mechanically-worked lubricators on pumps of the above type where the bearing part of the piston rod between the glands is the only available external moving part. A simple arrangement for overcoming this difficulty was recently devised and fitted by two of the engineers of the Vacuum Oil Co. Ltd., and our illustrations show the arrangement fitted to direct-acting pumps of the Davey or Tangye pattern, fig. 1 being a plan of the pump, and fig. 2 a section on A B through the distance piece which connects the water end and steam end.

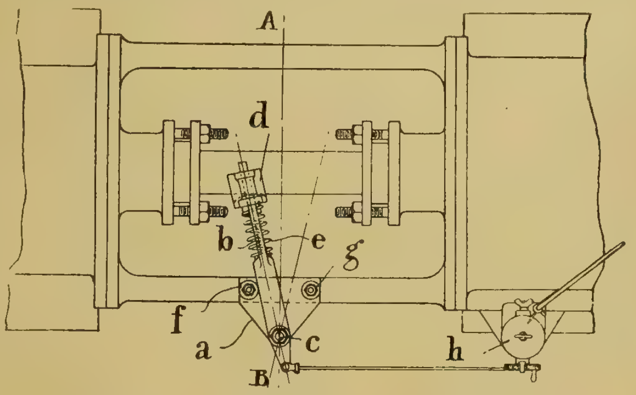


Fig. 1.

To the side of the distance piece between the steam and water ends is fixed a wrought-iron bracket *a*, which carries a forked lever *b* pivoted at *c* to the bracket *a*. This forked lever is provided with a brass half-bush *d* similar to that used for a connecting rod end, which is free to slide on the round projections of the forked lever *b*. The inside of the brass bush *d* where it bears against the pump piston rod is filed out saddle shape, so that no rough projections come against the rod and damage it. This also permits of the bush *d* adapting itself to the slightly circular motion of the forked lever *b*. A spring *e* is provided between the forks of the lever *d* which keeps the bush up to the rod, and the rod, in moving frictionally, actuates the lever *d*

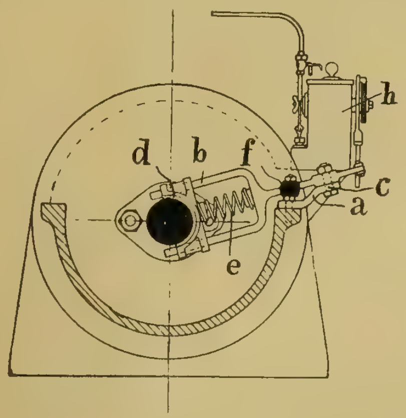


Fig. 2.

to and fro. The lever is prevented from overrunning and catching the gland studs by two rubber washers *f* and *g*, which are fitted on to the prolonged ends of the studs which secure the bracket *a* to the distance piece. Motion is taken for driving the vacuum Stirling lubricator *h* from the end of the lever *b* remote from the bush.

CONTACTS FOR ELECTRIC SWITCHES.

The present article refers to some improvements recently made in electric switches, fuses, and more particularly to those of heavy and medium current-carrying capacity, mounted on a slab or panel of insulating material and provided with back connections.

The object is to obtain an improved construction of electric switch, in which the current-carrying parts can be readily and conveniently made of standard wrought-copper sections of high conductivity, whereby the manufacture is rendered cheaper by the saving of material and labour, and the whole switch or the like efficient by the small number of surface contacts in series.

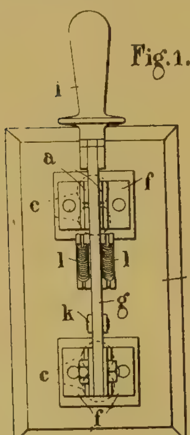


Fig. 1.

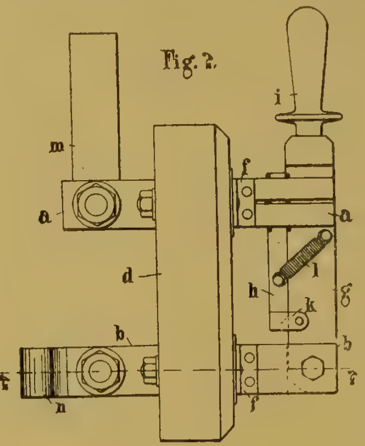


Fig. 2.

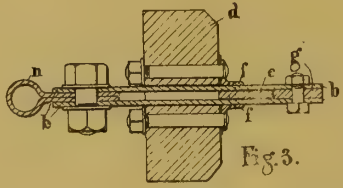


Fig. 3.

As regards switches or the like of heavy current capacity, it is usual practice at the present time so to construct these that current is taken from round stems into contact nuts by means of screw threads, which is not an electrically good arrangement.

This invention consists in an electric switch or the like, in which the switch jaws or equivalent contacts on the front of the panel consist of end or side surfaces of standard wrought-copper strips of rectangular cross-section carried right through to the back and thence direct to the socket or the like to which they are required to be connected.

Referring to the illustrations, fig. 1 is a front view; fig. 2 a side elevation of a switch suited to medium current of the order of 300 amperes. Fig. 3 is a section on the line 2—2 of fig. 2. Fig. 4 is a view as seen from one side of a panel of part of a switch for heavy currents. Fig. 5 is a detail view of one set of contacts for a switch of the kind shown in fig. 4. Fig. 6 shows a detail of a heavy current switch of the kind shown in fig. 4, illustrating the hinged part and a manner of connecting the cables to the same.

The improvements are shown applied to a panel knife switch in figs. 1 to 3. The switch contacts are formed of parallel wrought-copper bars *a* and *b*, split at the front end as illustrated. These bars pass through slots *c* in the panel *d*, as indicated in dotted lines in fig. 1, which run into one another. The two copper bars of the contacts *a* or *b* are separated by a metallic distance piece *e* of iron, steel, or copper, and on either side are attached angle pieces *f*, the whole being riveted together, and the angle pieces employed for the purpose of attaching the whole to the panel.

The movable member consists of two copper pieces *g* and *h*, the former pivoted to the lower set of jaws *b*, and provided with an operating handle *i* and the latter pivoted in a bracket *k* on the first piece *g*, and also connected thereto by a spring *l*, thus forming a quick brake attachment.

It will be seen that the current passes directly from the jaws in connection with the leads *m* on the back of the panel to the front of the panel without passing through surface contacts—except where such are used to connect the leads into the switch bars *a*—and it may thence be transmitted through the switch arm and the bars *b*, where desired, as, for example, to a cable socket *n*; by clamping the socket tightly to the bars, for example, between the contact pieces at the back. Thus only a single surface contact is required here, and no bolt and nut contacts are required for carrying current, such bolts as are employed being for the purpose of obtaining the requisite pressure to ensure good contact.

In applying the invention to switches of large capacities, each set of jaws is made of a number of wrought-copper bars suitably spaced apart and passing directly from the front to the back of the panel, as described above.

This construction is illustrated in figs. 4, 5, and 6.

Fig. 4 shows clearly an arrangement on the front of the panel for a switch capable of taking heavy currents, the top contact being made of a number of laminated copper bars *a*, with parts cut away, as shown. The bottom contact carries the hinged member *s*, carrying a suitable number of copper bars for engaging the upper contact.

Fig. 6 shows this hinge member both as regards the part *s* on the front of the panel and the part *t* which passes through and projects at the back of the panel.

In the construction shown the same copper strips which form the hinge of the switch after passing through the panel are drawn together, riveted, and soldered into one solid mass, then drilled with taper holes *v* for cone sockets *u*.

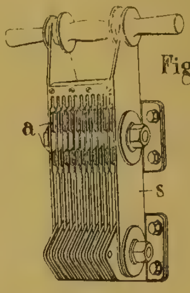


Fig. 4.

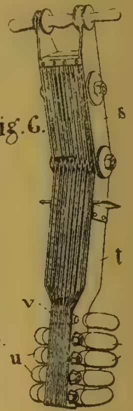


Fig. 6.

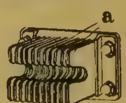


Fig. 5.

It will thus be seen that in the arrangements described the current is carried through a minimum number of surface contacts in a manner to secure minimum loss—hence minimum heating—combined with minimum weight of material, and the constructions are such that one is enabled to use standard material.

The improvements are applicable to contacts carrying currents up to any magnitude; for example, up to 10,000 amperes or more.

The above constructions of switches are due to Messrs. Ferranti Ltd. and M. B. Field.

MODERN AUTOMOBILE PRACTICE.

By A.M.I.A.E.

[ALL RIGHTS RESERVED.]

(Continued from page 266.)

GUDGEON PIN LOCATION.

In the last article we remarked that the side pressure should be uniformly distributed throughout the length of the piston, and we will now deal with the method to ensure this, but before doing so will lay down one or two points which bear directly on this problem. The cylinders, pistons, and rings should all be of the same material and preferably should be cast from the same pot; the iron should be soft and grey, and should have its carbon present in the form of graphite, since this latter materially assists in the lubrication of the moving parts. The co-efficient of friction is thus reduced and the "healing-over" effect thereby lessened. The iron should contain 4 per cent of carbon and 1·5 per cent of silicon, but if the carbon is less the silicon should be increased to 2 per cent; in the latter case the iron is harder and not so brittle. The coefficient of friction may be taken as ·15, and the pressure on the cylinder should not exceed 20 lbs. per square inch at a normal average piston speed of 1,000 ft. per minute for longevity, but for high-speed racing engines, where long life is not essential, this pressure may be as much as 30 lbs. per square inch on the actual rubbing surface of the piston. In addition to the rubbing surface we must take into account the connecting rod length in terms of the crank throw, as dealt with in the last article, and also the instantaneous velocity of the piston; thus if

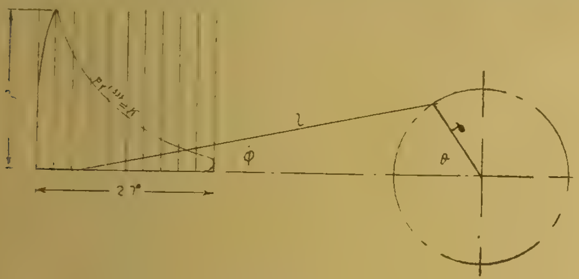


FIG. 20.

P = the total pressure on the piston in pounds

$= p \times A$;

ϕ = the angle which the connecting rod makes with the axis of the cylinder;

v = the instantaneous velocity of the piston in feet per minute;

p = the pressure on the piston in pounds per square inch;

A = the area of the piston in square inches

$$= \frac{\pi d^2}{4};$$

then that part of the stroke for which we must provide is when

$$\frac{\pi d^2}{4} p\, v \tan \phi = \text{a maximum.}$$

For certain connecting-rod crank-throw ratios the values of ϕ can be approximated for rough calculations from the tables in the "Practical Engineer Pocket Book" already referred to; but for more accurate results the values should be obtained in the following manner:—

Take the explosion and expansion stroke of the probable indicator card, based on the designer's previous experience, and set down the crank pin circle as shown in fig. 20; divide the card into ten equal parts and obtain values of ϕ. The product of the pressures p (which, in the absence of an actual card, are best calculated by the formula $P\,V^{1\cdot333} = K$) and of $\tan \phi$ will give the side thrust of the stroke of the piston. These products should be set down to a convenient scale as shown in fig. 21, from which it will be seen that the maximum value occurs between ·1 and ·2 of the stroke. In the same figure we have plotted values of

$$\frac{\pi d^2}{4} p\, v \tan \phi,$$

which shows the maximum value occurring between ·2 and ·4 of the stroke; thus for quick results it is sufficient to

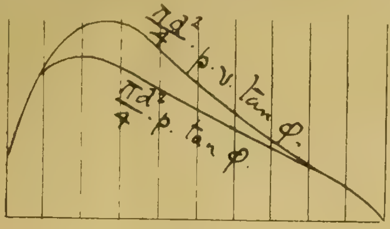


FIG. 21.

only consider values between ·1 and ·4, from which we can ascertain the relative effect of pressure and piston speed on wear.

Taking the values for the maximum product, and equating with the maximum permissible pressure as already laid down, then if L = the effective length of the piston, we have

$$\frac{\pi d^2}{4} p\, v \tan \phi = 20 \times d \times L \times 1000,$$

and
$$L = \frac{\pi\, d\, p\, v \tan \phi}{80000}.$$

The frictional resistance of the piston on the cylinder wall

$$= F = \frac{\pi d^2}{4} p \tan \phi\, f,$$

where
$$f = \text{the coefficient of friction}$$
$$= \text{say } \cdot 15.$$

This resistance can be shown graphically to act at a point approximately ·4 d from the cylinder centre line, and tends to rotate the piston about the gudgeon pin centre line; this force can be substituted by a couple acting through the line P_1 and P_2, fig. 22, where the gudgeon pin is shown centrally on the side of the piston.

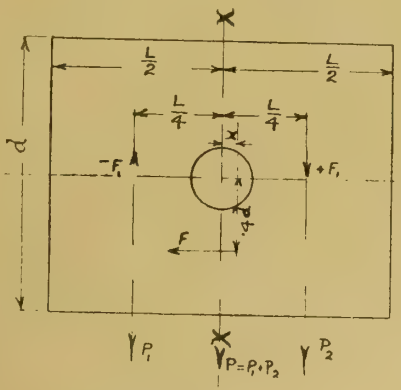


FIG. 22.

The couple is

$$F_1 \frac{L}{2} = \cdot 4\, d \frac{\pi d^2}{4} p \tan \phi,$$

so that
$$F_1 = \frac{\pi d^3 p \tan \phi}{5 L}.$$

Without the effect of the frictional resistance

$$P_1 = P_2 = \frac{P}{2},$$

but is of opposite sense, the piston being considered as instantaneously at rest. With the frictional resistance brought into consideration by the movement of the piston in the manner illustrated in the diagram,

$$P_2 \text{ is increased by } P\frac{x}{L},$$

and P_1 diminished by a like amount where $x =$ the distance from the centre line $X\,X_1$ of the neutral axis of all the moments.

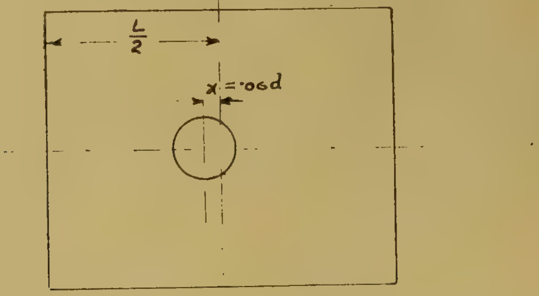


FIG. 23.

In order to restore equilibrium it is necessary to have

$$\frac{P_2}{\frac{L}{2} - x} = \frac{P_1}{\frac{L}{2} + x},$$

which is obtained by moving the gudgeon pin a distance x nearer the head of the piston, as shown in fig. 23.

$$\text{But} \qquad x = \cdot 4\,d\,\frac{F}{P}$$

$$= \cdot 4\,d\,\frac{\frac{\pi d^2}{4}\,p \tan\phi\, f}{\frac{\pi d^2}{4}\,p \tan\phi}$$

$$= \cdot 4\,d\,f;$$

$$\text{and if} \qquad f = \cdot 15,$$

$$\text{then} \qquad x = \cdot 06\,d.$$

When the piston between the rings and above the top one is allowed to bear on the cylinder wall, add the allowance for the necessary rings, and this will give us the total length of the piston. The summation of the product of the widths of bearing surface by the distance of their centres from the neutral axis must be equal. The values are set out algebraically in fig. 24, which looks somewhat formidable, but when the numerical values are substituted becomes quite simple.

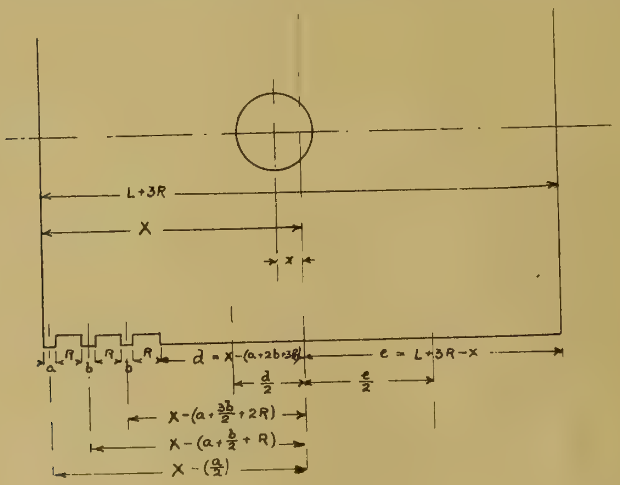


FIG. 24.

We then have

$$a\left[X - \left(\frac{a}{2}\right)\right] + b\left[X - \left(a + \frac{b}{2} + R\right)\right]$$

$$+ b\left[X - \left(a + \frac{3\,b}{2} + 2\,R\right)\right] + \frac{[X - (a + 2\,b + 3\,R)]^2}{2}$$

$$= \frac{[L + 3\,R + X]^2}{2}$$

from which we can obtain the value of X to satisfy the equation. From X we must subtract x, so that the gudgeon pin is situated

$$X - \cdot 06\,p$$

from the piston head.

PISTON HEAD.

The piston head should have a thickness

$$t = \cdot 02d + \cdot 1 \text{ in.},$$

which will be found to agree with modern practice for engines varying between $2\frac{3}{4}$ in. and $4\frac{1}{2}$ in. diameter. The shape of the head is usually one of the three forms shown in fig. 25, the preference being given to the flat type (*a*) on account of the simplicity of manufacture, and for sizes between the above limits this is quite satisfactory. Type (*b*) is intended to place the metal in compression when the explosion occurs, and at the same time to drain off any lubrication oil which may have worked through to the combustion space, and which is a frequent source of pre-ignition. This is unnecessary and may be prevented in the manner hereafter described. When steel pistons are used, as for aeroplane engines, where lightness is of great importance, and also in very high speed engines, the head usually takes the form shown at (*c*), in fig. 25, where the metal is placed in tension, which is permissible in this metal. Another advantage claimed for this type is that the combustion space is more nearly spherical, which is admitted to be the best form for greatest efficiency. When this type is adopted the valves should be placed in the head of the cylinder and all pockets avoided.

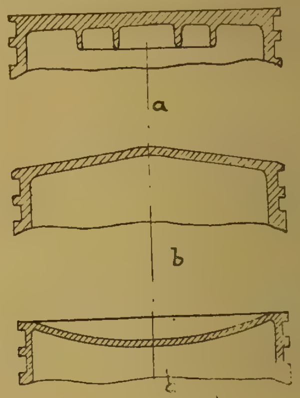


FIG. 25.

In order to prevent the pistons from cracking, which is now, fortunately, a rare occurrence, but which is liable in sizes over $4\frac{1}{2}$ in. diameter, two or three annular rings should be cast in the underside of the head as shown at (*a*) fig. 25; these have the effect of dissipating the heat more readily and of stiffening up the piston head.

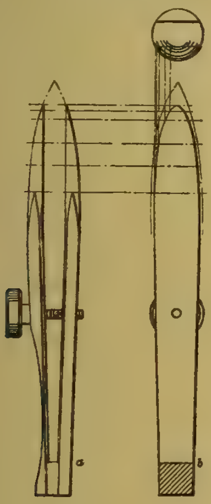
(*To be continued.*)

A NEW compound for belts, known as "Nuclinch" and another named "Flexite," for use on ropes and cables, made by the Improved Surface Co., New York, are being largely used in the United States. The component parts of the first are highly beneficial to leather, the materials penetrating the belt, not acting merely as a rubbing grease, and being found to keep it pliable and ensure uniformity of running at all times. The second is found to be a specific for protecting ropes and cables from sand rot.

TO SHARPEN A DRAWING PEN.

A frequently occurring job in drawing offices is the sharpening of drawing pens. Few draughtsmen, however, care to undertake the work themselves, and, indeed, the results obtained by most of those who attempt to sharpen their own pens is not, as a rule, very encouraging. The result of this is that, to save expense, pens—by those persons unable to sharpen them themselves—fall into a deplorable condition before being sent to an instrument maker or other skilled person to be operated upon.

The method generally employed for sharpening a drawing pen is to tighten it up until the blades are brought together, and round them off on a whetstone until a suitable contour is obtained and the nibs are of exactly the same length and shape. The whetstone first used should be moderately coarse, and the points of the pen should be ground only from the outside until a sharp edge is obtained, the finishing off being then performed in a similar manner with a stone of a hard, smooth nature. A pen can be perfectly sharpened by this means, provided a certain degree of skill and experience is possessed by the operator, but unless the latter is more or less of an expert, a number of small facets are very liable to be found on the outer surface instead of the desired continuous contour, and to obtain a uniformly sharp edge, without destroying more or less the previously rounded point, is a matter of considerable difficulty. It must always be remembered that the flat interior surface of the blade should never, on any account, be touched with the stone. To overcome these difficulties and find an easy method of producing the required result is a matter interesting to all those who have to use drawing pens, and consequently a simple plan given by a correspondent of the *American Machinist* may be useful to some of our readers. The method recommended by the above authority is as follows:—



The Surfaces of the Drawing Pen.

"On careful examination it will be noticed that the two blades consist approximately of a double curved surface of revolution intersected by planes, producing the shape of point shown in the illustration (*a*). It follows that if the pen is suitably clamped and the whetstone be guided tangent to the curved outer surface of the blade, the contour at *b* will result from the intersection of the new surface and the inner surface, as the material is ground away. Such an apparatus might be well worth building if something equally good and costing next to nothing were not available. The substitute is a narrow strip of carborundum cloth and a clamp to hold the pen. The only other tool required is an ordinary magnifying glass. The blades need not be initially rounded and ground to the same length. The grinding away of the material produces the correct point, something like a narrow ellipse, and the blades may be brought to equal length by the obvious method of giving the longer one a further grinding. Even with very little practice, the results are surprisingly excellent, and might easily be mistaken for the work of an instrument maker. It may be suggested that the excessively sharp edge is objectionable, but that is a fault equally applicable to the whetstone process and one quickly corrected by a few strokes on a piece of worn carborundum cloth."

CONTROLLING APPARATUS FOR HYDRAULICALLY-WORKED GUN MOUNTINGS.

The following apparatus is of the class used for controlling the recoil of guns, with special reference to hydraulic apparatus employed in addition to the brake cylinder for running the gun in and out, in which a valve fitted in a piston working within a cylinder is opened by the pressure set up beneath it when the gun recoils, allowing the water to pass from the run-out or pressure end of the apparatus to the run-in or exhaust end, and, after recoil, is closed against the service pressure in the system for returning the gun to the firing position.

Valves of this class have hitherto been loaded against the service pressure by means of heavy springs, which tend by their pressure to close them during recoil, owing to the condition of equilibrium which obtains. In consequence a rapid vibration of the valve is set up, causing waves of excessive pressure in the apparatus.

The controlling apparatus shown in our illustrations is the invention of Messrs. Sir W. G. Armstrong, Whitworth and Co. Ltd., in conjunction with Mr. Robert Matthews and Mr. Charles Wale, and is designed to obviate the above objectionable feature in such devices. In this apparatus an automatic valve is provided, which is free to move in a chamber formed in the piston or ram, and is constantly in communication with the run-out end of the cylinder, the opening of such valve at the commencement of the recoil being opposed by the pressure in the chamber and by a spring, both acting upon the valve. A small relief valve fitted in the chamber above the main valve is adjusted by means of a spring to govern the pressure at which the main valve is required to open. A separate spring is used for this purpose, but the spring for closing the main valve already referred to may, in some cases, also serve for the small relief valve.

In a valve on this principle the pressure below the main valve during recoil of the gun will greatly exceed that of the spring tending to close it, and it will be held firmly and wide open. Thus there is no tendency for the valve to close or vibrate during recoil, and excessive pressures on the apparatus are avoided.

The area of the valve is also no longer restricted by considerations of the size and power of the spring as in a purely spring-loaded valve, and larger passage for the water may thus be provided.

Referring to our illustrations, the piston *a* works within the cylinder *b*, and is provided with ports a^1, which are closed by the valve *c* of annular form sliding upon a stem a^2, which forms part of the piston. The other end of the valve *c* is fitted with suitable packings to work within the pressure chamber formed by the nut *d* screwed on the stem a^2. This chamber is preferably of somewhat larger diameter than that of the seating for the valve *c*.

Within the stem a^2 is fitted a relief valve *e* closing the space *f*, which communicates with the chamber *d* by means of the holes a^3 and grooved passages a^4.

The valve *e* is provided with an enlarged area above its seating forming a chamber commonly termed a cataract, by means of which the valve is held firmly open during recoil by the excess of pressure beneath it over that of the spring which is tending to close it. It is loaded to the pressure at which it is desired the main valve *c* shall lift by means of a spring *g*, and passages e^1 communicate with the exhaust end of the apparatus in recoil. The main valve *c* is also fitted with a spring *h* for closing it at the end of recoil and for keeping it tight when pressure is reversed by means of the working valve for the purpose of running the gun in, otherwise, since the diameter of the valve is greater than that of its seat, the unbalanced pressure on its nose would tend to open it.

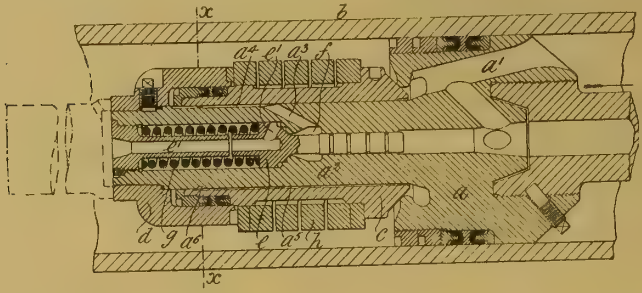


Fig. 1.

The chamber *d* is always in communication with the space below the main valve seating *c* by means of the longitudinal grooves a^4 and a^5 and the circumferential groove a^6. The tail or compensating rod may be in one, with the nut forming the chamber *d* as indicated. The right-hand end of the cylinder, as shown in fig. 1, is open to pressure for running out the gun and to exhaust for running it in, whilst the left-hand end is open to exhaust when running out and to pressure when running in.

On the gun recoiling the valve opens by the pressure set up beneath it, being transmitted to the chamber above its seating and discharging the water therefrom through a small relief valve adjusted by a spring to the pressure at which the main valve is required to open. This action is assisted by the arrangement shown for enabling the pressure below the main valve to act directly on the stem of the small relief valve.

Fig. 1 of the illustrations is a longitudinal section of a valve of annular form, which is adapted either to the case where the piston and rod are fixed and the cylinder recoils or *vice versa*; fig. 2 shows an end view of the valve;

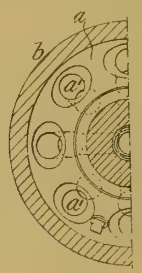


Fig. 2.

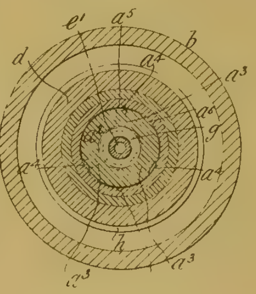


Fig. 3.

and fig. 3 is a section on the line *x x*, fig. 1. The arrow on fig. 1 shows the direction of the recoil when the cylinder is fixed; where the cylinder is arranged to recoil the direction will be reversed.

A party of graduates of the Incorporated Institution of Automobile Engineers recently visited the Brussels Exhibition, and were courteously shown round by Mr. W. G. Williams, representative of the Society of Motor Manufacturers and Traders. This gentleman also obtained permission for the party to inspect the ruins of the fire. A short visit was also paid to the F. N. Co.'s works at Liege. A joint meeting of the London, Birmingham, and Coventry sections of the graduates of the institution has been arranged to be held at the Engineering and Machinery Exhibition at Olympia on the 24th inst.

INDUSTRIAL BETTERMENT.*

(Continued from page 335.)

The ways of adopting representative methods of control in industrial organisations vary according to the conditions existing in each one of them; but all of them must embody some means of co-operation between management and working force, which can best be accomplished through an elected board composed of representatives from these two elements.

Some concerns, like the Pennsylvania Railroad Co., the United States Steel Corporation, and the National Biscuit Co., reserve a certain amount of stock at a reasonable cost, and encourage their employees to buy it, and thus become part owners in the enterprise, with a right to vote for representation on the Board of Directors. Others, like the N. O. Nelson Co., of St. Louis, extend their profit-sharing system so as to include their customers. These are examples of the direction in which those who are willing to break away from the beaten path are moving. Between the two extremes referred to are many who, like the William Filene Son's Co., of Boston, form a permanent shop committee, elected by the employees, and this committee has certain privileges of recommendation regarding the betterment of shop conditions, of improvement in methods of manufacture, and design of product, to a committee appointed by the management, composed of the heads of departments.

A system of this kind closely resembles the American democratic form of State and national government with its elected lower house, its appointed Senate, and at the head the Governor or President with his cabinet.

In this instance the cabinet consists of the officers of the company, viz., the treasurer, who has charge of the receipts and disbursements of money; the secretary, or general sales manager, who obtains the business; the superintendent of manufacture, who has charge of the conversion of the customer's orders into finished product, and the controller, who supervises the accounting or cost of the transformation of working capital into bills receivable. These four officers must develop departments which are entirely separate and distinct from each other, but which must be so harnessed and driven that they will pull together in parallel with proper team work.

When some means of participating in the financial vicissitudes of the business is added to a representative system of this kind, the interests of management and employee become identical; the workmen work with, rather than for, the management. These two elements pull together, and the best conditions exist for industrial betterment.

Having constructed the framework of the organisation according to the plan outlined, it will be necessary to instal administrative machinery of a type which will be in sympathy with those forces which are most effective in developing the latent efficiency of the human element in the organisation as a whole, to its fullest extent.

The representative system must be further developed according to the requirements of each establishment, but a very satisfactory means of obtaining the close co-operation of the individual operative with the management is by the development of a definite channel by which he can express his ideas and needs to the committees.

These expressions are made in the shape of signed suggestions, which are passed upon first by the works committee, composed of representatives of the working organisation, then by the board of foremen, and finally are disposed of by the manager, or whoever is in charge of the business. Every suggestion which is adopted is paid for.

By accepting no anonymous suggestions, and by giving full publicity to the actions of the committees, the dignity of character of the system is maintained, and it becomes one of the most fruitful elements of industrial betterment so far devised. It must be recognised, however, as a subordinate but important part of a representative system of management, and not an entity in itself which can be incorporated into a business organisation as ordinarily constituted. It is a plant which thrives and brings forth abundant fruit in proper soil and right environment, but is blighted and soon dies in captivity. I have seen attempts made to instal suggestion systems by managers who did not believe in representative control methods, and they have been complete failures.

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* A lecture delivered by H. F. J. Porter before the Graduate School of Business Administration, Harvard University, Cambridge, Mass.

Once there is established in the minds of the working organisation a feeling of confidence that, instead of exploitation, methods of co-operation have been promulgated by the management an esprit de corps is developed which is far more effective for shop discipline and efficiency than all the fear which can be engendered by strict supervision. This sentiment once established, all the rest comes, and if it is accompanied by efficient management it comes so quickly as to surprise everybody by the results.

Now, as to some of the details of industrial betterment, let us consider:—

1. The Selection of Workmen.

In this connection it must be borne in mind that the characteristics of an efficient workman are, first, good health, without which he cannot be regular in attendance, permanent in service or capable of giving a normal amount of strength physically or mentally to his duties when at work. Second, he must be of high moral quality, or his habits outside of working hours will disqualify him when at work, and, third, he must be of good mental calibre and have high manual skill in order to think and work right.

Every industrial establishment, managed according to modern ideas, establishes a beneficial society among its workmen and helps it financially. This society provides for the workmen during periods of sickness and assists the family at his death. One of the duties of the physician whose services are controlled by this society should be to pass upon each employee before he is accepted as a member of the organisation. He should be one of the staff of the employment bureau, which should include also one or more members of the working organisation. The only way the latter can develop and maintain an esprit de corps is by letting it have something to say about its personnel.

2. The Stimulation of the Workmen.

The environment of the workmen in the factory, his hours of work, his wages, and his prospects of advancement must be all so attractive as to cause him to strive to do his best in order to hold his position.

Where such conditions exist there is always a waiting list of applicants, and there is no better stimulant to exertion than the knowledge that if one does his duty he is fully protected, but that if he neglects it he discharges himself, and there is a man ready to take his place on short notice.

But human nature needs encouragement. It responds better to coaxing than to prodding. Men can easily be led, and they will then be imbued with a better spirit than when they are being driven. In the first case they move by their voluntary will, in the second case they move by the initiative of someone else's will, which means against their will, and then their resentment is aroused. Progressive managers have installed various means of encouraging men to work, finding that force does not bring about desired results. Bonus systems of payment are more conducive to exertion than fines or docking wages. The payment of a premium on punctuality and regularity of attendance will get the individual machines started promptly in the morning and at noon and keep them going every day.

3. The Education of the Workmen.

It is presumed that the most intelligent and skilled of the men available will be selected for each position which is to be filled.

If, then, the inducement to hold their positions subsequently is sufficiently strong, it will naturally act as a stimulant for all to improve their talents, and every encouragement on the part of the management should be manifested to aid them in their endeavour. Some of the larger and more progressive concerns have found it advantageous to establish schools in connection with their factories, where courses are given in technical and manual training which will aid the men to become more proficient in their work.

So much stress is being devoted to industrial education, however, in the correspondence, public, and other schools that it will generally be necessary only to inspire the ambition of the men to improve their talents and to place them in the way of obtaining the benefits of facilities already existing.

The provision of literature, technical and popular, which may be taken home will be a great help in this direction. A small charge can be made for keeping books out over a stated time. This charge acts as a reminder to return them and establishes a fund with which to secure new ones.

4. The Health of the Workmen.

When it is realised that the health of the operative and his efficiency are co-relative it should not require much persuasion to get the management to devote considerable attention to those conditions about the factory buildings which will effect the comfort and health of its occupants. Good air and plenty of it at the right temperature, good light, convenient and sanitary lavatories, all come as a matter of course.

All of these, however, must be supplied intelligently. Air can be forced in so that draughts occasioned by it are not only discomforting, but dangerous. Light may be accompanied by so much heat as to be uncomfortable. Lavatories may be so inconvenient and badly arranged as to be useless or unsanitary. In a large electric works, and in a steel works which I visited recently, I saw wash rooms which were so seldom used that the water had been shut off. In another the use of roller towels had resulted in the spread of skin and blood diseases. Rest rooms for the accommodation of those temporarily indisposed prevent the loss of valuable time. Coat rooms, where damp clothes can be changed for dry ones, and the operatives are encouraged to provide themselves with dry stockings and slippers, will be conducive to increased efficiency on wet days. There is nothing so distracting as cold feet, and the lowering of vitality due to wet clothing invites pulmonary diseases which will cause absences and loss of time.

Exhaust fans for extracting dust and grit from polishing and grinding operations, safety appliances attached to machinery to prevent accidental catching of clothing or limbs, all are conducive to saving expense in the long run.

The segregation of the tuberculous, and the exclusion of those suspected of having been exposed to contagious diseases, are precautionary measure now being generally adopted. The examination of the eyes and teeth, and extending help to remedy their defects, will tend towards preventing absences and saving time.

Emergency rooms for administering first aid to the injured, by competent experts, prevent incipient wounds from developing into more serious maladies.

Occasional talks by the physician of the beneficial society on "how to live right" will prevent much sickness in the families of the operatives and so increase the percentage of attendance of those who are the wage-earners. A cheerful room with facilities for warming their lunch and where the operatives may gather for their mid-day meal, with the provision of free coffee and tea, will tend to make the afternoon hours productive of better results than if they are left to themselves to eat a cold lunch, with, perhaps, the accompaniment of stronger stimulants.

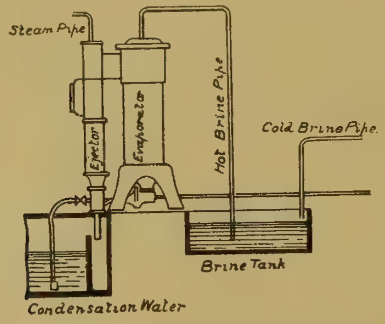
The drink habit has become of late years such a serious menace to discipline and an obstacle to efficiency, that many concerns have taken the stand squarely that they will not employ or retain in service any one who is addicted to alcohol or other drugs. The habit should, however, be looked upon as a curable disease rather than a vice, and every effort made to help individuals to effect a cure rather than perfunctorily to turn them out of the community for the public to handle. A man helped to free himself from the chains of intemperance will make a loyal adherent to the company's interests.

(*To be continued.*)

AN IMPROVED REFRIGERATING MACHINE.

The improved type of refrigerating machine shown in our illustration is the invention of Mr. Maurice Leblanc. The apparatus consists essentially of the following parts: A brine tank, an evaporator, an ejector, and a condenser.

From the brine tank the liquid is passed to the evaporator, into which it is delivered in a fine spray. The vacuum is maintained by means of a steam ejector working at a high speed of about 1,300 metres per second. A portion of the water is evaporated, owing to the pressure being only 2 mm. of mercury. The liquid, which is at a temperature of several degrees below zero, is afterwards delivered by a pump into the refrigerator, and from thence the liquid is returned to the brine tank, as well as the condensed vapour carried off during evaporation. To condense the latter vapour it is delivered, on leaving the ejector, into a chamber to which a rapid gyratory motion is imparted in order to increase the surface contact between the vapour and the apparatus. This vapour, which is at a pressure of 2 mm., is first compressed by a water, and subsequently by an air pump.



It will be seen that this machine uses as a refrigerating agent, instead of a gas easily liquefied by compression, water, the rapid evaporation of which is effected in a vacuum as in the Carré laboratory types of ice machines. By reason of the large latent heat of vaporisation, viz., 606 calories per kg. of water at zero, a considerable reduction of temperature is produced. In order to obviate any possibility of the water freezing in a mass, a sufficient addition of Ca Cl or Na Cl is added to make an ordinary brine serve as a vehicle for the cold.

Advantages said to be possessed by this machine are the non-employment of chemical product, the simplicity of the mechanical parts, and the possibility of maintaining constant the strength of the brine without having to especially concentrate it from time to time.

We have received from the International Correspondence Schools Ltd. a copy of the present month's "I.C.S. Student."

DESIGN OF ROPE DRIVES.

Of the many points to take into account in designing a rope drive the questions of length and angle are of high importance, as both have a material influence upon the efficiency of the system. Upon the arc of contact which the ropes make with the pulleys depends the amount of power which it is possible to transmit. Failure to appreciate this fact is bound to lead to unsatisfactory results. Under any given set of conditions the longer the drive the greater will be the arc of contact, and in the case of horizontal working it is usually productive of the best results to have a distance between the shafts of at least three times the sum of the radii of the driving and driven pulleys. This will give an arc of contact of a reasonable number of degrees and will allow the ropes to be worked at their proper horse power. A smaller arc will only deal effectively with a lower power. A drive which is too long is subject to serious jumping of the ropes under any sudden alteration of load, and to reduce this to a minimum it is necessary to increase the tension to a degree which, from the point of wear, both of the ropes and the bearings, is not desirable. Matters may be improved very considerably by the use of a grid or comb through which the ropes run, but, obviously, it is better practice to dispense with such adjuncts, if possible, and keep the length of the drive within reasonable limits.

It is in horizontal running, or at angles to the horizontal up to approximately 45 degrees, that rope driving gives the best results. In a vertical drive, or one in which the angle is more obtuse than 45 degrees, the arc of contact becomes too low to give a good grip on the pulleys, and hence for any given power a greater number of ropes must be used. In a vertical arrangement, the power it is possible to transmit will be reduced about 25 per cent from this cause. Where it is impossible to avoid the vertical or a very obtuse angle it is generally productive of better results if the bottom pulley acts as the driver, and under these conditions the single or continuous-rope system is often preferred to the multiple, as it is essential that the rope should be kept tight to prevent it hanging off the bottom pulley, and the tension gear employed with a single rope is particularly useful in this respect.

As a general rule it is preferable that the bottom should be the driving side, as under this arrangement the sag of the top side considerably amplifies the arc of contact. However, the reverse is sometimes purposely employed where, owing to a rapidly varying load, the ropes have a tendency to surge or jump. With the slack side at the bottom there is less likelihood of the ropes leaving the grooves, but they will not, of course, transmit the same power and a greater number must therefore be used.

Under ordinary conditions the pulleys should not be less in size than thirty times the diameter of the ropes. This is a general and safe rule, but circumstances occasionally necessitate some deviation from it. Where the pulley has to be of a smaller ratio the amount of power transmitted per rope must be reduced by the addition of other ropes to offset the excessive wear which takes place under such conditions. The more a rope is bent in passing over a pulley the greater is the internal friction set up between the strands and fibres, and the effect of this soon becomes apparent in the shape of wear. As the less bending a rope is subjected to the longer it will wear, it is always advisable to err on the side of large pulleys.

The groove, of which the sides form an angle with one another of 45 deg., has now become standard practice, as it has been found to give the best results. It combines a maximum of frictional adhesion when the rope is on the pulley with a minimum of resistance when it leaves it, and does not tend unduly to convert the natural circular shape of the rope into that of a V. A more acute angle, whilst securing a better grip, wears the rope as it leaves the groove, and very shortly alters its shape in such a manner that its efficiency drops. An obtuse angle of 30 deg. or thereabout has little wearing effect, but it has been found by experience that it does not suffice to give the necessary grip. Some engineers prefer an angle of 40 deg.; as there is then less tendency on the part of the rope to rotate around its centre and so wear the surface; but the 45-deg. groove with perfectly flat sides is by far the most usual, and is, on the whole, considered the better. It is very difficult to assign a reason for the revolving of ropes as the phenomenon appears to follow no regular law. Generally speaking, it is deprecated, but there are not wanting engineers who prefer a certain amount of rotation. They contend that with rotation the wear is made more even.

It should be borne in mind that the rope should under no circumstances be allowed to touch the bottom of the groove, as this implies slip, owing to the fact that under such conditions the rope cannot be wedged in the groove as it should be. Partly for this reason it is often advisable when ordering ropes to send a templet of the grooves to the rope maker, thus throwing upon him the responsibility for the success of that part of the drive. This is particularly the case where the grooves on the two pulleys differ in any respect as may at times be the case. So long as the difference is not enough to cause the rope to ride too high above the teeth in the one case and too near to the bottom of the groove in the other there is no difficulty in working under such conditions.

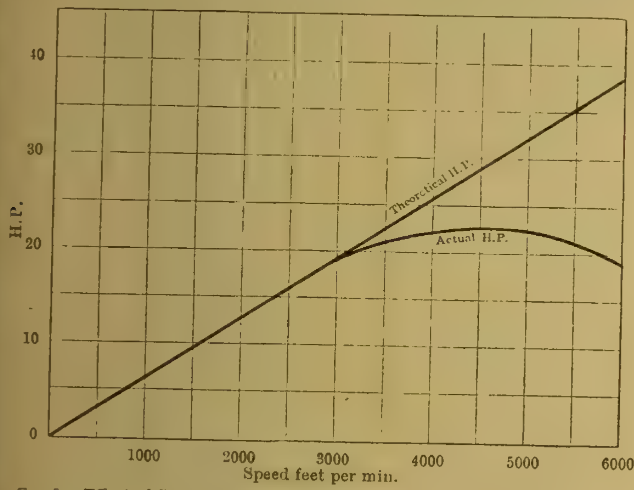


FIG. 1.—Effect of Centrifugal Force on Power Transmitted by a 1¼ in. Rope.

Numerous tables have been published from time to time giving the horse power that ropes will transmit at various speeds, and, for ordinary conditions, they are doubtless reliable. It must not be forgotten, however, that relative pulley diameter, length, and angle of drive have an important bearing upon the power it is possible to transmit, and, as before stated, it may be necessary under certain conditions to increase the number of ropes by 25 per cent or more to insure freedom from trouble and undue wear.

In diameter ropes are seldom less than 1 in., and, owing to the resistance offered to bending and the consequent waste of power, a diameter of 2 in. may be taken as the other extreme. The most usual sizes are between 1¼ in. and 1¾ in. These constitute a happy mean which gives a minimum of power loss by bending together with a maximum of weight for the production of the necessary amount of sag. Where the multiple-rope drive is in use, it is not correct practice to employ ropes of varying sizes on the same pulleys, as there is always a tendency on the part of the smaller ropes to run the pulley at a different speed, particularly where there is much difference between the diameter of the pulleys. This necessarily sets up friction, and the smaller ropes will be found to have worn more quickly than the others.

There should always be plenty of clearance around a rope drive, not only to allow for a fair amount of sag, but also for convenience in carrying out repairs. It is usual to assume that a horizontal drive under ordinary conditions will sag from 8 per cent to 10 per cent of the distance between the two shafts, and if the sag be greater than this, the ropes are running too slack.

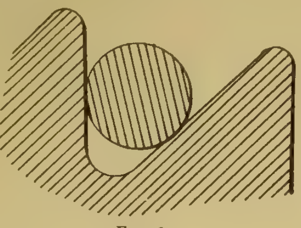


FIG. 2.

Most authorities agree that for main drives a speed ranging between 3,600 ft. and 5,000 ft. per minute is the best and most economical: It is quite possible to carry the speed much higher than this with safety, but, while some circumstances may justify it, as a general rule it is not good practice. Theoretically, the power it is possible to transmit with any given rope drive should increase in direct proportion to the speed at which it is run, but in practice this is by no means the case, as centrifugal force comes into play. This is demonstrated in fig. 1. The straight line shows the power theoretically possible to transmit. The curve shows the manner in which the horse power falls off above a certain critical speed between 4,000 ft. and 5,000 ft. per minute. In addition to this important consideration, it is very necessary to remember that excessively high rope speed is inefficient in other directions. The life is materially shortened by the undue amount of bending which takes place, and air resistance to the movement of the ropes and pulleys becomes an appreciable factor. The horse power which a rope will transmit with safety at ordinary speeds is very much in excess of that given in the average table, but it is not advisable greatly to exceed a load which gives a working strain of 200 lbs. per square inch of sectional area, as this means a correspondingly shortened life.

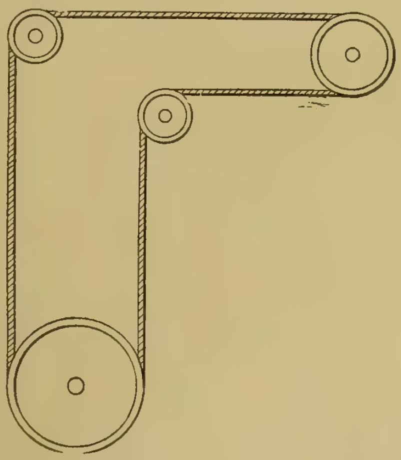


FIG. 3.—Right-angle Drive with Parallel Shafts.

It happens occasionally that it is necessary to connect two shafts which are not strictly parallel. With ordinary pulleys there is an angle, depending to some extent upon speed, power, length of drive, and relative diameters at which the ropes will not keep in the grooves unless forcibly retained by means of jockey pulleys. This is usually put at anything over 3 deg. It is unsafe, however, to place too great reliance upon a figure, which may be a long way out under peculiar conditions. If such a drive cannot be avoided it is better practice to instal pulleys having specially shaped grooves. A pulley groove which has been found satisfactory is that shown in fig. 2. While this groove retains the angular relation of 45 deg. between the two faces, its centre is several degrees out of the vertical, and the extent of this latter angle must depend upon the amount the two shafts are out of parallel. It is obvious that such an arrangement permits the rope to run on and off the pulleys without undue friction on one side, and entirely obviates all risk of the rope mounting the groove.

The cross drive is best avoided where possible, but if it is installed in the right way it will, in most cases, be found satisfactory. The usual method is to employ a multiple-rope drive working in pairs, between each of which it is desirable to leave an empty groove. The ropes of each pair are crossed respectively right and left handedly, so as to make the two centre ones the driving side. The result is that as both are moving in the same direction there is no friction between them. The two ropes forming the outer or sagging side, having little strain upon them, are easily forced aside by the inner pair, and friction between the two, although appreciable, is not important. If it be desired to use one rope lapped twice around the pulleys instead of two separate ones, the tight side should be arranged to run on the outside, the sagging ropes crossing each other in the centre.

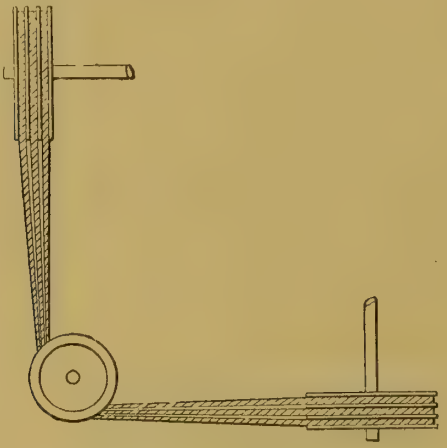


FIG. 4.—Right-angle Drive with Shafts at Right Angles.

In the half-crossed drive, where one pulley is at right angles with the other, it should be arranged so that the slack side runs on the straight and the tension side on the skew. The former will not enter the groove if the conditions are reversed, whereas the tight side does so readily.

The right-angle drive is the least desirable of any, and should be avoided if possible. The loss of power is necessarily very considerable, and in all but the simplest form of right-angle drives difficulties are apt to arise with the guide pulley. Fig. 3 illustrates a method which will obviously give little trouble, as the grooves of all the pulleys are in line with one another. However, it is not always possible to employ such a simple arrangement, and something similar to the more complicated drive shown in fig. 4 may be essential. A moment's consideration will show that under these conditions the grooves of the guide pulleys cannot all be in line with those of the driver and the driven; there is, therefore, a tendency on the part of the ropes to leave the grooves, and most careful design is necessary to secure satisfactory running. The design of the guide or jockey pulley will materially affect the operation of such a drive. Speaking generally, the grooves should be well rounded at the bottom and wide, but in complicated drives, particularly those of the right-angle class, it is often necessary to employ a special form, which can only be arrived at after mature consideration of the particular problem. Grooveless guides, similar to a cotton reel in shape, have been tried, and are, as a matter of fact, still frequently employed, but experience has shown that on the whole they are not desirable, although there are certain simple cases which may be negotiated by such means.

There is a certain amount of divergency of opinion as to whether the three or four-strand rope is the better. It is claimed for the latter that it has four points of contact with the pulley, as against three in the former, and for this reason it is supposed to give a better grip. Advocates of the three-strand rope advance the theory that the triangular form fits itself better to the groove, and a good deal of the preference shown for it is due to the fact that, unlike the four-strand rope, it possesses no core. Where first-class ropes are concerned it is possible to overestimate the importance of this feature. There is no denying the fact that in a badly-made four-strand rope the core is very apt to take more than its fair share of the load and to fail prematurely; but it is certainly not fair to assume that all makes are alike in this respect, and, looking at the matter from an impartial point of view, there is probably little to choose between the two types of rope.

With regard to material, there can be no question that the cotton rope is better than the hempen. Owing partially to lower internal friction, the life may be put at twice that of the latter, and there is less loss of power in bending, less stretch, and less noise. The cost is higher, but, as a general rule, it is worth incurring.

It is perhaps not generally known that in some branches of the rope trade it is customary to treat the rope with black lead or oil adulterants, with a view of increasing the weight. This is sometimes carried to the extent of an addition in weight of 25 per cent or even more, and, since ropes are sold by weight, it is well to be alert to detect the practice.—F. H. Davies, in *Power and the Engineer.*

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"Electric Lighting for Motor Cars." By Marks and Clerk, London. Technical Publishing Co. Ltd. Price 3s. 6d.

On first thoughts one would hardly consider the subject of electric lighting for motor cars sufficiently broad to warrant a volume to itself.

A cursory glance, however, into this book gives early proof that there are certain problems in this connection which have to be solved to ensure efficient results. These problems, as affecting designers and manufacturers, are clearly defined, and the solutions, which have shown themselves of practical merit, are fully described.

Besides the generation of current for electric lighting, the efficient projection of it demands some attention. This aspect is dealt with in a chapter written by Mr. A. C. Aldis, M.A., a well-known authority upon lenses and reflectors.

An appendix dealing with the photometric measurements of various illuminants, and compiled by Mr. G. A. Shakespeare, M.A., B.Sc., concludes a handy little volume which should be in the hands of every motorist, whether as designer, builder, or user of motor cars.

BOOKS RECEIVED.

"Journal of American Society of Naval Engineers." Vol. XXII., No. 3. Washington D.C. From the Secretary.

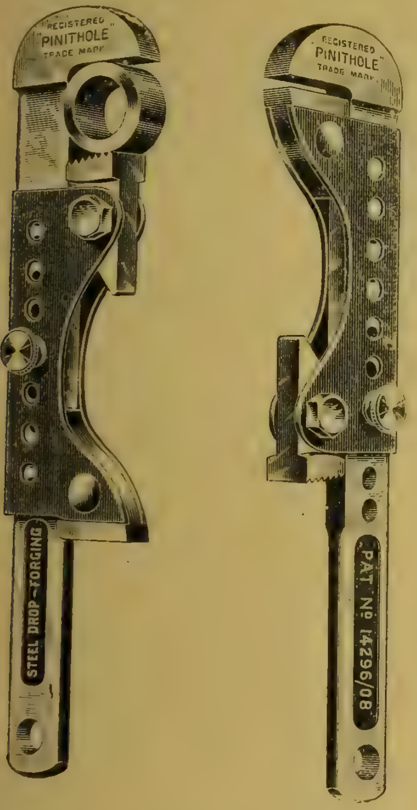
"Official Gazette of the United States Patent Office." Vol. CLVII., No. 5. Published by Authority of Congress, Washington.

"Journal of the Franklin Institute." Vol. CLXX., No. 3. From the Institute, Philadelphia.

A HANDY FORM OF SPANNER WRENCH.

Our illustrations show a new pattern of spanner wrench, known as the "Pinithole" wrench, lately brought out by the Pinithole Co., of Manchester. It will be seen that the tool, which is the invention of Messrs. B. J. Brearley and F. T. Brearley, is, unlike many of the combination spanners and pipe wrenches that have been devised, of a very simple form of construction. It combines a spanner and a pipe wrench, and is capable of being applied both to regular sided objects, such as nuts, bolts, etc., as well as to such objects as pipes, couplings, and other bodies of an irregular shape. The tool can be used in most cases where an ordinary spanner can be employed, and is readily adjustable for objects of various sizes.

The device consists essentially of a lever having a jaw-like formation at one of its ends, and a sleeve capable of being moved on or about this lever in the direction of its jaw-like end. Provision is made for adjusting the sleeve relatively to the lever in certain pre-arranged positions. At each end of the adjustable sleeve a pivoted jaw is provided, one of which jaws is formed with a flat, smooth face parallel to the face of the fixed jaw, the other with a roughened or serrated face at an angle to the fixed jaw for use as a pipe wrench or the like purpose. Either of these jaws can be brought into operation in combination with the fixed jaw, and the adjustment of the sleeve relatively to the fixed jaw lever can be made by means of a series of holes in the body of the latter, and of corresponding holes in the sleeve, and a pin, as shown.


REGISTERED "PINITHOLE" TRADE MARK
STEEL DROP-FORGING
REGISTERED "PINITHOLE" TRADE MARK
PAT. No 14296/08

The ordinary standard pattern of wrench is made of a capacity to fit with the flat jaw, all nuts from ⅛ in. to 1¾ in. across flats. With the serrated jaw it will grip pipes of the same diameters, and in this direction it will be found useful for gripping worn or rusty nuts, studs, pins, etc.

The lever with fixed jaw is made of a polished-steel drop forging, the jaw face being ground and case hardened. The sleeve consists of a polished bent steel plate, drilled, tapped, and fitted with case-hardened steel smooth-faced spanner jaws, accurately ground and secured in position by a steel cup-headed rivet. The pipe bit or jaw with serrated face is of high carbon tempering steel, with teeth or serrations accurately milled out of the solid. The pin and bolt are of best mild steel. The tool is tested to a pull of 200 foot-pounds before leaving the works, and its weight is 36 ozs., or 2¼ lbs.

The economy of using these combination tools are shown by the following item given in "Engineering Costs":—

"A fitter requires the following ordinary screwing-up tools for dealing with all sizes of bolts up to 1 in. diameter: Eight spanners (double-ended) weighing 16 lbs., cost 20s.; 4 pipe wrenches (parrot-nosed) weighing 8 lbs., cost 16s.; or 12 tools in all weighing 24 lbs., cost 36s. But the same man equipped with one 'Pinithole' spanner wrench, weighing 2¼ lbs., and costing 6s., will set up or take adrift the same work—and most other things held together by screw threads—with less trouble and in less time."

In our illustrations we show the spanner wrench, in one view, as adjusted for use as a spanner for flat-faced nuts, and in the other view as arranged for using the toothed or serrated jaw as a pipe wrench.

TRADE CATALOGUES.

Messrs. Webster and Bennett Ltd., Foleshill, Coventry, have sent us their Section B catalogue giving particulars and dimensions, etc., of their range of multiple spindle drilling machines. A copy of their Section E catalogue is also to hand which describes a range of horizontal boring machines manufactured by the Werzengmachinen-Fabrik "Union," Chemnitz, for whom this firm are the sole agents in this country. Copies of the catalogues will be forwarded by Messrs. Webster and Bennett Ltd. to any of our readers who may be interested on forwarding a trade card.

We have received from **The Dermatine Co. Ltd.,** London, S.E., their price lists Nos. 17, 18, 19, and 20, which deal with belting, packing rings, hose and tubing, and valves respectively. A special feature of the last-mentioned catalogue is an article on pumping and condenser plant, concerning the application of valves, whether flexible or hard, to resist steam and oil.

We have received from the **Power Gas Corporation Ltd.,** Stockton-on-Tees, the well-known firm which controls the patents and processes for the manufacture of Mond gas, an interesting and instructive catalogue which has just been issued dealing with their various specialities. A copy will be forwarded to any firm interested on application.

The Dexine Patent Packing and Rubber Co. Ltd., Abbey Lane, Stratford, London, E., have issued a new edition of catalogues and price lists in which some important changes have been made. The prices now quoted supersede and cancel those of previous editions.

We have received from **Messrs. The Bowesfield Steel Co. Ltd.,** of 110, Cannon Street, E.C., a copy of their small catalogue of black and galvanised and plain and corrugated steel sheets and of the various accessories manufactured by them. The little book, which is nicely printed and illustrated, also contains a section giving a number of useful tables and memoranda and some pages of squared tables for memorandum, etc.

We have received from **Messrs. W. P. Butterfield Ltd.** a monthly list of riveted cisterns of various standard sizes; also odd sizes, which they have in stock.

We have received from **Messrs. John Spencer Ltd.,** of the Globe Tube and Engineering Works, Wednesbury, Staffordshire, a handy catalogue giving particulars, prices, etc., of tubes and fittings for gas, steam, water, and other purposes; well-boring tools; wrought and cast-iron sanitary appliances; valves, etc. The catalogue concludes with British standard tables and weights of bars and tubes per foot, etc.

We have received from the **Peerless Rubber Manufacturing Co.,** of Warren Street, New York, a publication illustrating and describing some of their specialities in belting, hose, packings, etc.

On Wednesday, September 7th, the fifth vacation visit of the session of the Society of Engineers was made, by the courtesy of the company and with the permission of the Admiralty, to the works of the Thames Ironworks, Shipbuilding, and Engineering Co., at Canning Town, E.

A NOVEL BOILER INSTALLATION.

When boilers of large capacity are required, those of the water tube type are usually selected. The Sächsische Maschinenfabrik, late R. Hartmann, however, have made a new departure in this direction, and for a recent instllation at the Chemnitz Electricity Works have followed a distinctly different course by substituting for water tube boilers an installation of boilers of a composite type. The construction of these boilers is shown in our illustrations. Each boiler consists of two shells, the lowermost being fitted with three combustion tubes, and the top one with 220 fire tubes, the heating area being thus raised to the high figure of 608 square metres.

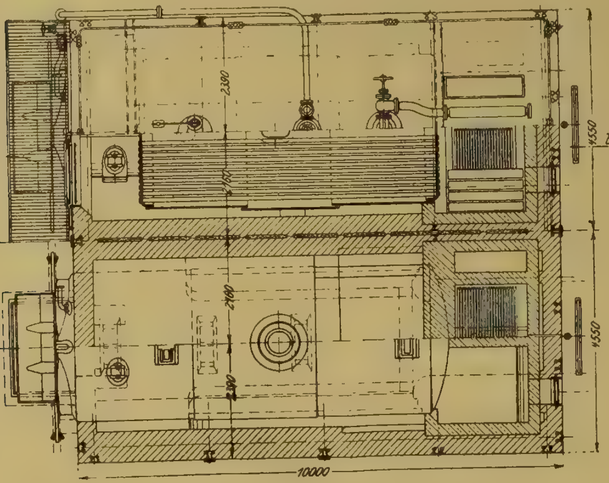


Fig. 1.

In spite of the numerous adverse criticisms, the satisfactory results that have been obtained in practical working with this type of boiler have completely fulfilled the anticipations of the designers.

The construction of the boiler will be inferred from figs. 1 to 4, fig. 1 being a plan, fig. 2 a section on the line *a b*, fig. 1, and fig. 3 a section on these planes, viz., the lines *c*, *d*, *e*, *f*, and *g*, *h*, fig. 2. It was found to be rather a difficult task to provide the required grate area of about 8·75 square metres, the free grate area being about 3 square metres. In spite of the three combustion tubes the grate had to be made of a length of 2·65 metres, and a distance of 3·00 metres between the fire bridge and the door. In the case of practical working at full load, the fire requires attention at intervals of about a quarter of an hour, but the superintendence altogether is by no means trying, and one man is sufficient to take charge of both boilers.

The fuel employed consists of a mixture of nut coal of 6,400 metric heat units and of Bohemian lignite nuts of 5,400 heat units at the ratio of 1 : 1 laid on in layers 5 to 10 centimetres in height.

About eight hours are required to set the fire properly going, the amount of fuel thus expended being about one ton. This expenditure of time and fuel plays a by no means unimportant part in practical working. When one of the battery of boilers is shut down it will retain its heat if the slide be closed until the load on the electricity works requires it to be again brought into operation. The diagram fig. 4 shows the decrease in steam pressure after 40 hours.

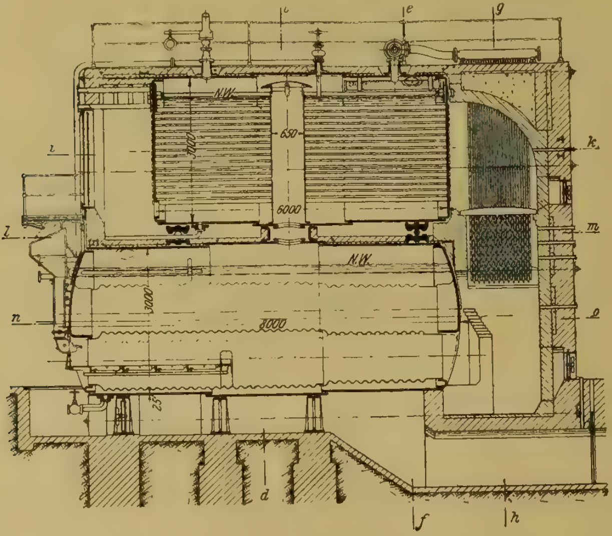


Fig. 2.

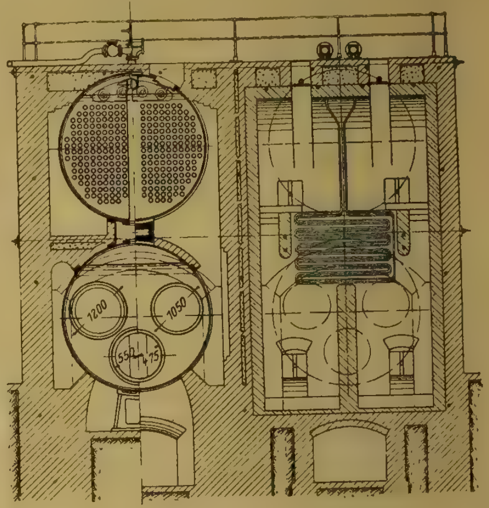


Fig. 3

The following are the results of the official tests made on delivery. Each of the tests lasted about eight hours, only one of the two boilers of the battery being in operation. About four days previous to the experiment the flues had been cleaned, and both before and after the tests the flues were again overhauled, when all seams and tubes were found to be perfectly tight. During about three-quarters of the time of testing, one boiler out of five units connected to the same chimney stack was in full operation, the fires of the remaining ones being kept low. During the rest of the time all the boilers were gradually brought up to, and worked at, their normal capacities. It is worthy of notice that the chimney stack to which these boilers were connected was found to discharge comparatively little smoke, whilst the second chimney stack of the works at the same time gave out enormous amounts of smoke, thereby showing the perfect combustion obtained in the boilers under consideration.

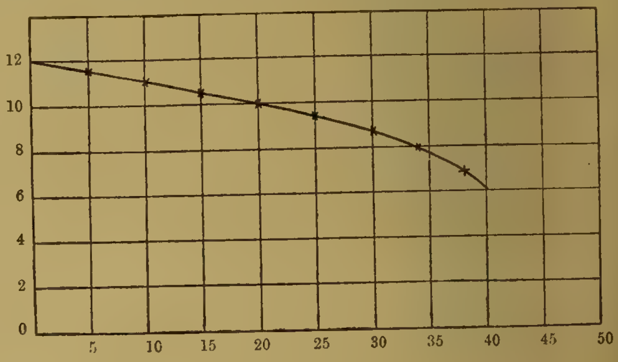
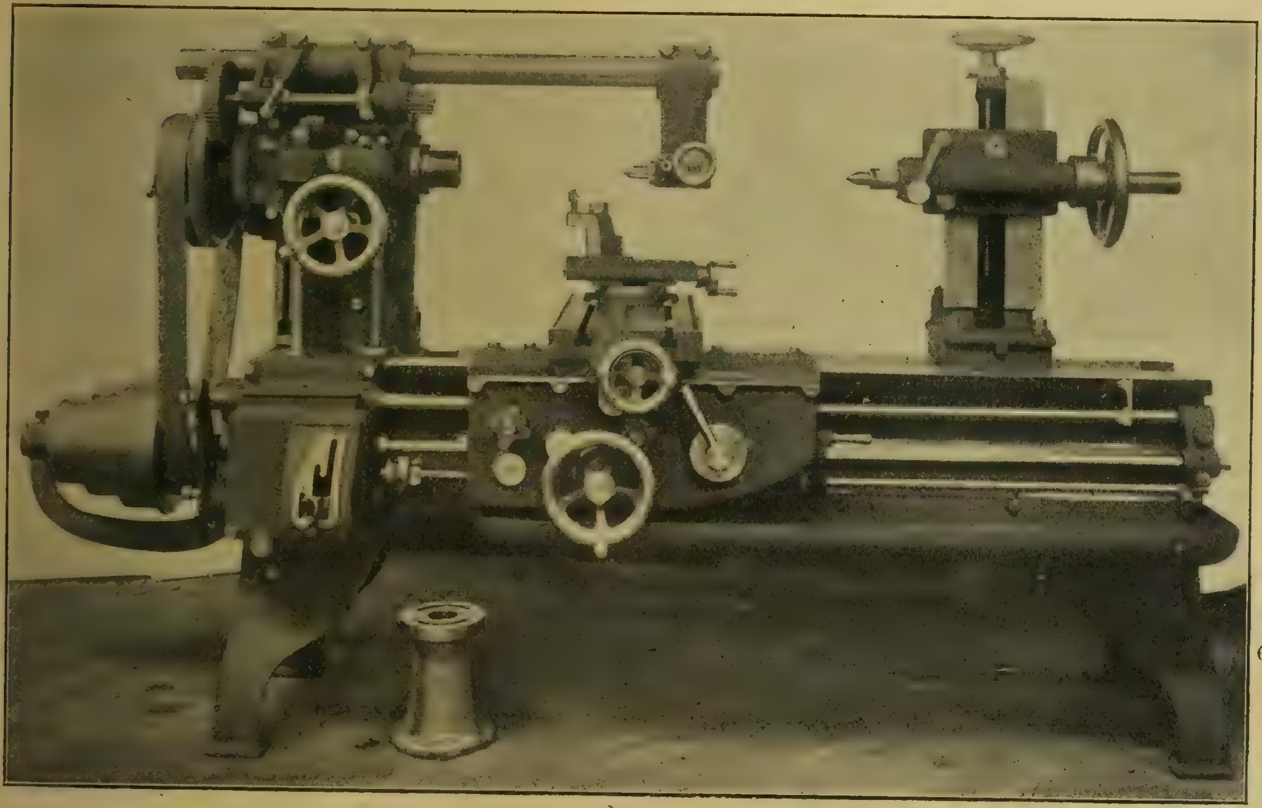


Fig. 4.

The Naval, Mercantile Marine, and General Engineering and Machinery Exhibition, Olympia, 1910.

Messrs, Drummond Brothers, Ltd., Guildford, Surrey. Although Messrs. Drummond's exhibit consists for the most part of working examples of their well-known small lathes—than which, perhaps, there are none so popular amongst amateurs and for the lighter grades of professional work—the distinctive feature of the stand, and, indeed, one of the few really novel machines of the Exhibition, is the "Drummond-Barreto" Universal Machine, of which we give an illustration. This accommodating tool is adapted to be used for turning, boring, drilling, screw cutting, milling, and gear cutting, and is especially useful for general repair work.



DRUMMOND LATHE.

The bed of the machine is of box form, with flat bearing surfaces. The saddle has wings working on a narrow V and square guide in front, and is gibbed to a square guide at the back. The tailstock, which has a hollow mandrel, works on a square guide at the back, and bolts also to a flat surface below the level of the saddle guides, enabling the saddle wings to pass the tailstock and giving as much range of movement to the saddle as any ordinary heavy lathe. The saddle is fitted with a lathe type apron of double box section, with all gears working between two gun-metal bushed bearings. The quick return hand wheel, nut lever, and self-acting, sliding, and traversing clutch handles are conveniently situated for operation; reversing for screw cutting and feeds is effected by a lever on the apron itself, instead of on the headstock. The saddle has self-acting sliding movement, and carries a ⊥-slotted boring table which has a self-acting traversing movement; a quick change gear box under the head gives three speeds, changeable by hand lever, whilst the tool is running, to the sliding and surfacing motions.

The lead screw is fitted close up to and well under the saddle guide on bed, and is, therefore, well protected from dust or chips. The lead screw is used only for screw cutting, a separate feed rod actuating the feeds. A full set of change wheels enables any screw to be cut; separate gears on the usual quadrant are used instead of a quick-change gear box.

The traversing boring and milling table is fitted with a swivelling slide rest of the usual pattern for lathe work; two bases, one extra high for large diameter work, being supplied. A universal dividing head is also fitted for gear cutting, dividing, and similar milling work. The spindle is worm driven, and two index plates drilled with eight rows of holes each are supplied, enabling divisions being made from two to fifty rising by one, all numbers divisible by two or five up to one hundred, and nearly all numbers divisible by four or five up to two hundred, and most numbers from two hundred to three hundred, also many higher numbers.

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The dividing head can be swivelled through 360 deg., and is graduated. A tailstock is supplied to work on the table in conjunction with this head for all jobs when the head is in a horizontal position, the largest gear so cut being 14 in. diameter—with the blank fixed on the head alone and the head set vertical, the cut being taken downwards by lowering the headstock of the machine, gears can be conveniently cut up to 40 in. diameter. Provision is made to set the dividing head also at right angles to the table, enabling extra large worm wheels up to 40 in. diameter to be machined, the angle being obtained by swivelling the dividing head and the cut taken inwards, the machine head and cutter being brought to the height of the centre of the blank. The vertical movement of the machine head being slow and controlled by a hand-wheel, actuating a worm and worm wheel.

The machine head slides on specially designed ways, giving a much longer and narrower guide than usual, at the same time having a very broad flat bearing surface gibbed to a square guide to prevent twist. The mandrel is hollow, with extra large bore right through, and runs in phosphor bronze bushes, adjustable for wear.

The mandrel drive of a new form gives twelve speeds ranging from five revolutions per minute to 270 revolutions per minute, in practically geometric progression; the three highest of these speeds being by direct belt drive, three through belt and direct gear drive to mandrel, and six through this drive and back gear; only two gear wheels more than the usual four in back-geared lathes being used to obtain the twelve speeds. The pinion of the back gear speeds operates directly into the face plate itself, the gear on this taking the place of the usual plate wheel on the mandrel. This method relieves the mandrel of all torsional strain when extra large work needing the slower speeds is being done.

The head has a raising and lowering movement actuated by hand wheel, worm and worm wheel on a screw working in a fixed nut and fitted with ball thrust. The head is extended upwards and bored to receive a hollow cast-iron bar, carrying an arm and centre for milling purposes. This bar runs clear through the head clamps and is readily removed when desired.

The tailstock has also the necessary raising and lowering movement to enable it to be brought to coincide with the position of the head, and provision is made by hardened surface pegs and dead-length gauges to give the necessary accuracy in setting.

The feed and screw gears are driven through spiral gear by a splined vertical shaft actuated by spiral gears from the mandrel. The screw shaft and feed gears are geared to a reversing mechanism employing spur gears and direct dog clutches only; this gear reverses from the apron without shock at any speed with the machine running. The reversing is arranged so that reversing and running back during screw cutting can be done without danger of crossing when cutting odd pitch screws.

Messrs. J. Parkinson and Son, of Shipley, who are well known as manufacturers of vices, have also on their stand, besides a show of these useful appliances, a representative collection of their machine tools, comprising milling and profiling machines and high-speed lathes. The latter are represented by a 7½ in. centre "Trunk" lathe, shown in operation, and by an 8½ in. lathe, the latter tool having a 5¼ in. hole through spindle, and being thus adapted for large bar work, and on details of which large quantities are not required at a time, and for which the purchase of expensive turret lathes, with their elaborate and special

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" Ireland: Messrs. Booth Bros., Upper Stephen Street, Dublin.
" Manchester: Mr. A. W. Taylor, 46A, Market Street, Manchester.

OLYMPIA EXHIBITION.

SEE

STAND 112

DRUMMOND BROS. LTD.

equipments of tools and cutters, would not be justified. The principal features of the tool are the following: Bed is of straight type, and of a standard length of 10 ft., with square edges and a strip on front shear as a guide for the saddle. On the front of this strip is the take-up jib, an arrangement which is found to considerably diminish the twist and maintain the saddle in alignment, whilst allowing of the feeding being effected with a less expenditure of power. A four-tool turret is fitted to the cross slide of the saddle, the latter being driven either by the screw at the front or by the back shaft behind the bed when feeding, and a knob on the saddle permits of the direction of feed being reversed on the instant. On the cross-feed screw a micrometer adjustment to indicate $^1/_{64}$in. on the diameter, turned, is provided.

Messrs. Babcock and Wilcox, of London and Renfrew, show a patent water tube boiler (portable type) as illustrated in fig. 1, complete with iron casing, having 955 sq. ft. heating surface, constructed for 200 lbs. working pressure, and fitted with usual mountings, and having a steel-stayed chimney. On their stands, Nos. 27 and 63, are shown a model of a sea-going torpedo boat destroyer (speed 30 knots), fitted with White-Forster water-tube boilers, and a model of a water-tube boiler (marine type), illustrated in fig. 2; a model of a water-tube boiler (standard land type) as supplied for all industries; a model of their patent chain-grate stoker, for burning bituminous coal smokelessly; and a model of the Lassen and Hjort water purifier for eliminating the hardness from feed water for boilers, etc.

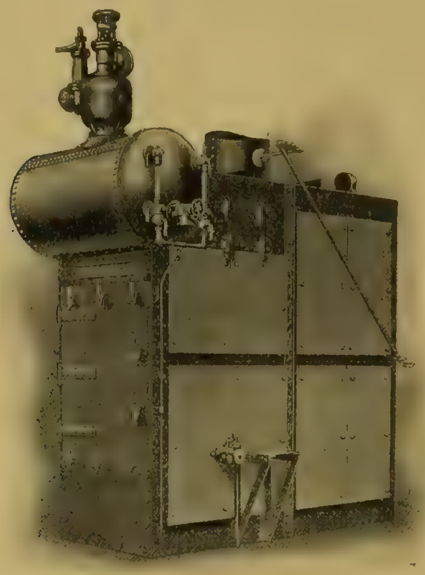


FIG. 1.—Babcock and Wilcox Portable Boiler.

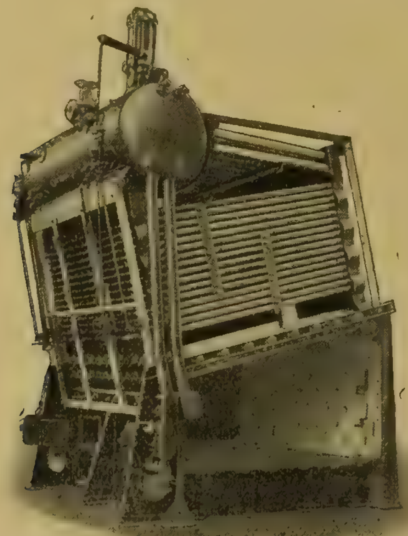
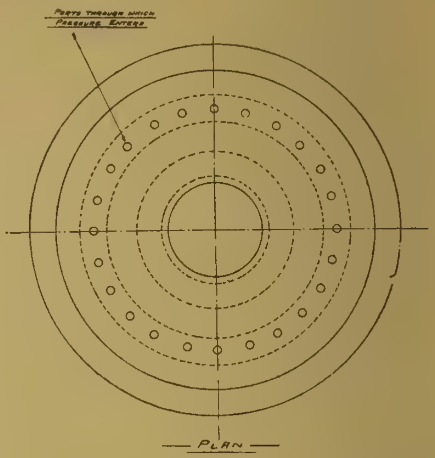
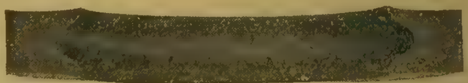


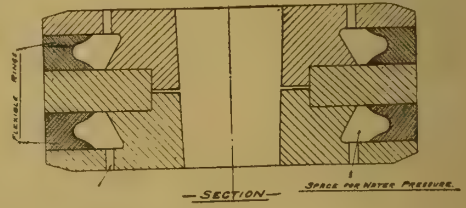
FIG. 2.—Babcock and Wilcox Boiler, Marine Type.

The **Dexine Patent Packing and Rubber Co. Ltd.,** Stratford, London, E.—Quite a novelty, and of exceptional interest, is the "N.P." (Never-Pass) pump piston, examples of which are shown on the Dexine Co.'s stand. The illustrations show the principle of this plunger, and it is obviously superior to the customary bucket type of plunger, especially in cases where trouble is experienced with oval or scored barrels. The pressure the pump is working against automatically adjusts the rings to the walls of the chamber through the annular rows of ports at alternate strokes, diametrically, and also expands the lips against the plates between which the rings are clamped. As demonstrating the efficiency of the piston the following figures are of interest:—



Ordinary ebonite rings (quite new when set to work): Number of double strokes made, 38,700; number of hours working, 57; number of units generated by engines, 6,016. N.P. patent bucket: Number of double strokes made, 32,000; number of hours working, 57; number of units generated by engines, 5,980. Pump when fitted with N.P. bucket made 82·7 per cent of the number of strokes made by the same pump fitted with ordinary ebonite rings and passed the same volume of water.





Other specialities shown at this stand include Dexine high-pressure jointing, gauge glass rings, manhole joints, valves, and also Warin's patent bucket.

(*To be continued.*)

The fire gases were tested from time to time as to their carbonic acid and oxygen contents, to which effect test samples were taken at the end of the first and last draughts respectively. The average contents of carbonic acid at the end of the first flue was found to be 3·9 per cent, and at the end of the boiler 11·1 per cent, the oxygen contents being 5·6 per cent behind the first and 8·1 per cent behind the last flue.

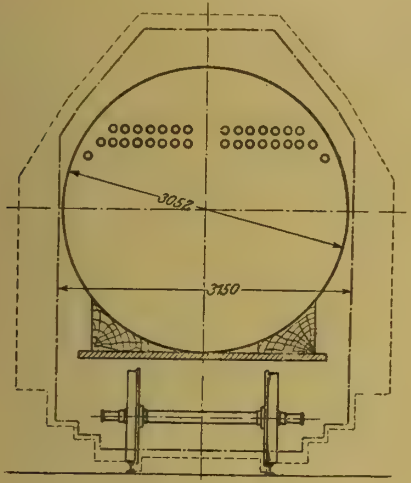


Fig. 5.

The table below gives the most important data regarding the above tests :—

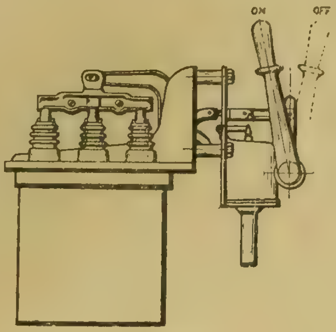
Testing No	1.	2.
Heating value of fuel ........................W.E.	5,900	5,900
Amount of fuel used during one hour ....kg.	1,400	1,060
Amount of fuel used per square meter grate area ,,	160	121
Amount of hearth residues per hour .... ,,	28	27
Amount of the above, combustible.........per cent	27	35
Feed water temperature ....deg. C.	35	25
Water evaporated per hour ....kg.	9,194	7,012
Water evaporated per square meter of heating area.. ,,	15·1	11·5
Temperature of fire gases at end of combustion tubes deg. C.	798	718
,, ,, at end of boiler ...... ,,	231	220
Draught in front of slide ....mm. W.S.	23	13
Efficiency ....per cent	76·9	73·3

A valuable feature in connection with this novel type of boiler is the fact that the boilers, in spite of their unusual capacities, can be easily transported on rail, as shown in the diagrammatical view fig. 4.

NEW DESIGN OF MINING PANEL.

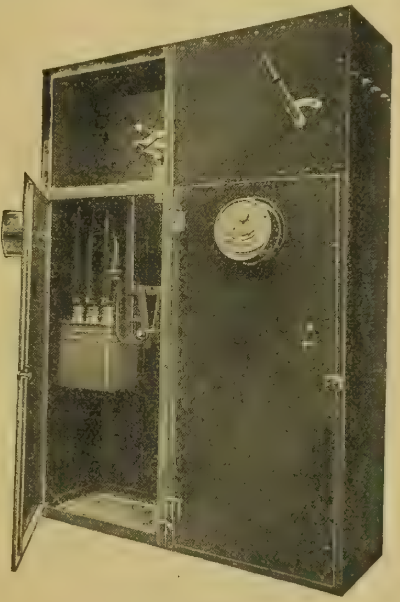
A new type of mining panel designed and built with a special view to the conditions which exist in mining work is shown in our illustrations. The panel is designed so as to prevent the opening of an isolating switch until the corresponding oil switch has been put to the "off" position, and likewise so that the oil switch cannot be put "on" whilst the isolating switch is in the "off" position.

Provision is also made for the interlocking of each door, so that it cannot be opened until all pressure has been cut off the panel by the isolating switch. The cover of one of the isolating switch chambers has been removed in the illustration in order to show the internal construction of the apparatus.



Oil Switch.

The panels can be designed to accommodate current and potential transformers, and any desired combination of instruments can be fitted to the fronts.



Miner's Panel.

The above mining panel has been designed and is manufactured by Messrs. A. Reyrolle and Co. Ltd., electrical engineers and manufacturers, Hebburn-on-Tyne, who, we understand, are making them in large quantities.

MANUFACTURED GRAPHITE.

Graphite is a mineral which is found in a number of parts of the world in an amorphous and so-called crystalline form. As found in a natural condition, graphite is invariably mixed with other substances; for example, clay, mica, sand, talc, etc. Some of the impurities with which the mineral is associated can be removed by floating in air or water, but there remain some which have a specific gravity identical or so nearly identical to that of the pure graphite that it has been found impossible to separate them by the above process.

The use of graphite for lubricating purposes renders it of great value to engineers, but graphite as made by nature does not possess all the qualities desirable. Various grades of graphite have been obtained by mining for many years past; indeed the mineral has been known and used by man since the fourteenth century.

For lubricating purposes, however, which is an application of comparatively recent years, a very high grade of purity is required, one at least of 99 per cent being a desideratum, so that being thus practically chemically pure its nature would then be soft and unctuous and entirely devoid of grit.

This condition, so difficult to obtain in the case of natural graphite, is said to be obtained by the process for making artificial graphite discovered by Dr. E. G. Acheson.

Material made by this process, which is known as Acheson graphite, is now made at Niagara Falls, where an astonishingly rapid progress has been made in this new industry of manufacturing artificial graphite of a better quality than that made by nature. The chief feature of the Acheson process is the use of an electrically-heated furnace, and that the results obtained are so far superior to the natural product is not so surprising when we consider that in addition to the advantages derived from the furnace operation, of which the operator has complete control, each ounce of the raw material can be selected, whilst in the process of nature no choice of raw materials was possible.

This full control of raw material selection and of the operation in the electric furnace admits of certain definite chemical and physical properties being given to each individual grade of graphite made, and so ensuring their practical utility in their particular fields of application.

In the direction of lubrication, for instance, as is well known, it is frequently undesirable or practically impossible to apply graphite in the form of powder to surfaces where the lubrication is required. This difficulty has been overcome by the production of a graphite of very high purity made by the above process and incorporated with grease, oil, or water, the trade names given to these three products being respectively gredag, oildag, and aquadag.

Other grades of Acheson graphite manufactured are especially applicable for the following purposes: Filling dry cells, facing in foundries, making lead pencils, making paint pigments, etc.

HIGH-SPEED TOOLS AND MACHINES TO FIT THEM.*

Those engineers who saw, at the Paris Exhibition in 1900, a lathe running at a high speed with a tool with its point red hot removing a dark blue chip, felt that they were witnessing the beginning of a revolution in tool-steel and in machines fitted for its use. This revolution has now taken place, and we are slowly accommodating ourselves to the new regime, but many changes have had to be made, not only in the direction of making far stiffer and more powerful machines, but also in our views regarding the values of certain types of machines for producing certain classes of work and the grouping of machines.

The use of high-speed steel for tools has been gradually extended, the old temper steel having to retreat from one position to another. For some time high-speed steel was considered to be useful only for rough cutting with the tool of the usual lathe form. Then its use was extended to twist drills with wonderful result; again its use was considered problematical in capstan and turret lathes where high speeds with copious supplies of oil or lubricant were already in vogue, but now no maker of such machinery would advocate the use of anything but the best high-speed steel. Milling cutters of all descriptions are made of high-speed steel, and although the tool makers still advertise the alternative of temper steel, those who have had experience of the high-speed milling cutters would not think of ordering cutters of temper steel, unless the cutter was only required to accomplish a small amount of work, in which case it would be policy to run slower rates with a cheaper tool. Reamers, chisels for chipping hammers, rivet snaps for pneumatic and hydraulic riveting devices, have all been found to give the greatest satisfaction when made from high-speed steel. Examining such a list of uses, it becomes apparent that this steel has other properties besides that of retaining hardness at high temperatures.

The three properties of modern high-speed steel are: (1) The edge can be made very hard; (2) hardness retained up to a high temperature; (3) toughness. These properties are what make the steel so universally useful, but when high-speed steel was first introduced it had only the property of retaining its hardness up to a high temperature.

There are a few points which should be stated at the outset. There are three classes of high-speed tool steel, which will be called in this paper:—Class A: For cutting mild and medium steel. Class B: For cutting hard steel, such as tyres, etc. Class C: For cutting very hard steel and for use in cases where a sharp and lasting cutting edge is required; especially useful in cases where deep cuts with fine feeds are used.

More power is required to remove a thin wide chip than a chip of double the thickness and half the width, that is, to remove a chip 1 in wide with a feed of $^1/_{16}$in. requires more power than to remove a chip ½ in. wide with a feed ⅛ in. This is less noticeable with tools with sharp edges. Tools with blunt cutting angles require more power than tools with sharp cutting angles to remove the same amount of material, the objection to sharp cutting angles being that the edge is apt to break. The total power used for a given cut, including the power absorbed by friction in the machine, increases at a smaller ratio than the increase in cutting speed, in other words, less horse-power is used per pound of material removed at high speeds than is used at low speeds. This is only true up to a certain point.

Figures of the speeds and feeds and depths of cuts which can be taken with lathe tools of high-speed steel under ideal conditions are interesting, and are very useful in showing in what direction we should modify our old methods and design new machines, and to what perfection we should strive; but these figures are not of much use as a guide to what is actually performed in the general run of workshops. There are so many variations in the actual conditions that, without a careful study of each class of case, it is difficult to say what is the best rate to cut at. Mr. Taylor gives 12 variable elements, but even this number does not cover the whole ground, and such questions occur as one man working several machines and several tools cutting simultaneously. Thus, on certain work where there is a large amount of repetition, it has been found possible to employ to advantage lathes with two saddles and three rests to turn work from 3 ft. to 4 ft. long. As one man looks after two of these lathes he has to keep six tools at work on very hard steel. It is quite evident that under these circumstances it is important that the tools should not require changing often, as this would cause the lathe to be idle for a portion of the time, and too much of the workman's energy would be used up in changing the tools and setting in the cuts. One of the advantages of the use of high-speed steel in the above case is that the tools will generally run for the day without requiring to be ground. This work could be done at higher cutting speeds using one tool and grinding more frequently; the result would be more effective to watch but less satisfactory to pay for.

Regarding the question of cutting angles, careful experiments have shown that the sharper the angle is the less the amount of power required to remove a given amount of material, the feed and depth of cut remaining constant. On the other hand, the sharper the angle is, the more likely is the cutting edge to crumble or break, and the smaller is the body of steel to conduct away the heat generated by cutting. In no well-regulated machine shop do the workmen grind the tools they use; grinding machines with trained operators are now almost universally employed for this purpose.

The importance of working to standard angles is obvious, and the fewer the standards the better, so long as the loss in cutting efficiency is not greater than the gain in grinding and forging tools to a small number of standards. The question of what standards are required must depend on the variety of work and material and quality of machines in a shop. The author strongly deprecates becoming a slave to standards when many variables are involved, and feels that it should be the duty of a capable shop manager or foreman to experiment with tools of various cutting angles when he has a suitable run of work.

High-speed steel has improved in the past few years and will probably improve in the future, and with these improvements we find the cutting edge remains sharper for a longer time and the cutting angles may be made more accurate. As an instance, when turning axles at the most convenient feed and speed and depth of cut, the belt failed to drive the lathe when using the standard round-nose tool. A tool was ground with a smaller radius on the nose, a straighter cutting edge, and a sharper angle; the belt was found to have sufficient power to drive the lathe with the full depth of cut when this tool was used, and the tool was adopted as the standard for this particular work. The reasons for the above are: (*a*) The cutting length of the tool was diminished, less power being required to take a thick narrow chip than a thin wide chip; (*b*) The sharper angle presents less resistance to the chip after it is sheared from the body of the material. Such a tool would not have been suitable for the general practice of the shop where heavy feeds are used.

On turret lathes the highest class of high-speed steel is now largely used, and tools with a very sharp cutting angle are employed. A test, carried out at the works of Messrs. Alfred Herbert, gave the following result:—

Reducing a Mild-Steel Bar from 1½ inches to ¾ inch Diameter at one cut.

Tool.	Revs. per minute.	Cutting speed. Feet per min.	Feed per rev.	Feed per min.	Weight removed per min.
					lbs.
Carbon steel..............	149	58·5	0 0134	2·01	0·753
Class C.—Special high-speed steel............	470	185	0·05	23·5	8·8125

Total clearance angle 7°. Slide slope 35°. Cutting angle 48°.

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* Abstract of a paper by Mr. H. I. Brackenbury, read at the Birmingham Meeting of the Institution of Mechanical Engineers in July last.

The pressure of the chip on the tool in tons per square inch, cutting on steel of a tensile strength of 25 tons and 44 per cent elongation, was 75 tons, which is about 25 per cent less than results given with tools of which the cutting angles range from 65 deg. to 70 deg.; part of this reduction was probably due to the keen cutting edge which this special high-speed steel maintains. The whole of the tests worked out as follows, omitting one exceptional case:—

Tests.	Horse-power.	Lbs. per min. removed.	Lb. per h.p. minute.
Tests made, 1909.			
Highest figure............	14·4	7·58	0·52
Lowest figure............	6·1	2·01	0·33
Manchester Experiments, 1903			
Highest figure............	8·94	4·41	0·49
Lowest figure............	17·19	5·6	0·32

The 1903 figures represent net horse power at the tool, but the 1909 figures include all losses in the machine.

Perhaps the most striking instance of the value of high-speed steel is given by the use of twist drills. The improvement obtained by the use of this steel for drills is more easily grasped than in the case of turning tools, as there are far fewer variables. Given sufficient power, a high-speed drill does three times the amount of work and requires grinding less frequently than the temper-steel drills. The author does not advocate the policy of scrapping all old material, but in the case of twist drills, where any quantity of work is required to be done on steel, he advises the use of nothing but high-speed steel drills. As an instance of their superiority, a drill $\frac{3}{4}$ in. diameter passed through a cast-iron block $2\frac{1}{2}$ in. thick in eight seconds, which is equal to a travel of $18\frac{3}{4}$ in. a minute.

(*To be continued.*)

METAL MARKETS.

AUGUST.

Pig Iron.—Last month closed with a quiet, steady market with a general disinclination to do business, but at this season of the year the market is generally sensitive and any movement in the direction of opening out operations would probably be followed by brisk buying to meet autumn requirements. Shipments of pig iron for August are fairly good, the figures being given at 100,066 tons, 86,151 tons of which have gone from Middlesbrough and 13,915 tons from Skinningrove. The highest and lowest daily settlement prices quoted during the month are as follows: At Glasgow, Scotch, 56s. $1\frac{1}{2}$d. and 55s. Cleveland, 50s. $1\frac{1}{2}$d. and 49s.; hematite, 66s. $4\frac{1}{2}$d. and 64s. 9d. In London, Cleveland, 50s. $1\frac{1}{2}$d. and 49s. Rubio ore has been quoted at 20s. ex-ship Tees. Coke was firm and in fairly good demand, being quoted at 16s. At the end of the month Messrs. Connal and Co., the warrant storekeepers, had in stock 457,601 tons of Cleveland pig iron, composed of 416,469 tons of No. 3 Cleveland, 35,385 tons of other kinds of iron deliverable as standard, and 5,747 tons of other kinds of iron not deliverable as standard.

Manufactured Iron and Steel.—The prices of the manufactured iron and steel have remained fairly stationary. At the end of the month steel and iron ship plates were quoted at £6 10s., steel ship angles at £6 2s 6d. iron ship angles at £7, packing iron and steel at £5 15s., iron ship rivets at £7 7s. 6d., steel bars at £6 5s., iron bars at £7, steel hoops at £6 12s. 6d., steel strip at £6 10s., steel sheets at £7 7s. 6d., steel joists at £6 2s. 6d.—all less $2\frac{1}{2}$ per cent f.o.b. Galvanised and corrugated steel sheets, which are in exceedingly good demand, are firm at £11 10s. per ton for 24 gauge—less 4 per cent and delivered f.o.b. Heavy steel rails at £5 10s., and cast-iron railway chairs at £3 10s., both net f.o.b. A better business in chairs is being done than has been experienced for some time, and, besides this, the demand for pipes and for shipbuilders' castings is increasing.

Copper.—The price of copper was low at the beginning of the month, but towards the end advanced considerably. The highest and lowest daily settlement prices were £56 7s. 6d and £55 2s. 6d. The prices at the beginning and end of the month were £55 5s. and £55 17s. 6d.

Tin.—There has been a considerable increase in the price of this metal during the month, the lowest quotation being £150 15s. and the highest £164 10s. Prices at beginning and end of month were £150 15s. and £163 respectively.

Lead.—Prices in both the soft foreign and English varieties of this metal have remained fairly steady. The highest and lowest prices during the month were soft foreign, £12 11s. 3d. and £12 10s.; English, £13 and £12 17s. 6d.

Spelter.—G.O.B.'s have remained steady, price at the beginning of the month being £22 12s. 9d and at at the end of the month £22 13s. 9d, The highest and lowest prices reached were £22 13s. 9d. and £22 12s. 6d.

LAUNCHES AND TRIAL TRIPS.

Chilka.—The British India Steam Navigation Co.'s new steamer Chilka, built by Messrs. Barclay, Curle, and Co., Whiteinch, was launched on the 23rd August. The vessel is 403 ft. in length, 50 ft. in breadth, and 25 ft. in depth. She has three complete decks, and is fitted with forecastle and bridge and boat decks. On the bridge deck there is provided accommodation for first and second-class passengers in large, airy staterooms, all rooms being lighted from ship's side. A commodious dining saloon is fitted at the fore end of the bridge deck for first-class passengers, and a similar apartment for second class at the after end. Above this accommodation, and extending for its full length, there is the boat deck, providing an extensive promenade for first and second class; at the fore end is a built steel house containing the officers' quarters, and also an entrance giving access to the accommodation below. A feature of the vessel is the provision for 2,000 native passengers, due regard being had to the susceptibilities of Eastern caste. The vessel will be propelled by twin sets of triple-expansion engines, steam being provided by four single-ended boilers, all constructed by the builders.

Farn.—Messrs. William Doxford and Sons Ltd., Pallion Yard, Sunderland, launched on August 24th the screw steamer Farn, made to the order of Messrs. Farrar, Groves, and Co., for the Fargrove Steam Navigation Co. Ltd. The vessel, which is to be fitted with tri-compound engines by Messrs. Doxford, and is to carry about 7,500 tons, is built on the single-deck principle, with modern construction deep frames, no side stringers, and clear holds, with centre steel bulkhead fore and aft in holds between hatchways. She will be classed A1 at Lloyd's.

Kendal Castle.—The steamer Kendal Castle, recently launched by Messrs. Short Brothers Ltd. from their shipbuilding yard at Pallion, Sunderland, to the order of Messrs. James Chambers and Co. for the Kendal Castle Shipping Co. Ltd., of Liverpool, recently underwent her trials off the port. She is built to the Isherwood system of longitudinal framing, and will take Lloyd's highest class. Her leading dimensions are: Length, 363 ft.; beam, 50 ft.; and depth moulded, 28 ft. $1\frac{3}{4}$ in.; and she is designed to carry a dead weight of over 6,800 tons on a moderate draught. The propelling machinery is fitted by Messrs. George Clark Ltd., of Sunderland, and consists of triple-expansion engines, with cylinders 25 in., 41 in., 68 in. diameter, and a stroke of 45 in., taking steam from three large multitubular boilers working at 180 lbs. pressure, and fitted with Howden's system of forced draught. Several runs along the measured mile were taken, and a mean speed of $11\frac{1}{2}$ knots was easily maintained, the engines working smoothly.

MESSRS. R. THOMPSON AND SONS LTD. launched from their Southwick-on-Wear yard a self-trimming collier, built to the order of Messrs. Wm. France, Fenwick, and Co. Ltd., of London and Sunderland. The vessel is of the raised quarter and well deck type, and will take the highest class of Lloyd's. Her principal dimensions are: Length overall, 374 ft. 3 in.; breadth, 38 ft.; depth moulded, 18 ft. 2 in. She will carry about 2,310 tons dead weight on a light draught of water, and is fitted with bulb-angle framing. Four powerful steam winches, etc., and latest improvements are supplied. The vessel's engines are of the triple-expansion type, and are by the North-Eastern Marine Engineering Co. Ltd., Sunderland, having cylinders $21\frac{1}{2}$ in., 26 in., and 59 in., with a stroke of 39 in., steam being supplied by two extra large boilers working at 180 lbs. pressure.

Cedar Branch.—The steamship Cedar Branch, built by Bartram and Sons, Sunderland, for the Nautilus Steam Shipping Co. Ltd. (Messrs. F. and W. Ritson, managers), was recently taken out to sea for her load trial. The vessel, which measures 412 ft. in length overall, has been constructed to the highest class of the British Corporation Registry, of Glasgow. She has been specially designed for the owners' trade with the West Coast of South America, and is fitted with an unusually large number of derricks and deck machinery for dealing expeditiously and safely with the cargo. There are also two very large derricks to lift 35 tons each. The machinery is by Messrs. J. Dickinson and Sons Ltd., Palmer's Hill Engine Works, Sunderland, the cylinders being 28 in., 47 in., 78 in., by 51 in. stroke, and three boilers 17 ft. by 11 ft., 180 lbs. pressure. The vessel is fitted throughout with the electric light. On being taken over the measured mile the vessel easily maintained an average speed of 12½ knots, fully loaded.

Valenca.—The twin-screw steamer Valenca, built by the Ailsa Shipbuilding Company to the order of Messrs. John M. Campbell and Sons, Glasgow, on behalf of Brazilian owners, ran official trials on the Firth on August 31st. She attained a speed of 10 knots.

Driebergen.—There was launched from the Harbour Dockyard of Messrs. Irvine's Shipbuilding and Dry Docks Co. Ltd., West Hartlepool, on the 5th September, the steamship Driebergen, which has been built to the order of Messrs. Furness, Withy, and Co. Ltd., West Hartlepool, for Mr. J. J. A. van Meel, of Rotterdam. The dimensions are: 289 ft. 6 in. by 40 ft. 2 in. by 20 ft. 6½ in. The vessel has a single deck, poop, bridge, and top-gallant forecastle, and has been built to the British Corporation Registry's highest class. A powerful quick-warping steam windlass is fitted forward for working the cables, and steam steering gear is fitted amidships, with hand screw gear aft, and a large multitubular donkey boiler is also fitted. The cabins are heated with steam, and the sanitary, ventilating, and lighting arrangements are effected on improved lines. Triple-expansion engines are being supplied by Messrs. Richardson, Westgarth, and Co. Ltd., Hartlepool, having cylinders 20½ in., 33 in., 54 in., by 36 in. stroke, with two large single-ended boilers working at a pressure of 180 lbs. per square inch.

Kamma.—The new steel-screw steamer Kamma, built by Messrs. Wood, Skinner and Co. Ltd., Bill Quay-on-Tyne, to the order of Mr. Martin Carl, of Copenhagen, left the Tyne on August 31st last for her official trial trip. She has been built under Lloyd's Special Survey for their highest classification, and is fully equipped with all the necessary appliances in the way of deck fittings and machinery to facilitate the loading and discharging of cargo with despatch. The propelling machinery, which has been constructed by Messrs. The North Eastern Marine Engineering Co. Ltd., Wallsend and Sunderland, at their Northumberland Engine Works, Wallsend, consists of a set of their latest type of triple-expansion engines having cylinders 17½ in., 29 in., 48 in., by 33 in. stroke, steam being supplied by one large steel boiler working at a pressure of 180 lbs. per square inch. During the trial run the machinery worked very satisfactorily, a mean speed of over 10 knots being easily maintained.

Marengo.—On Wednesday, 30th August, this steel screw steamer, which has been constructed by Messrs. The Northumberland Shipbuilding Co. Ltd., Howdon-on-Tyne, to the order of Messrs. Thos. Wilson, Sons, and Co. Ltd., Hull, for their North Atlantic trade, left the Tyne for her trial trip. The vessel has been specially designed for this trade and built to the highest class in Lloyd's Register. She is built on the deep frame and girder system, rigged as a two-masted schooner. She is about 425 ft. in length, with three complete steel decks, including the shelter deck, all fore and aft, with a cargo-carrying capacity of about 9,000 tons. A large quantity of water ballast is carried in the cellular double bottom and after peak tank, which with the bunkers will put the vessel in excellent trim irrespective of cargo. The shelter 'tween deck is of exceptional height, and is arranged so that a large number of emigrants can be carried. The steamer has 12 derricks and 10 powerful steam winches with extended shafts, by Messrs. John Lynn and Co. Ltd., Sunderland, to ensure the most expeditious handling of cargo. Powerful combined steam and hand steering gear, on the Wilson-Pirrie principle, by Messrs. Donkin and Co., Newcastle, is fitted in steel house on shelter deck aft and actuated from amidships by telemotor gearing, and a powerful steam windlass of the latest type by Messrs. Emerson, Walker, and Thompson Bros. Triple-expansion machinery of special design and construction has been supplied by Messrs. Palmer's Shipbuilding and Iron Co. Ltd., Jarrow, to comply with the Hamburg-Baupolizei requirements, the indicated horse power being 3,000, the working pressure 200 lbs., and the boilers fitted with Howden's forced draught. The trial trip proved in every way satisfactory, and a speed of 13 knots was easily obtained.

Dalecrest.—On September 2nd the steel screw steamer Dalecrest, built by the Northumberland Shipbuilding Co. Ltd., Howdon-on-Tyne, to the order of Messrs. Taylor and Worthington, Liverpool, for Messrs. The Dalecrest Steamship Co. Ltd., Liverpool, left the Tyne to undergo her official trial trip. The vessel is 390 ft. long by 49 ft. beam by 29 ft. deep, and has been built under special survey to the highest class at Lloyd's. Special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes arranged for, consisting of eight steam winches, a large number of cargo derricks, and steam windlass by Messrs. Clarke, Chapman, and Co. Ltd., Gateshead-on-Tyne. She is fitted with the usual water ballast arrangements for light passages. The machinery has been supplied by Messrs. Richardson, Westgarth, and Co. Ltd., Sunderland, consisting of engines with cylinders 25 in., 41 in., and 60 in., by 48 in. stroke, with three large steel boilers of 180 lbs. pressure. The vessel is designed to carry 7,500 tons dead weight on the light draught of 23 ft. 8 in. The trial trip proved in every way satisfactory, and a speed of 11¾ knots was easily obtained.

George V.—Messrs. R. Readhead and Son, 63, Quayside, Newcastle, have added another powerful tug boat to their fleet. The new vessel is a screw tug, George V., which has been built by Messrs. Sir. W. G. Armstrong, Whitworth, and Co., and engined by Messrs. J. P. Reynoldson and Sons, South Shields. Her length is 106 ft.; beam, 23 ft.; and depth, 12 ft. 9 in.; and she is fitted with triple-expansion engines, with 15½ in., 25 in., and 41 in. cylinders, with a 27 in. stroke. Her boiler is an extra large one, of the marine type, working at 170 lbs. pressure, and the engines are fitted with direct steam reversible gear. The vessel, which is said to be one of the most powerful single screw tugs in the United Kingdom, has been fitted out with all the latest improvements to enable her to cope with the over-sea as well as the harbour trade. She was subjected to her speed trials over the measured mile on September 6th, and attained a speed of 13 knots per hour.

Inventor.—On the 8th September this large steel screw steamer, which has been built by Messrs. David and William Henderson and Co. Ltd., Glasgow, to the order of Messrs. Thomas and James Harrison, Liverpool, underwent her trials on the Firth of Clyde. The vessel is 470 ft. long between perpendiculars by 58 ft. broad by 34 ft. 10 in. depth moulded, has a gross tonnage of 7,680 tons, is classed in Lloyd's 100 A1, and fulfils the requirements of the Board of Trade for their passenger certificate. She is rigged as a four-masted schooner, and has an exceptionally large number of powerful derricks which with 10 steam winches provide ample means for the rapid loading and discharging of large cargoes. The machinery, which was constructed by the builders, consists of quadruple-expansion engines having cylinders 25½ in., 36½ in., 52 in., and 74 in. diameter, by 54 in. stroke, with steam from three boilers at 215 lbs. pressure. During the trials everything worked satisfactorily, and a mean speed of 14 knots was easily attained.

NAVAL NOTES.

H.M.S. Hope.—On September 6th there was successfully launched from the Wallsend shipyard of Messrs. Swan, Hunter, and Wigham Richardson Ltd. the ocean-going torpedo-boat destroyer Hope for the British Admiralty. This vessel is one of the 20 destroyers of the Acorn class, which were ordered under the Naval Programme of 1909-10. The main propelling machinery is made by the Wallsend Slipway and Engineering Co. Ltd., and consists of Parsons steam turbines, driving three propellers on separate shafts. The last-named firm have also made the water-tube boilers which are of the Yarrow type and heated by oil fuel. There are four of these, which were put in before the launch. It is expected that very shortly H.M.S. Hope will be ready for steam trials, the specified sea speed being 27 knots an hour.

H.M.S. Nereide.—The 27-knot torpedo-boat destroyer Nereide was launched from the yard of Messrs. Hawthorn, Leslie, and Co., Hebburn, on September 6th. The Nereide is the 25th destroyer built for the British Admiralty by Messrs. Hawthorn, Leslie, and Co. The Nereide has a length of 240 ft. by 25 ft. 3 in. by 15 ft. 6 in., and she will be fitted with turbine engines of 13,500 H.P.

His Majesty's ships Bonaventure and Antelope, with eight submarines, recently arrived in Torbay for important experiments in the use of wireless telegraphy in connection with submarines. One of the latest type of submarines has been fitted with the necessary apparatus, and messages have been received successfully, although no messages have been sent out. A series of experiments are to be carried out in Babbacombe Bay.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 8th September, 1910.

Liverpool.—*First class:* J. T. Ogden, R. K. Kermode, W. Bamber, S. S. Nickels.

London.—*First class:* W. E. Hodgson, W. H. Copeman, L. W. McGregor, A. S. Newson, D. W. Miller, S. Woon. *Second class:* F. C. Hodge, W. J. Muir, A. McQueen.

North Shields.—*First class:* J. L. Coates, O. Westin, P. A. Westerberg, L. Bates, F. Hollingsworth. *Second class:* T. Atkinson, J. T. Bell, A. McK. McGregor, J. W. Smith, H. C. Walker.

TRADE NOTES.

We are informed that **Messrs. The Bowesfield Steel Co. Ltd.**, have been awarded a gold medal at the Japan-British Exhibition for their exhibit of black and galvanised and plain and corrugated steel sheets and accessories.

The Dundee Shipbuilding Company and Mr. W. V. V. Lidgerwood, Coatbridge, have secured a joint contract for the fitting out of a steamer built in Holland. The vessel will be towed to Dundee.

Messrs. Alfred Herbert Ltd. inform us that they have been appointed sole agents for Great Britain and the colonies for the plain grinding machines made by the Norton Grinding Co., of Worcester, Mass., U.S.A. They intend to carry a representative stock of the various sizes of these machines, so that they will be able to give prompt delivery, and also intend to keep one machine under belt for demonstration purposes. One of the Norton Co.'s experts, Mr. Wickstrom, is at present in this country, and his services will be available for giving guaranteed production on any specified work, for operating the company's machines, and for assisting customers generally in order to ensure the satisfactory production of work.

Messrs. Robey and Co. Ltd., Globe Works, Lincoln, inform us that they have obtained a silver medal for their improved traction engine at the Staffordshire Agricultural Society's Show held last month, which was the only award.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2271. Gas Explosion in Cylinder.—I should be glad if any reader could answer the following questions at the earliest convenience: If gas mixture in explosive proportions were forced into a cylinder and exploded, and fresh explosive charge forced in, would incoming charge explode? if so, would its force be equal to that of two explosions? If it would not "gradually" explode, would it increase the pressure against the walls of cylinder; or what effect would exploding charge have on fresh charge entering? The cylinder would not allow any to escape, being enclosed.—B. A.

Answer.—Every fresh charge of gas and air forced into the cylinder in explosive proportions in the manner indicated would explode on ignition, but no useful work would be done by the combustion, since the volume of the explosion chamber is fixed. Potential energy would be stored in the gas by the increased pressure (the latter due to higher temperature *and* increased weight of gas in cylinder); by releasing one end of the cylinder—fitted to act as a stationary plug or as a piston at will—work could be drawn from the cylinder at any time, but of the total energy due to the explosions more or less of the thermal energy would be lost according to the lagging of the cylinder. The energy of the compressed gas might also be more or less completely used by allowing the gas to escape into a working cylinder fitted with suitable piston and valve gear. Suppose that the explosion of the first charge in the cylinder creates a pressure P″ (calculable from $P'' V = cwT$; where V = constant volume of cylinder, c = constant, w = weight of gas concernd, T = absolute temperature of gas), then, before the second charge of volume V′ at atmospheric pressure can be introduced, it will have to be compressed to pressure P″ (requiring work

$$= \frac{P' V' - P'' V''}{(n - 1)},$$

where n = index in $P V^n = C$, to be done on it), and then displaced into the explosion cylinder from the compressor (requiring further work = $P'' V''$ to be done). If the main cylinder be of large capacity, the rise in mean pressure, due to forcing in the fresh charge, need hardly be accounted for; if, however, the receiver be relatively small, the new mean pressure must be calculated from $P V = c w T$; v c T and the new value of w being all known. On igniting the gas it will explode with rapidity as yet inappreciably reduced by the presence of the burnt gases (from the first explosion). The total heat of combustion evolved by each charge on explosion is known, as also the total weight of gases in the cylinder at any moment, the specific heat of same and the mean initial temperature of the mixture (new charge and burnt gases). Thence the temperature and pressure created by the second explosion are calculable, but it should be noted that the temperature as thus determined is never realised in practice owing mainly to the presence of moisture, time lag in combustion, and so on. The only really accurate means of determining the temperature due to gaseous explosions is by experimental measurement. To introduce the charge for the third explosion will need yet higher compression, and hence greater expenditure of energy in compression (see fig. 1). Note, however, that the work done to displace the compressed gas into the firing cylinder (P d V) is approximately constant (so long as the law $P V^n = C$ holds good), for though P_n is greater the volume V_n is less in the same ratio (referring to fig. 1 the areas *c d e o*, *f g h o*, *i j k o*, etc., are equal). The total work done on each charge to introduce it into the working cylinder increases much as shown in fig. 1. As the pressure and temperature in the firing cylinder rise, the new charges would begin to ignite spontaneously on entering the vessel; ultimately it would become impossible to force the charge into the cylinder before explosion occurred. The same total number of heat units are *ultimately* liberated by the combustion of each charge of gas, but as the number of burnt charges increases, and as their pressure rises, the proportional amount of the new charge steadily decreases both as regards weight and volume, so that the molecules of "clean" gases become more and more separated by those of foul, burnt gas. Combustion is, in consequence, slower, and therefore under all practical conditions the temperature and pressure increments due to explosion are less than would be expected by theory. Nevertheless the pressure

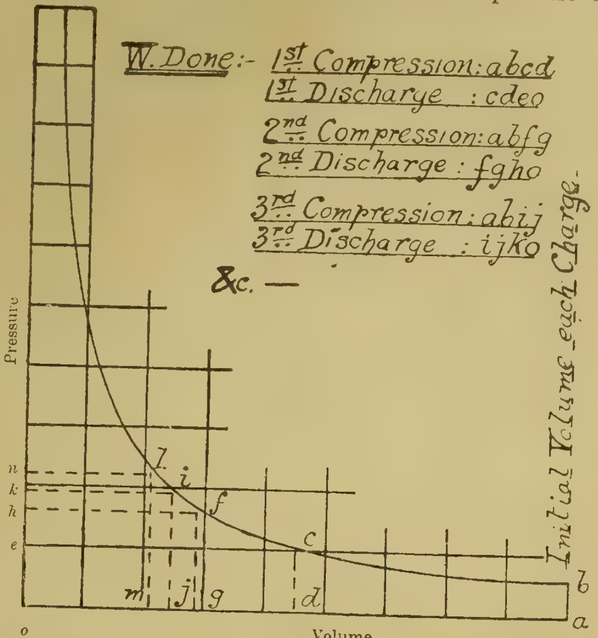

Fig. 1.

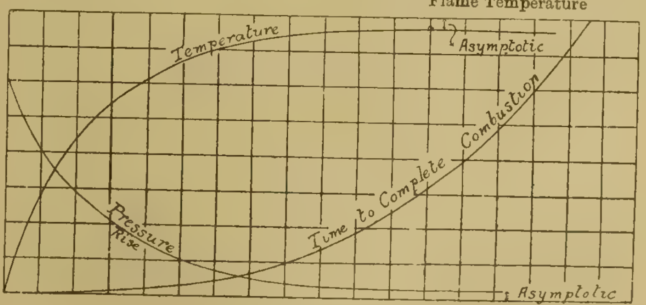

Fig. 2.

and temperature both rise steadily for some time. The pressure increments are, at first, due to both the higher temperature and increased total weight of gas succeeding each charge and explosion. After a time, however, the temperature approaches, and ultimately coincides with, the flame temperature of the mixture used (providing the cylinder will stand the pressure and temperature then obtaining). The whole heat evolved by the combustion of each fresh charge is then of necessity completely utilised in raising the temperature of the charge itself to the flame temperature. No further increase in temperature of the whole then occurs (see fig. 2). The pressure rise per explosion is then merely that due to the increased weight of gas in the cylinder. As more charges are burnt, the combustion of successive explosive mixtures becomes more and more sluggish, but it is always complete and always evolves the same total British thermal units, provided that the mixture used is in the correct proportions for complete combustion, and that ignition is persisted in for as long as may be necessary for each charge. Also, it is assumed that the same chemical action occurs at the higher pressures and temperatures, an assumption which is not justified in the final stages. The temperature rise per explosion and the ultimate temperature reached are not affected by vitiation of the incoming charges (since no expansion occurs, and hence only radiation can affect the conditions as time goes on), IF, *and only if*, the whole process is perfectly adiabatic. The more perfectly the explosion chamber is heat-lagged the higher the final temperature reached (other conditions being constant and up to the theoretical flame temperature as limit); and the more rapidly the pressure increments per explosion decrease in magnitude. Probably the pressure and temperature increases per explosion, and the time for complete combustion of each charge vary as shown in fig. 2. It must be clearly understood that the above pressure and temperature *limits* could not be attained in practice, but, given suitable cylinder materials, they could be approached more nearly the more adiabatic the working. If perfectly adiabatic working were possible, the whole potential energy stored in the cylinder could be utilised at any time by allowing the gases to expand in a suitable thermo-dynamic engine.—THERMOS.

2276. Blast Furnace.—Could some of your readers inform me whether the blast temperature, percentage moisture in blast, and the combustion temperature reached in blast furnaces can be conveniently related, and, if so, how exactly?—TAP.

2277. Keying, Shrinking, etc.—Can anyone give some reliable figures comparing keying, shrinking on, and hydraulic pressing of wheels, etc., on shafts as regards cost, time of fitting, reliability, general convenience; indicating also limits and limitations of each method?—MINER.

MISCELLANEA.

AN old piece of tube forms an efficient tool for packing condenser tubes. One end of the tube should be cut to fit between the condenser tube and the stuffing box, the other arranged to fit an ordinary brace. If the packing be cut into 18 in. lengths and is first well soaked in oil that has been well boiled, it is said that a very satisfactory result can be got with considerable expedition as compared with other methods.

To cool off a boiler properly is an important matter as regards the prolongation of its life. Should the water be run out of a boiler when the latter is in a heated condition and cold air should suddenly gain access to the tubes and be allowed to play against the shell when the brickwork is still hot, there will be a great danger of sudden contraction taking place, which may seriously strain the boiler and will be very likely to cause leakage. The doors should be all closed and the boiler and the contained water be allowed to cool down as gradually as possible.

SCHOOL OF ART WOOD CARVING.—The School of Art Wood Carving, 39, Thurloe Place, South Kensington, which is under Royal patronage, has been re-opened after the usual summer vacation, and we are requested to state that some of the free studentships in the evening classes maintained by means of funds granted to the school by the London County Council are vacant. The day classes of the school are held from 10 to 1 and 2 to 5 on five days of the week, and from 10 to 1 on Saturdays. The evening class meets on three evenings a week and on Saturday afternoons. Forms of application for the free studentships and any further particulars relating to the school may be obtained from the secretary.

MESSRS. VICKERS, SONS, AND MAXIM are said to be about to put on the market a new metal alloy. The alloy, which is to be known as "duralumin," is slightly heavier than aluminium, about one-third the weight of brass, and is said to be as strong as steel. Mr. H. B. Weeks, chief chemist of the Vickers Works, Barrow, states that they believe the alloy to be superior to anything of its kind hitherto manufactured, and that Vickers Co. have decided to manufacture it on a large scale. The alloy can be rolled, drawn, stamped, extended, or forged at suitable temperatures. It is less corrodible than other high aluminium alloys under all the usual corrosive tests, and possesses such valuable properties that they thought there was bound to be a large demand for it.

POROUS GAS ENGINE CYLINDERS.—If the iron of a gas engine cylinder is at all porous, more or less water is likely to sap through the water jacket wall into the cylinder while the engine is standing idle for a considerable time, and this will make starting the engine difficult. A correspondent in *Power* suggests the following method of overcoming the difficulty. Fill the water jacket with a solution of copper sulphate or a solution of sal-ammoniac and allow it to stand for a considerable time, then drain the solution out and wash the jacket out with clean water. The copper sulphate or sal-ammoniac, as the case may be, penetrates the pores and causes a rusting action which fills them with hard cement of iron rust and thus prevents the water from entering the pores.

A GOOD lubricant for hoisting ropes is made by mixing one bushel of freshly slaked lime to a barrel of coal tar, or a mixture of pure tar and tallow can be used. When pine tar which contains no acid is used a base lime is unnecessary, as tar is solution proof to ordinary mine water. Another good mixture contains tar, oil, axle grease, and a little pulverised mica mixed to a consistency that will penetrate between the wires to the core and will not dry nor strip off. The lubricant should not be so thick as to prevent inspection of the rope, and after the first application should be used sparingly, so that the rope may be kept clean and free from grit. Graphite mixed with grease is another lubricating mixture that is used successfully, and sometimes pulverised asbestos is used instead of graphite.

THE use of iron wire in the manufacture of electric light bulbs was forecasted at a meeting of the physical science and mathematical section by Dr. H. J. S. Sand, of the Nottingham University College. A demonstration of vacuum-tight seals between iron and glass was given, and Dr. Sand claimed to have discovered a method of sealing iron wire vacuum-tight in glass. The only metal that up this had been sealed vacuum-tight into glass on a successful commercial scale was platinum. Two hundred and fifty million electric lamps are stated to be manufactured annually, and they contained minute pieces of platinum which is one of the most expensive metals known, and the amount used annually in this way was worth over £100,000. The cost of the same wire, if of iron, would be trifling.

A COURSE of lectures on "Reinforced Concrete," by Mr. H. Kempton Dyson, secretary of the Concrete Institute, has been arranged for at the London County Council School of Building, Ferndale Road, Brixton, S.W. The lectures will take place during the next session on Tuesdays and Fridays from 7-30 p.m. to 9-30 p.m. This course has been arranged to provide instruction in both the practice and theory of reinforced concrete construction. The course will be divided into two sections, the first being devoted to lectures on construction of reinforced concrete, the quantities for same, and workshop and laboratory practice, and the second to lectures on theory and design of reinforced concrete. The lectures on construction and quantities will deal with the history and development of reinforced concrete, materials, tools and appliances, making of concrete, and manufacture of reinforcing steel, centering, the actual work of construction, architectural treatment and finishings, quantity taking, and estimating. The lectures on theory and design will deal with the elasticity of the materials, experimental data, bending moments, shear stresses, beams, slabs, walls, columns, arches and domes, chimneys, reservoirs, tanks, bins, caissons, retaining walls, dams, pipes, sleepers, fence posts, poles, temperature stresses, rules and regulations, and practice in design. The workshop and laboratory practice is intended to supplement the lectures on practice and theory, and will deal with cement, its properties and testing, properties of stones and other aggregates, sand, water, steel, concrete proportioning and making, steel manipulation, making of centering and moulds, tests of structural members of reinforced concrete, the making of which affords practice in construction, bending moments, shear, adhesion, etc. The course will be amplified by experiments, diagrams, lantern slides, specimens, models, and the use of testing plant. An endeavour will be made to visit works in course of construction in order to acquaint students with actual working conditions. The fees for the course and further particulars can be obtained from the secretary of the school.

PATENTEES' CHRONICLE
OF
Applications for British Patents.

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*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

SEPTEMBER 5th, 1910.

20610 Combination tools. Brearley.
20611 *Smoke consuming apparatus. Lyddon.
20612 Cleaning boiler tubes. Rogers.
20613 Tyres. Harwood.
20614 Looms. Greenwood and Pickles.
20615 Bags. Adlard.
20616 Knives. Lovell.
20617 Pumps. Clarke.
20618 Vaporisers. Hamilton.
20619 Tennis racquets. Sykes.
20620 *Spectacles. Zeiss.
20621 Tyre valves. Parsons and Cooke.
20622 Rotator. Webb.
20623 *Apron. Clarke and Harris.
20624 Earthenware insulators. Norman.
20625 *Flycatcher. Alberry.
20626 Egg-beaters. Carter.
20627 Weighbridge. Aveling and Hipkins.
20628 Line props. Griffiths and Meredith.
20629 Match delivery machines. Alderson.
20630 Syringes. Bridger.
20631 Needles. Bridger.
20632 *Anti-skid device. Horniel.
20633 *Tyre. Braibant.
20634 *Aloys. Spezialfabrik fur Aluminium, S. L. Gimblt.
20635 Pens. Schulz.
20636 *Calculating machines. Quentill.
20637 *Pipes. Cooke.
20638 Window sash silencer. Hockey.
20639 Razors. Kendal.
20640 *Belts. Heinrich.
20641 Shearing machine. Berry, and H. Berry and Co. Ltd.
20642 Stirring device. Ede, Hall and Churchyard.
20643 Hairpins. Phillips.
20644 SECRET APPLICATION.
20645 Valve. Greer.
20646 Reapers. Datchett.
20647 *Flexible conductors. Thompson.
20648 Actuating mechanism. Sharman and Edwards.
20649 *Purifying wax. Richter and Orth.
20650 *Bleaching fats. Richter and Orth.
20651 Cable conduits. Carter.
20652 Jacquards. Jardine and Watchorn.
20653 *Speed indicators. Ringelhan.
20654 Turn tables. Sulley.
20655 Manf. of lac. Freymuth.
20656 Carburetters. Thornton.
20657 Syphons. Piper.
20658 Liquid delivery apparatus. Piper.
20659 *Calks. Capewill.
20660 Firearms. Schmeisser.
20661 *Lighting. Brougham.
20662 *Lubricators. Brown.
20663 Unhairing machines. Rees.
20664 *Pulverisers. Luckenbach.
20665 *Couplers. Harris.
20666 *Dyeing machines. Morton.
20667 *Indicating position of sunken vessels. Blaine, East and Stevens.
20668 *Generation of combustible gas. Winter.
20669 *Coating sheets. Wood.
20670 *Pumps. Honig, Hammebrath and Schmenger.
20671 Washing apparatus. Greenhill.
20672 *Cellulose esters. Mosk.
20673 Sifting apparatus. Gentrup.
20674 *Water motor. Kailting.
20675 *Writing characters. Bahr.
20676 *Windows, doors, etc. Seiffert and Cremer.
20677 *Stops. King and Pride.
20678 *Furnaces. Wedge.
20679 *Couplings. Boirailt.
20680 Valve. Rowley and Champness.
20681 *Calculating machines. Wolter.
20682 *Perambulator. Heydemann.
20683 *Aerial machines. Soper.
20684 *Safety apparatus. Filsell.
20685 Electric circuits. Sulton.
20686 Valves. Beauchamp.
20687 Brushes. Mackie and Williamson.
20688 *Shuttles. Walker.
20689 Ambulance. Palmer and Kempster.
20690 Thermostats. Cortland.
20691 *Bottle washing machine. Dawson and Dawson Bros. Ltd.
20692 *Colour measuring device. Hellige.
20693 Motor vehicles. Sulley.
20694 Aeroplanes. Somner.
20695 *Flying machines. Kiefer.
20696 Alarm. Gerardella and Holzman.
20697 Stoves. Pascall.
20698 *Valves. Corliss.
20699 *Tobacco pipes. Johnston and Dark.

SEPTEMBER 6th, 1910.

20700 Cocks. Solari.
20701 Ventilating appliance. Leeming.
20702 Ventilating appliance. Leeming.
20703 Window frames. Ashby.
20704 Oil engines. Warsop.
20705 Typewriter. Cridland and anr.
20706 Couplings. Jones and anr.
20707 Vessels. Wrench.
20708 Carburetters. Wright.
20709 Tyres. Clissold.
20710 Oil engines. Griffin.
20711 Purifiers. Samuelson and anr.
20712 Thread holders. Hollingwood.
20713 Pickers. Hollingwood.
20714 Looms. Hollingwood.
20715 Foods. Van Pracey and anr.
20716 Cycle lock. Carpenter.
20717 Air pumps. Morison.
20718 Candlesticks. Tonge.
20719 Bottle washers Taylor.
20720 Toys. Jameson and anr.
20721 Tobacco. Lyddon.
20722 *Moulding tiles. Norman.
20723 Trays. Piercy.
20724 *Footballs. Pope.
20725 Advertisements. Booth.
20726 Dyes. Tootal.
20727 Sanitary appliances. Adams.
20728 Miners' lamp. Anstee.
20729 Non-skid devices. Levin.
20730 Bronzing machines. Smith.
20731 Weft forks. Payton.
20732 Clutches. Cairns.
20733 Submarines. Eagles.
20734 Carburetters. Poppe.
20735 *Lighting. Searle.
20736 Cutting tools. Ashton.
20737 Talking machines. Smith and anr.
20738 Rings. Shapland.
20739 *Curtains. Knapp.
20740 *Bottles. Blake and anr.
20741 Boot trees. Frank.
20742 Grinding machine. Arrowsmith.
20743 *Boot heels. Plant.
20744 *Welts. Plant.
20745 Cranes. Davidson.
20746 Motor vehicles. Clinch.
20747 *Boilers. Johansson.
20748 Boilers. Johansson.
20749 Plating. Bishop and anr.
20750 Lifts. Hodgson.
20751 Axle boxes. Morgan.
20752 *Compressing. Stanbor.
20753 *Brushes. McLeod.
20754 Electro-deposition. Coles.
20755 *Cigar holder. Lloyd.
20756 *Dark slides. Reiser.
20757 Suspenders. Peschel.
20758 Signal app. Smith.
20759 *Electric starting app. Allgemeine El. Ges.
20760 *Medical app. Moliere.
20761 Leg rest. Easypoise Ltd. and anr.
20762 *Collar supports. Thorandt and anr.
20763 *Cleaning device. Koch.
20764 Spelter condensers. Schane.
20765 *Incinerators. Conley.
20766 *Compressors. Conley.
20767 *Spinning plates. Stump.
20768 Flying machines. Briere and anr.
26769 Cycles. Tungsten.
20770 Reflectors. English and anr.
20771 *Tools. Beer
20772 *Rims. Ball.
20773 *Rims. Ball.
20774 Skates. Ellis.
20775 Washing machine. Scholefield.
20776 *Electro-deposition. Gusiguere.
20777 *Nitrogen oxides. Houssu.
20778 Signalling app. Cortland.
20779 Prevention of condensation. Hookre.
20780 Carburetting. Boyd and anr.
20781 Machine tools. Peters and anr.
20782 Concrete. Goddard.
20783 *Current converters. Goodwin and anr.
20784 *Targets. Ellis.
20785 *Nuts. Maurin.
20786 *Aerial vessels. Cugne.
20787 Multi-cylinder engine. Sharp.
20788 *Locking device. Withers.
20789 Cocks and valves. Jenkins.
20790 Electric cables. Caddy.
20791 Pipe connector. Flory.
20792 Measuring apparatus. Whitmore.
20793 Studs. Lanz.
20794 *Gases. Boyer.
20795 *Cutter bars. Lake.
20796 *Storing grain. Seck.
20797 *Vehicles. Strasy.
20798 *Photography. Olson.
20799 *Tree protectors. Luck and ors.
20800 *Mill. Gouillon.
20801 Freezing. John.
20802 Controlling device. Burge.
20803 *Submarines. Justice.
20804 Street lamps. Anderson.
20805 Clockwork. Anderson.
20806 Box machinery. Stoker.
20807 Distillation. Epstein.
20808 Collars. Tattersall.

SEPTEMBER 7th, 1910.

20809 Glass movements. Jones.
20810 Massage machine. McLaren.
20811 Water taps. Cole.
20812 Boiler tube expanders. Kilborn.
20813 Engine. Thorp.
20814 Lavatory plugs. Ward.
20815 Dye manf. Levinstein.
20816 Swing bridges. Livesey.
20817 Brush cases. Sadler.
20818 Electric light control. Barry.
20819 Leather mats. Stickland.
20820 Pneumatic tyres. Roberts.
20821 Refuse destructor. Leask.
20822 Spool winding. Hollingworth.
20823 Looms. Hollingsworth.
20823 Looms. Hollingsworth.
20824 Looms. Hollingsworth.
20825 Cycle frame. Todd.
20826 Chemical crystal production. Billing.
20827 Electric lamp holder. Bailey.
20828 Electric switch insulation. Railing.
20829 Device for tapping barrels, etc. Smart.
20830 Bobbin carrier. Fotheringham.
20831 Tyres. Wireberg.
20832 Feed water apparatus. Tranter.
20833 Transmitting telephone messages. Wallis.
20834 Cycle cranks. Saudland.
20835 Motor car engines. Smith.
20836 Machine tool adjustment. Allen.
20837 *Bracelet. Smith.
20838 *Tyre manipulation. Kendrick.
20839 *Blind cord. James.
20840 Flying machine. Lowe.
20841 Chairs. Bajde.
20842 Lamp holder, etc. Conradi.
20843 Brush binders. Brooks.
20844 Reinforced concrete. Christmas.
20845 Advertisement dummies. Wallace.
20846 Window fastenings. Wakefield.
20847 Firegrates. Charters.
20848 Tyres. Anthony.
20849 Dwelling houses. Hewitt.
20850 Clutches. Baines.
20851 Apron spring. Davies.
20852 Cord holder. Jones.
20853 SECRET APPLICATION.
20854 *Folding bed. Berger.
20855 Internal-combustion engine. Schmid.
20856 *Button holes manf. Société Francaise La Lingerie Universelle.
20857 Treatment of peat. Johnson.

20858 Castors. Wilkinson.
20859 Stoves. Light.
20860 Wind screens. Rogers.
20861 Electric traction. Watson.
20862 *Shirts. Rider.
20863 *Circuit breaker. La Société d' Electricité "Nilmelior."
20864 *Rail joints. Hall.
20865 *Tyre manf. Leinen.
20866 *Aeroplanes. Rodrigo.
20867 *Compressors. Marks.
20868 *Looms. Rovira.
20869 Motor cycles. Pugh.
20870 Railway vehicles. King.
20871 Emery wheels. Whitham.
20872 *Induction coils. Wright.
20873 *Acetylene gas generator. Boult.
20874 Artificial leather. Hart.
20875 *Sulphate of ammonia manf. Herss.
20876 Amusement. Vellére.
20877 Carriage door. Dawe.
20878 Egg boxes. Cook.
20879 *Propellers. Maxwell.
20880 Inflator connectors. Merkham.
20881 *Soldering lamps. Philippe.
20882 Electric switch control. B. T.-H. Co.
20883 *Eyeglasses. Moshamer.
20884 Sheet displaying device. Brown.
20885 Automatic machine. Denne.
20886 *Balloon protectors. Mach.

SEPTEMBER 8th, 1910.

20887 Blackboard cleaner. Simmons.
20888 Coal conveyor. Baillie.
20889 Game. Mertz.
20890 Liquid intermixing. Fretwell.
20891 Vent plug. Joel.
20892 Tyres. Doyle.
20893 Steam generator. Bone.
20894 Boring apparatus. Hall.
20895 Hairpin. Rogers.
20896 Purification of ores. Hardingham.
20897 Manf. of quartz goods. Moeller.
20898 Manf. of quartz lamps. Moeller.
20899 Lithographic press. Payne.
20900 Electric switches. Tucker.
20901 Wheels. Turner.
20902 Cigarette manf. Bowie.
20903 Earth closet doors. Wilson.
20904 Money raising device. Dorst.
20905 Decks for ships. Bland.
20906 Secondary batteries. Taylor.
20907 Reversing gear. Sayers.
20908 Spare tyre wrappers. Brooks.
20909 Photo cameras. Pritchard.
20910 Weft threading device. Heywood.
20911 Electric lamp holder. Martin.
20912 Advertising appliance. Farley.
20913 Electric lamps. Evans.
20914 Advertising device. Tooley.
20915 Variable gears. Stratton.
20916 Roller cleaning device. Tytler.
20917 Electric railway. Mawson.
20918 Gramophone. Davies.
20919 *Fireproof flooring. Baird.
20920 Plant training device. Phillips.
20921 Sluice valve. Munro.
20922 Carriage door lock. Wells.
20923 Gas mantle. Coventry.
20924 *Looms. Rouge.
20925 Load carrier. Adshead.
20926 *Fans, etc. Hessling.
20927 Ball castors. Jacob.
20928 Window sash fastenings. Ash.
20929 Pneumatic tyres. Lodge.
20930 Postal devices. Kempston.
20931 Wood shaping machine. Evans.
20932 Carriage windows. Sykes.
20933 Saucepan. Lee.
20934 Pump. Poore.
20935 *Portable cooking apparatus. Janeke.
20936 *Fanlight latches. Rudeferia.
20937 Cigar, etc., holder. Davis.
20938 *Change speed gear. Buch.
20939 Saucepans, etc. Adolpus.
20940 Fruit, etc., growing device. Davis.
20941 Window fastener. Willis.
20942 Trip valve. Mills.
20943 Roller skates. Heckler.
20944 Bottle stoppers. Hemming.
20945 *Centrifugal machine. Paton.
20946 Hatpins. Lilley.
20947 Driving gear. Drummond.
20948 *Rotary transformer. Auvert.
20949 Shuttles. Roberts.
20950 Memoranda recorder. Hill.
20951 Flying machine. Bailey.
20952 *Soap shaving device. Riggs.
20953 *Cushion heels. Teer.
20954 Locking glasses. Anderson.
20955 Omnibus shelter. Finkelstein.
20956 Machine tools. Drummond.
20957 *Governors. Société Anonyme Ateliers H. Cuenod.
20958 *Piano player. Lake.
20959 *Type casting machine. Degener.
20960 *Type casting machine. Degener.
20961 *Type casting machine. Degener.
20962 *Playing cards. Boult.
20963 *Flying machine. Romagnoli.
20964 *Explosion engine. Société Clerget and Co.
20965 *Valves. Meiger.
20966 Hat boxes. Mansell.
20967 Gas turbines. Corthésy.
20968 *Internal-combustion engine. Bosch.
20969 *Washing tubes. Bosch.
20970 *Dye manf. Lucius.
20971 Internal-combustion engine. Adams.
20972 Concrete roofs. Hayman.
20973 *Turret lathes. Munthe.
20974 *Turret lathes. Munthe.
20975 Inflating cycle, etc., tyres. Bond.
20976 Treatment of oil. Roesch.
20977 *Printing press. Phillips.
20978 *Typewriter. Alexander.
20979 *Typewriter. Alexander.
20980 *Typewriter. Alexander.
20981 *Cigar, etc., holder. Wirth.
20982 Treatment of oil. Roesch.
20983 *Oriental, etc., carpets. Renard.
20984 Window blinds. McLaren.
20985 *Article mending device. Sotery.
20986 Automobile construction. Morgan.
20987 Waterproof covering. Bartlet.
20988 Shock absorber. Stephens.
20989 *Separating alkali metals from alloys. Johnson.
20990 Steam generator. Dolman.
20991 Pneumatic cleaner. Hearn.
20992 *Medical instruments. Buisset.
20993 Fuel economiser. Lovis.
20994 Internal-combustion engine. Lewthwaite.
20995 Electric cranes. Mueller.
20996 Vehicle wheels. Gummer.

SEPTEMBER 9th, 1910.

20997 Carriage door lock. Wood.
20998 Two-wheeled vehicles. Clift.
20999 Picture frames. Pickland.
21000 Brushes. Tuton.
21001 Bottle. Horbordt.
21002 Pump. Telford.
21003 Carriage door lock. Godden.
21004 Boot attachment. Percival.
21005 Mat holder. Adams.
21006 Tyres. Oakley.
21007 *Night light. Glafey.
21008 *Measuring instrument. Brousseau.
21009 *Workman's time indicator. Gluch.
21010 *Saucepans, etc. Scrivens.
21011 Vacuum cleaner. Barton.
21012 Clutch. May.
21013 Looms. Halliwell.
21014 Aeroplane. Roberts.
21015 Trousers stretcher. Ratcliffe.
21016 Sight feed lubricator. Adams.
21017 Cycle crank. Firman.
21018 Typewriters. Bouracier.
21019 Separating device. Wyllie.
21020 Belt securing device. Murray.
21021 Water heater. Charlton.
21022 Agricultural motors. Burgess.
21023 Pipe joints. Krogmann.
21024 *Internal-combustion engine. Valvero.
21025 Fabric stretchers. Graham.
21026 Illuminated signs. Venner.
21027 Unloading wagons. Thomas.
21028 *Blowpipes. Acetylene Dissons and Applications de l'Acetylène.
21029 *Taximeters. McKenna.
21030 *Taximeters. McKenna.
21031 *Magnetic separators. Ruthenburg.
21032 Photo camera. Feeny.
21033 Canister for sprinkling water. Farris.
21034 Speed indicator. Ellingham.
21035 Tyre lever. Ellingham.
21036 Tent tables. Robertson.
21037 Sweetmeats. Ewbank.
21038 Degreasing apparatus. Booth.
21039 *Target supports. Schellenberg.
21040 Tyres. Nidal.
21041 Electric voltage regulator. B. T.-H. Co.
21042 Safety razor. Myers.
21043 Wheel manf. Strover.
21044 Railway points. Thomson.
21045 Magnetic separator. Meek.
21046 Internal-combustion engine. Potter.
21047 *Automatic valve. Löloff.
21048 *Illuminating apparatus. Turenne.
21049 Carburetters. Scholes.
21050 *Stoking apparatus. Axer.
21051 Sash fastener. Turnidge.
21052 *Colouring matter. Anilin.
21053 *"Bridge" marker. Wilks.
21054 Heel pads. Holmes.
21055 Table. Teske.
21056 Treatment of fibrous plants. Thompson.
21057 Spectacle case. Lovell.
21058 Gas burners. Simihance.
21059 Preserve tins. Ginzler.
21060 Fishing reels. Brown.
21061 *Cycle seats. Hill.
21062 *Cigarette holder. Taylor.
21063 *Barges. Hearson.
21064 Starting gear. Cowey.
21065 *Breech mechanism for gun. Schneider.
21066 *Scaffold binding. Jones.
21067 *Speed regulator. Capon.
21068 *Evaporators. Dinckels.
21069 Petrol can fastening. Hunter.
21070 Baskets, etc. Bowie.

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21071 Explosive. Lanfrey.
21072 Tip-up seats. Taggart.
21073 Pipe wrench. Chipchase.
21074 Rubber article manf. Tarver.
21075 Bottle. Harbordt.
21076 Chemical analysis. Hume.
21077 Card cases. Cowburn.
21078 Loom mechanism. Wilkinson.
21079 Vehicle tyres. Beldam.
21080 Portable lamp. Gray.
21081 Collar stud. Yates.
21082 Repair corsets for tyres. Noblett.
21083 Cash check till. Gledhill.
21084 Cycle mudguard. Tye.
21085 Tar spraying machine. Wadsworth.
21086 Gas generator. Watson.
21087 Pentagraph engraving machine. Mowatt.
21088 Safety railway chairs. Redpath.
21089 Finger ring manf. Jennens.
21090 Liquid spraying device. Hamill.
21091 Kettles. Hill.
21092 Pistons. Lloyd.
21093 Windows. Dyson.
21094 Turbines. Portars.
21095 Lavatory appliance. Adams.
21096 Flushing apparatus. Adams.
21097 Loom patten chains. Dawson.
21098 Foundry ladle stopper. Caulfield.
21099 Roller gauging. Clarkson.
21100 Tubes. Twiss.
21101 *Wire cord manf. Larmuth.
21102 Electric terminals. Genn.
21103 Medical apparatus. Curtis.
21104 *Sirens. Roellig.
21105 Drafting apparatus. Thomson.
21106 Gas cleaner. Raupp.
21107 Springing motor vehicles. Ogston.
21108 Speed indicator. Good.
21109 *Cigarette manf. Boult.
21110 Rat, etc., traps. Cunningham.
21111 Hammock. Früh.
21112 *Gyroscope wheels. Rutt.
21113 *Non-skid tyre. Rutt.
21114 *Anti-deviating device for aeroplanes. Rutt.
21115 *Motor boat. Rutt.
21116 Lock nuts. Ploncard.
21117 Cycle brakes. Cox.
21118 Rubber vulcanite manf. Killen.
21119 Razor sharpening. Oddy.
21120 *Telephone exchange. Siemens.
21121 Photo screen. White.
21122 Treatment of zinc, etc. Vautin.
21123 Seats, etc. Dubben.
21124 Hats. Thomson.
21125 Illuminating device. Böhn.
21126 Wheels. Wright.
21127 Solid and liquid separation. Kruse.
21128 Hydrochloric acid manf. Westhausser.
21129 Hand embroidery letters. Reis.
21130 *Concrete structures. Kepplex.
21131 Vehicle suspension. Cowey.
21132 *Steam turbines. Huha.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to October 17th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

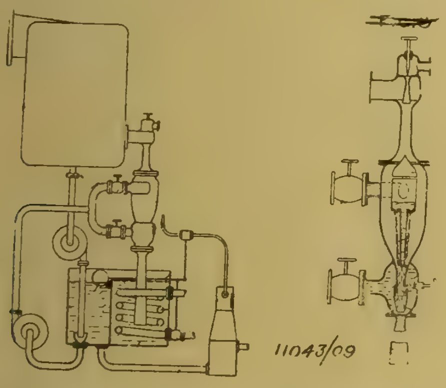
Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

10934 Hansford and Wright: Prepayment apparatus for the supply of gas, electricity, or the like.

11043 Morison: Steam engine condensing and vacuum-producing apparatus. [Cognate Application. 27153, 1909.]

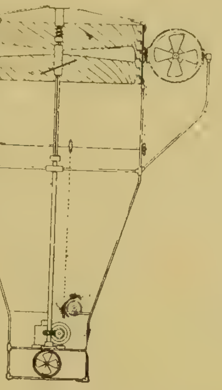
This invention has reference to steam engine condensing and vacuum-producing apparatus of the kind in which air and vapour are withdrawn from a main condenser by or with the aid of water supplied under pressure through a water jet ejector arranged to deliver the water with the withdrawn air into a circulating tank or system into which water of condensation from the condenser is also delivered and from which the air can escape, means being provided whereby an adequate supply of water to the air ejector is maintained under varying conditions of load in the main condenser. The present invention has for object to provide improved constructions of steam-condensing and vacuum-producing apparatus of the kind referred to. For this purpose, in steam engine condensing and vacuum-producing apparatus of the kind referred to constructed according to the present invention, the air ejector is so constructed that the supply of water, or water and steam, to its various parts is capable of being separately controlled, and there is provided in connection with the water circulating tank into which the air ejector discharges its water with the air withdrawn from the condenser, and into which water of condensation is directly or indirectly discharged from the condenser, and from which water is directly and continuously delivered back into the air ejector, means whereby the water that is directly delivered back to the air ejector, or another portion of water that is caused to pass from the tank through another bye-pass circuit to the air ejector, can, when required, be cooled and returned in its cooled state to the air ejector, the arrangement being such that the supply and thermal control of the water passing through the air ejector can be varied to suit the quantity of air, steam, and required vacuum in the condenser and enable the apparatus to be worked in the most advantageous manner under varying working conditions. An air ejector suitable for the purpose mentioned comprises a water-spraying device and a water jet device arranged in series or in parallel with each other, or a water-spraying device and a water jet device arranged in parallel with each other and in series with a final water jet device, or a steam nozzle with a water-spraying or condensing device and a water jet device arranged in series or in parallel with each other, or with a water-spraying device and a water jet device arranged in parallel with each other and in series with a final water jet device, and means whereby the flow of fluid through the water jet devices and the steam nozzle, when used, can be severally controlled to suit varying working conditions.



11043/09

11090 Geoghegan and Moore-Irvine: Apparatus for aerial navigation.

The invention relates to improvements in apparatus for aerial navigation and is designed to provide an improved means for accomplishing same. It consists essentially of one or more lifting screws or propellers mounted in or at the extremity of a corresponding number of open-ended cylinders rifled internally, the screw or screws being preferably mounted so as to slide vertically on the driving shaft or shafts, so that when motion is first imparted to a screw it slides upwards on its shaft, only having to lift its own weight and subsequently taking the whole weight of the apparatus only when it is rotating at good speed and has slid to the top of the shaft, with or without supplementary lifting means also preferably capable at the commencement of motion of sliding vertically on vertical support or supports consisting of a series of air valves mounted in a suitable framework and adapted to be reciprocated vertically, the valves offering little resistance to the air on the upward movement, but offering full resistance to it when moving downwards, and one or more screws or propellers for propelling and manœuvring the apparatus preferably arranged in or at the ends of rifled cylinders normally arranged horizontally, but which are mounted on pivots or swivels so that they may be directed in any way desired for manœuvring or to assist the lifting effort.



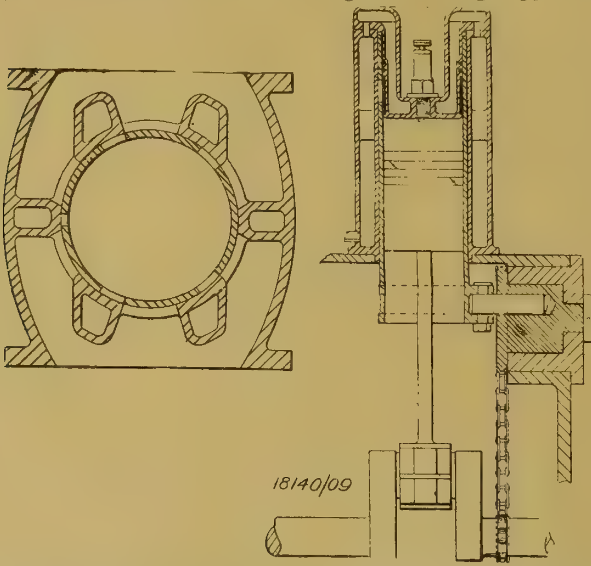
11090/09

12948 Almond and Wilde: Device applicable to the doors in the front casing of carding engine cylinders. [Post-dated November 25th, 1909.] 13428 Masters and Hansford: Apparatus for charging and discharging gas retorts, coking ovens, and the like. [Application for Patent of Addition to 9057, 1909.] 13488 Adams: Sewage purification apparatus. 13589 A. F. Craig and Co., and Murray: Apparatus for refining paraffin wax. 13711 Buckminster: Presses. [Date applied for under International Convention, June 13th, 1908.] 15681 Thomas and Thomas: Electric switches. 15723 Hudson: Oil spray and vapour burners for heating steam boilers and for like purposes. 15747 Laing: Liquid-fuel furnaces. 15828 Scheinder: Method of preparing wool or other animal fibre for the mordanting, dyeing, or printing. [Application for Patent of Addition to 6152, 1907.] 15859 Kent: Moving picture display apparatus. [Post-dated January 7th, 1910.] 15878 Pugh and Holroyd: Formation of engaging means between two articles for preventing relative rotary movement.

15957 Heatons Ltd., and Heaton: Slugging machines for use in the manf. of boots and shoes.

This invention relates to machinery employed in the manufacture of boots and shoes, and has particular reference to slugging machines of the type wherein the slugs are automatically cut from the end of a continuous length of wire and carried beneath a driver which drives them into holes previously formed in the stock by an awl which also feeds the work. The object of the invention is to provide a slugging machine of the kind referred to with mechanism which will enable pre-arranged changes as regards the material, length, size, shape, the number, and the disposition of the slugs which are being inserted to be effected at the will of the operator and during the continuous operation of the machine. The invention comprises mechanism which upon the actuation of a knee lever or equivalent member is adapted to effect a specific pre-arranged change in the slugging; means which are brought into operation simultaneously with the changes to adjust or vary the amount of blow imparted by the driver according to the requirements of the slugs to be driven, consisting of a buffer adjustable in height by means of a rotatable sleeve or cam actuated through the medium of intermediate links and levers from the rock lever of the feed device controlling mechanism; a movable wire-feeding throat, an independent feed device for feeding each length to the throat adapted to be brought into operation by the actuation of a knee lever or equivalent member; a movable awl-stopping device and means actuated by the means for controlling the feed devices for adjusting the position of the device relatively to the awl; means for shogging the wire-feeding throat comprising a sliding rod carrying the wire-feeding die or throat block and a cam lever or stepped bar reciprocated through the silding rod; mechanism for controlling the feed devices consisting of sliding racks adapted to rotate the shields of the feed devices, a rock lever adjustably coupled on opposite sides or ends to the sliding racks, spring-controlled pivoted clawkers or detents on opposite sides of ends of the rock lever, a continuously reciprocating rod disposed centrally of the rock lever fulcrum and having on opposite sides teeth or shoulders adapted to engage the aforesaid clawkers or detents; means to impart reciprocation to the rod, mechanism actuated by a knee lever or equivalent member adapted to move either of the clawkers into the path of the corresponding tooth or shoulder on the reciprocating rod, and with or without a connection between the aforesaid mechanism and the reciprocating cam lever of the wire-feeding throat actuating mechanism; and means for varying the disposition or pitch of the slugs consisting of mounting the awl stop or plate on a slidable plunger actuated in one direction by a spring and in the other direction by a sliding wedge block which receives motion through the medium of intermediate links and levers from the rock lever of the feed device controlling mechanism.

16007 Trist, and Trist Piano Player Ltd.: Piano-playing mechanism and the like. 16092 Mille: Automatic lubricators [Date applied for under International Convention, September 16th, 1908. Application for Patent of Addition to 12474, 1907.] 16644 McLoughlin: Safety suspending apparatus for mining cages and similar lifting and lowering apparatus. [Post-dated January 17th, 1910.] 17338 Brown: Grips used on the handles of cricket bats, and other striking or driving appliances. [Post-dated January 19th, 1910.] 18010 Lindner: Smoke-consuming furnaces. 18036 Jevons and Green: Circuit breakers for electric welders and the like. 18086 Loewe: Apparatus for the manf. of artificial silk or for coating or glossing textile fibres. [Date applied for under International Convention, September 18th, 1908.] 18092 Monroe: Driving mechanism for rope-yarn spinning machines. [Cognate Application. 26728, 1909.] 18116 De Bajza: Airships. 18118 Sauvageon: Electric furnaces for the continuous manf. of glass.



18140/09

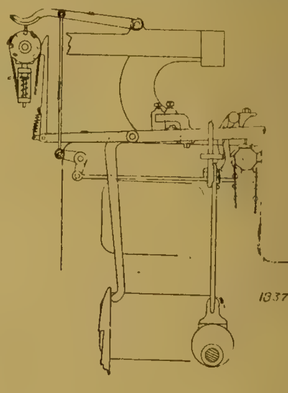
18140 Burt, and Argylls Ltd.: Internal-combustion engine.

This invention relates to internal-combustion engines, and particularly that class of such engines as are of the high-speed type, and has for its object, by means of the special construction of the engine cylinder and of the construction and arrangement of the working parts within the cylinder, the provision of a simple and efficient engine which is practically noiseless in its action. The cylinder proper, so far as its main body is concerned, is formed in the usual manner. In conjunction with the upper or explosion end of the cylinder, a cylinder head is provided which may be water jacketed and is secured to the end of the cylinder and has its central portion projecting well into the cylinder and is fitted with loose rings like a piston. Between the inner wall of the cylinder and this projecting portion of the cylinder head an annular space is left in which is arranged to slide the upper or inner end of a liner or sleeve in which a special arrangement of ports are provided, one set of these ports being arranged in the cycle of the engine to open communication with the inlet ports in the cylinder which admits the explosive mixture to the interior of the cylinder and the other set opening communication with the exhaust outlet, while the inlet ports are closed. The sleeve is slightly longer than the full length of the cylinder, the extra length projecting beyond the lower or outer end of the cylinder itself where it is provided with a pin projecting from and jointed to its outer circumference, which pin is engaged by a crank disc or the like situated on what ordinarily constitutes the two-to-one or valve shaft, so that this liner or sleeve has in addition to a reciprocating action caused by the inward travel of pin actuated by crank disc a rotating action due to the transverse action of the pin in the crank disc. The motor piston is connected to the main crankshaft of the engine in the usual manner and works inside the loose liner or sleeve. The inlet and exhaust ports are placed at the upper or back end of the cylinder on opposite sides and close to the inner end of the projecting head, and these ports as also the inlet and exhaust ports in the sleeve or liner are of such formation as to give the best possible opening for the inlet and exhaust gases. The inlet and exhaust ports in the cylinder are so arranged in conjunction with the ports in the liner that the requisite and desired admission and exhaust and the necessary cut-off takes place by means of the combined reciprocation and rotation of the sleeve or liner.

18177 Berard: Reinforced concrete walls. [Date applied for under International Convention, August 7th, 1908.] 18216 Kuhn: Manf. of fermented beverages. [Application for Patent of Addition to 4622, 1908.] 18218 Kuhn: Manf. of beverages. 18219 Kuhn: Process relating to the manf. of temperance beer. [Cognate Applications. 22259, 1909, and 771, 1910.] 18221 Field, and Ferranti Ltd.: Contacts for electric switches and the like. 18226 Dowse: Hat holder for ladies' and gentlemen's hats. 18307 Watts: Safety razors and razors other than safety razors. 18329 Wolff: Obtaining tetrachloride of tin from tin scrap and other materials containing tin. 18357 Pink: Method of making artificial marble and floor and wall coverings. 18375 Von Mach: Process for protecting balloons against fire. [Date applied for under International Convention, August 7th, 1908.]

18376 Riddick, Riddick, Whiteoak, Stuttard, and Wilson: Pattern surface mechanism for circular box looms.

This invention relates to pattern surface mechanism for controlling the movements of circular or rotary shuttle boxes of looms, and especially to such arrangements as permit the employment of four separate pattern surface cylinders, one exercising controlment over another, and the object of the invention is to obtain an improved construction and arrangement of devices which will enable the employment of the four cylinders with their consequent saving in the length of pattern surfaces which they have to carry for the production of many designs or patterns of fabric that have to be woven, and that without making it too complicated for the weaver to readily understand and keep in unison or working condition. The invention consists essentially in the employment of two primary and two supplementary pattern cylinders, the pattern surface on one primary cylinder being arranged to control the movement of the other primary cylinder, while the second



18376/09

primary cylinder controls the movement of the two supplementary cylinders, one of which is employed for directly controlling the movement of the first primary cylinder, while the other supplementary cylinder directly controls the movement of the second primary cylinder.

18381 Hood: Self-adjusting collapsible chair lounge. 18384 Lanchester: Alighting mechanism for flying machines. 18405 Hope-Jones: Electric time indicators. 18412 Flack (Prouty): Starting of internal-combustion engines. 18420 Hutchinson: Magnetic separators. 18424 Sibson and Allsop: Singeing machines. 18427 Aitken: Rotary hair brushes. 18436 Colin and Jeance: Wireless telephony. [Date applied for under International Convention, April 17th, 1909.] 18451 Bary: Process for casting metals and apparatus therefor. 18455 Parker: Dip pipes. 18461 Wetter (Chemische Fabrik Grunau Landshoff and Meyer Akt.-Ges.): Manf. of new alizarin preparations suitable for dyeing and printing. 18494 Weidemann and Templin: Vacuum cleaning apparatus. 18518 Thornley: Governors for operating the cut-off gear or expansion valves of engines worked by steam or other expansible fluid. 18524 Marconi, and Marconi's Wireless Telegraph Co.: Transmitting apparatus for wireless telegraphy. 18527 Buddicom: Reinforced concrete structures. 18537 Luis: Mixing and grinding machines. 18543 Boult (United Shoe Machinery Co.): Boots and shoes and methods of making them. 18544 Forster: Glass-blowing machines. [Date applied for under International Convention, May 27th, 1909.]

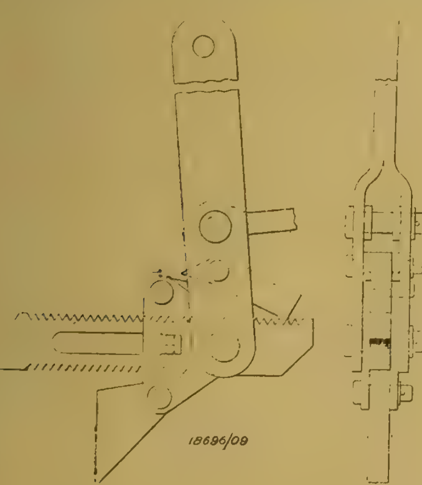
18564 Fine Cotton Spinners' and Doublers' Association, and Dowbekin: Carding engines.

This invention relates to an improved appliance for locking the doors or covers of carding engine cylinders to prevent the opening of the door while the cylinder is rotating. The device consists essentially of a vertically movable hooked ar cranked latch fitted to slide up and down in a slot in the door and a bolt at right angles thereto pivoted in a recess in the edge of the bend, the end of the bolt engaging the cylinder to retain the bolt in contact with the hooked end of the latch while the cylinder is rotating.

18565 Sherratt: Trawling gear. 18590 Marino: Means for preserving or protecting the lead supports of the positive electrodes of secondary or storage batteries from per-oxidation. 18605 Smith, Mitchell, Askham, and Hey: Method and means for the recovery of volatile solvents and like liquids. 18638 Seddon and Birch: Stop motion mechanism for machines for combing cotton and like fibrous substances. 18651 Glenn: Means for maintaining the balance of vessels in air. 18669 Sir W. G. Armstrong, Whitworth, and Co., Matthews and Wale: Controlling apparatus for hydraulically-worked gun mountings. 18681 Still and Adamson: Steam traps. 18685 Freer, and British United Shoe Machinery Co.: Folding or like machines. 18687 Rorke and Rorke: Switch for controlling electrical circuits.

18696 Consolidated Brake and Engineering Co., and Luard: Brake mechanism for railway and like vehicles.

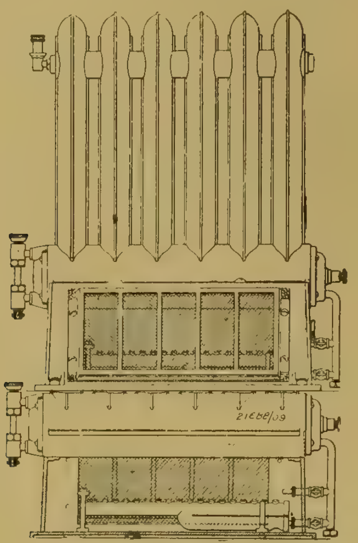
This invention relates to compensating brake mechanism for railway and like vehicles, and to that class of mechanism in which the wear upon the brake blocks is taken up by means of a ratchet in connection with the pull and push rods, and provided with teeth upon opposite faces engaging with a pivoted pawl and detent. The present invention is to obviate certain defects which have been found in practice to accompany the use of brake mechanism of the kind above referred to, and to this end, in lieu of providing a single power pawl working in conjunction with the detent, two such power pawls are provided which engage with the two sets of teeth upon the opposite sides of the ratchet, the two power pawls being preferably mounted upon a swivel piece or bridle which embraces the ratchet, and is pivoted to the lower end of the actuating link or lever or the equivalent carrying the detent, the pivot pin running in a slot in the ratchet. In practice that power pawl which engages with the same set of ratchet teeth as the detent is so positioned and shaped that when it is out of engagement with the ratchet teeth it bears upon a tail piece on the detent so as to cause the detent to be in engagement with the ratchet; on the other hand, if the detent is out of engagement with the ratchet teeth, its tail depresses the pawl into engagement therewith so that the ratchet is at all times held either by the detent or by the pawl, thereby preventing the mechanism being tampered with by unauthorised persons.



18721 Forgrove Machinery Co., and Grover: Apparatus for feeding wrapping material to tablet and the like wrapping machines. 18771 Leake and Rushworth: Electrical or electrically-operated fire alarms. 18818 Pickford: Bags for laundry purposes. [Cognate Application. 24512, 1909.] 18821 Rigby: Sole-levelling and like machines. [Date applied for under International Convention, August 17th, 1908.] 18839 Glover: Construction of apparatus for cutting toothed wheels. 18846 Berryman: Apparatus and processes for the manf. of artificial ice. 18947 Markarian: Differential axles for railway cars and the like. [Date applied for under International Convention, August 18th, 1908.] 19031 Glover: Apparatus for testing the capacity of the diaphragms, bellows, or like measuring appliance of a gas meter. 19058 Crampton and Ward Ltd., and Ward: Upholstered seats and like furniture. 19076 Parker: Carburetters for internal-combustion engines. 19080 Doulton and Noke: Decoration of pottery. 19177 Tullidge: Automatic sight-testing apparatus. 19223 Whitehead: Apparatus for automatically sampling liquids, solids, such as cereals and the like. 19247 Woolcock. Manf. of so-called concrete blocks, slabs, pipes, and the like. 19362 O'Brien: Buffering devices for use on railways. 19448 Jost: Means for driving and keeping wet screens used for moistening and cooling the draught of air caused by a fan. 19459 Lake (Pine St. Patents Co.): Processes of making cement clinker and apparatus therefor. 19575 Barker: Apparatus for heating and ventilating rooms, halls, and other appartments. 19641 Tweedale: Kites and similar aerial machines. [Cognate Application. 23776, 1909.] 19709 Zerkowitz: Apparatus for separating liquids. [Rights under Section 91 of the Act not granted.] 19837 Cowley: Pneumatic ammunition-conveying apparatus. [Date applied for under International Convention, August 31st, 1908.] 20210 Strasburger: Bottle-filling machine. 20229 Marconi, and Marconi's Wireless Telegraph Co.: Transmitting apparatus for wireless telegraphy. 20347 Walker: Circular knitting machines and the method of producing flat-fashioned fabrics thereon. 20400 Garros: Apparatus for the manf. of ceramic ware, glassware, enamelling metals, and the like. [Date applied for under International Convention, September 5th, 1908.] 20521 Lomas: Apparatus for supporting the shafts of four-wheeled vehicles. 20708 Coan and Marx: Loose-leaf ledgers, binders, and the like. 20801 Sankey: Apparatus for moulding flower pots and other earthenware vessels. 20879 Smith: Means for securing detachable tyre-carrying rims in position. 20931 Phillips: Governors. 21051 Pugh, Pugh, and Allen: Couplings for railway wagons, carriages, and the like. 21076 Cleathero: Means for locking nuts, bolts, and the like. 21185 Berry and Markham: Electric switches and switch fuses. 21247 Bladon and Bladon: Oil-tight cover or filler for oil feeders or other receptacles containing liquids. 21331 British Northrop Loom Co., and Hollins: Appliances or magazines for containing and delivering ring travellers for spinning frames. 21399 Headley: Wheels for perambulators, mail-carts, and other light vehicles.

21688 Cannon Iron Foundries Ltd., and Hawthorne: Gas-heated and other radiators and analogous heating appliances.

This invention has relation to gas-heated and other radiators and analogous heating appliances for use in motor garages, motor car houses, chemical and other laboratories and works, and in other places or situations where explosive or combustible fumes or gases may be present and where radiators or appliances with open burners or with an open fire cannot be used in view of the risk of such fumes or gases becoming ignited by the burner flame. The improvements are principally applicable to gas-heated radiators which have the burners enclosed within a chamber having provision for the admission of air to support combustion and for the escape of the products of combustion through apertures filled with wire gauze to prevent the lighting back from the burner chamber into the outside atmosphere of any fumes or gases that may be present in such atmosphere or that may be carried into the chamber with the air. The present invention consists mainly in forming in the walls of the enclosed burner chamber suitable air admission openings, ports, or apertures which are furnished and completely filled with one, two, or more sheets or insertions of fine wire gauze which will, according to a well-known principle, admit air for supporting combustion to pass through the reticulations or mesh and to carry with it any combustible or explosive fumes or gases that may be present in the atmosphere which the fumes or gases burn on the inner side of the gauze and within the enclosed burner chamber, but the flames caused thereby cannot strike back through the gauze or ignite any fumes that exist on the outside of the chamber.



21740 Fowler and Smith: End-tipping road wagons or railway wagons. 21815 Middleton: Force pumps particularly applicable to engine lubricating pumps. 22009 Pearson and Stoneham: Manf. of boards or sheets from peat. 22011 Lord, and R. G. Whitaker Ltd.: Machines for folding, shaping, and curling collars. 22016 Carter and Temple: Automatic device for regulating the mixture of steam and air in suction gas producers. 22136 Dyson, Parker, Parker, and Parker: Barrel tilters. [Application for Patent of Addition to 23400, 1908.] 22146 Jack: Game of skill. 22172 Fox: Means for producing advertising and other cinematograph pictures in railway tunnels and the like. 22201 Talbot: Manf. of iron and steel. 22213 Dove: Brushes. 22259. *See* 18219, 1909. 22328 Frater: Means for preventing the puncture of a pneumatic tyre. 22370 Eastwood: Fruit and vegetable slicers. 22395 Weber: Tables for attaching to bedsteads. 22469 Smith: Wheatmeal bread. 22572 Wheatcroft and Phillips: Sectional boilers for heating water or generating steam. 22619 Birmingham Small Arms Co., and Norman: Rifle sight attachments. 22630 Ashton: Cardboard and like boxes. 22655 Moore: Treating cassava and other succulent vegetables, and the manf. of starch and other products therefrom. 22713 Bevan: Abrading or surfacing rolls. 22733 Downs, Ewing, and Kilpatrick: Cooling and reciprocating appliances for cream-cooling vats, tanks, or the like. 22844 Johnson: Table croquet. 22890 Travers: Tap for use in drawing off beer, porter, and like liquors from casks and similar receptacles. 22931 Hogfeldt: Machine for manufacturing boxes with cardboard or the like. [Date applied for under International Convention, October 7th, 1908.] 22949 Alldays and Onions Pneumatic Engineering Co., and Simms: Detachable wheels for motor cars and other vehicles. 23072 Smith and Walmsley: Feed motion for circular combing machines. 23110 Meyer: Process for devulcanising and reclaiming rubber waste. 23164 Hoskins and Sewell Ltd., and Johnson: Folding table attachments for ships' and analogous berths. 23181 Johnson (Badische Anilin and Soda Fabrik): Manf. and production of halogen derivatives of indigo. 23468 Peck and Holme: Machine or mechanism for simultaneously measuring and ticketing cloth, calico, and other fabrics or piece goods. 23684 Evans: String cutter. 23776. *See* 19641, 1909. 23802 Rogers: Audible electric signalling devices and the like. 24144 Vicars, Vicars, and Vicars: Biscuit-cutting machines. 24166 Dow and Wells: Pliers and the like. 24324 Buchanan: Mail-handling devices. 24401 Lewins: Packings for the tube ends of steam engine or other condensers. 24512. *See* 18818, 1909. 24847 Dickson: Multi-coloured advertising signs for gas lights. 24922 Goddard: Hygienic feeding bottle. 24936 Manning: Loose-leaf binders and the like. 24950 Beuttell: Appliances or means for mounting incandescent electric lamps. 24988 Crawshaw, Warburton, and Nicholls: Means for checking shuttles in looms for weaving. 25017 Potter: Sheds for aeroplanes. 25229 Dawson: Files or binders. 25398 Auster and Auster: Hood fittings for motor cars and other vehicles. 25471 Popovics: Planting hairs into the skin. 25489 Halstead: Rollers for use in dyeing, bleaching, and other operations. 25536 Siemens Bros. and Co., and Dieselhorst: Insulator for high-tension electric circuits. 25546 Mack: Vapour burners. 25671 Purser, and J. C. Lyell and Co.: Belt or rope driving mechanism suitable for motor cycles, and applicable also more generally for the transmission of motive power. 25747 McNab: Apparatus for indicating direction and speed of rotation of ships' propeller and other shafts. [Date applied for under International Convention, April 20th, 1909.] 25812 Kotz: Band saws. 26038 Williams: Toy aeroplanes or flying machines. 26139 Millington: Pumps. 26238 Gail: Machinery for buffing metallic bedstead mounts, knobs, or the like.

26478 Justice (S. P. A. Societa Ligure Piemontese-Automobile): Differential or balance gearing for motor-driven road vehicles.

> This invention relates to differential or balance gearing for motor-driven road vehicles, and has for its especial object a device for permitting the application to commercial motor vehicles of the cardan-joint method of transmission so largely used and suitable for motor cars. The mechanism comprises a cone pinion which receives motion directly through a shaft which starts from the change-speed gear and at maximum speed makes the same number of revolutions as the motor. This pinion transmits motion to a crown to which is connected a drum carrying planet wheels, which latter, through the intervention of crown or mitre wheels, in the well-known way drive two spur pinions, and the cylindrically arranged teeth of which operate two internally toothed cylindrical crowns. These last are fast on axles which carry at their ends the fixed driving wheels, and in this way the motion is transmitted. There is thus a primary reduction of speed between the cone pinion and crown, and a second reduction after transmission through the differential gear between the spur pinions and the internally toothed cylindrical crowns. The differential gear, running at high speed, is made of reduced dimensions.

26728. *See* 18092, 1909. 26996 Strub: Hinge and pivot adjustments. 27029 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new vat dyestuffs. [Application for Patent of Addition to 7819, 1909.] 27153. *See* 11043, 1909. 27250 Miller: Process for cleaning barrels, casks, and the like, and for recovering soakage therefrom. 27474 Gjuke: Rock drills and similar tools. 27598 Schaumann: Bullet-resisting flexible armour. 27776 Watts: Elastic tyres for motor road vehicles. 27840 Scherl: Maintenance of equilibrium of unstable vehicles or other bodies in unstable equilibrium by the action of a gyroscope. [Date applied for under International Convention, November 25th, 1909.] 27939 Lowthime: Purses and the like. 28044 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new pharmaceutical compounds. 28066 Bruns: Starting and reversing mechanism for single or multi-cylinder internal-combustion engines. 28164 Harle et Cie.: Arrangements for electrically reproducing a movement at a distance. [Date applied for under International Convention, December 7th, 1908.] 28351 Viscount St. Vincent: Golf bag.

28375 Ageron and De Charpin: Carburetters for explosion motors.

> This invention consists in improvements in and relating to carburetters for explosion motors. The object of the invention is to provide means whereby the power of explosion motors can be varied within considerable limits by feeding them with explosive mixture compressed to various degrees according to the power required. If, for example, the cylinder of a motor takes one litre of mixture at atmospheric pressure by making it take four litres, by giving the mixture the pressure of four kilograms, about four times the power would be obtained from the motor. To obtain this result it is necessary, firstly, to produce a mixture of practically constant composition, and secondly, to convey this mixture to the motor at a pressure that can be varied as desired. According to the invention a reservoir is provided into which air under variable pressure is introduced by a pipe provided with a cock. Part of the air is passed directly to the carburetter through a branch pipe and part operates to produce corresponding pressure on the petrol in a second reservoir and to transmit it to the carburetter by a separate pipe. The air and the petrol thus reach the carburetter at the same pressure and are mixed preferably by atomisation of the petrol in the compressed air and thus form an explosive mixture of practically constant composition, the pressure of which can be

varied by the sole manipulation of the aforesaid cock. This mixture passes without further admixture to the combustion chamber in which, without varying the cubic capacity of the chamber, a greater or less quantity of the mixture can be introduced according to the state of compression of the mixture.

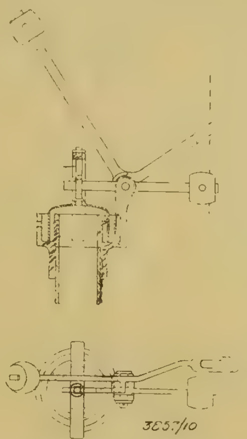
28842 Courtecuisse: Automatic advertising or signalling apparatus. 29132 Otis Elevator Co. (Otis Elevator Co.): Electrically-operated ammunition hoists or gun-loading systems. 29247 Merck, Merck, and Merck: Method for the preparation of concentrated solutions of thiosinamine. [Date applied for under International Convention, February 26th, 1909. Application for Patent of Addition to 22533, 1905.] 29395 Cater and Schofield: Knife or tool for tapping rubber and other gum trees. 29441 Tomsett: Cash tills. 29688 Lake (Submarine Signal Co.): Submarine signalling apparatus 29729 Lockwood and Charters: Siphon discharge flushing cistern for water closets and the like. 29864 Dreyfus, Friedl, Bentley, and Clayton Aniline Co.: Treatment of old, or waste, vulcanised rubber for the recovery of rubber therefrom. 29888 Knapp: Marine vessels. 30021 Entreprise Generale de Foncage de Puits Etudes et travaux de Mines and Koepe: Sinking of mines, shafts, and the like. [Date applied for under International Convention, December 23rd, 1908.] 30044 Johnson: Instrument for acquiring the art of reading flashlight signals for maintaining self-practice therein and the promotion of higher efficiency in the art. 30167 Pauly: Apparatus for forming artificial stone building blocks, pipes, and the like. 30187 Olmsted: Speed-governing devices for electrically-driven shafts. [Date applied for under International Convention, January 9th, 1909.] 30311 Cunniff: Spinning spindles. [Date applied for under International Convention, June 21st, 1909.] 30475 Gibson: Internal-combustion engines. 30585 Schimming: Working process for internal-combustion engines.

1910.

11 Bulle: Vacuum insulated vessels. 135 Brat: Turbines. 197 Willson: Acetylene gas generators especially applicable to buoys. 199 Marks (Royal Typewriter Co.): Ball bearing for typewriting machine carriages. 452 Howard and Hadley: Means for treating the fumes from zinc retorts. [Application for Patent of Addition to 4563, 1909.] 465 Bullivant and Selby: Torpedo nets and means for brailing them. 485 Hedley and Doyle: Apparatus for recording the "coasting" time or distance of street cars, trains, or the like. [Date applied for under International Convention, January 18th, 1909.] 771. *See* 18219, 1909. 834 Henri, Helbronner, and Von Recklinghausen: Sterilisation of milk and other liquid goods, liquids used for medicinal and surgical purposes, serums, and the like. [Date applied for under International Convention, March 2nd, 1909.] 852 Schroeder: Combined storage vessel and injector of subcutaneous solutions. [Date applied for under International Convention, January 13th, 1909.] 862 Dodge: Chains. 1201 Hull: Bicycles. 1242 Pocklington: Cycle saddles. 1318 Massohn: Airships of the rigid type. 1398 Schultz: Process of obtaining a diagnostic and curative preparation. 1489 Bray: Gas and like burner fittings. 1687 Marshall and Salfeld: Valve gear for internal-combustion engines. 1699 Jahde: Glass globes for artificial sources of light. 1780 Molloy: Pneumatic tyres. 1781 Jager and Carl: Azo dyes. [Date applied for under International Convention, June 18th, 1909. Samples furnished under Section 2 of the Act.] 1979 Heintz: Paving blocks and paving. 2038 Rawie: Railway buffers. 2081 Best: Driving mechanism for velocipedes. 2140 Fulford and Howe: Side carriages for cycles and motor cycles. 2432 Felten and Guilleaume Lahmeyerwerke Akt.-Ges.: Means for checking the use of electric lighting apparatus, and more particularly of electric glow lamps. [Date applied for under International Convention, February 1st, 1909.] 2476 Benard: Bottles. 2484 Brooks: Tools for tightening box straps. [Date applied for under International Convention, March 3rd, 1909.] 2485 Rapkin, and Gamble Music Hinge Co.: Means for binding loose sheets. 2494 Fairweather (Selig Polyscope Co.): Method of and apparatus for drying films. 2830 Vogtlandische-Maschinenfabrik (vorm. J. C. and H. Dietrich) Akt.-Ges.: Embroidery machines. [Date applied for under International Convention, February 9th, 1909.] 2894 Martin: Current motors. 3004 Kantorowicz: Manf. of adhesive substances soluble in cold water from starch-bearing fruits, roofs, bulbs, and the like. [Date applied for under International Convention, February 13th, 1909.] 3077 Strasburger: Bottle-filling machines. [Date applied for under Rule 13, September 3rd, 1909.] 3078 Strasburger: Bottle-filling machines. [Date applied for under Rule 13, September 3rd, 1909.] 3121 Lampert: Process and apparatus for cooking articles of food. [Date applied for under International Convention, February 9th, 1909.] 3250 Sprague, and Chamberlain and Hookham Ltd.: Prepayment electricity meters. 3382 Doxford: Navigable vessels. 3395 Marks (Royal Typewriter Co.): Ribbon vibrator mechanism for visible typewriting machines. 3423 Weithaler: Process for the production of a glazed mortar coating on cement goods, walls, and the like. 3437 Stiepel: Process of preliminary preparing chrome tanned leather for making glue. 3511 Lossier: Armour plate. 3633 Wratten: Dark-room lamps. 3737 Robin: Dropping pipettes for pharmaceutical or like purposes. 3845 Baumgarth: Catamenial appliances.

3857 Rowell and Rowell: Petrol air gas generators or producers.

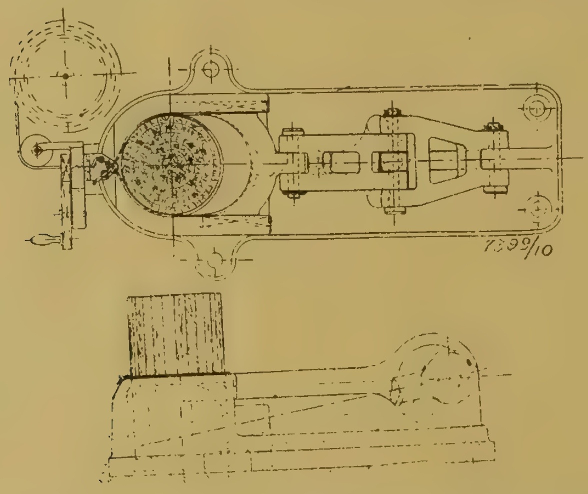
This invention comprises improvements in or relating to petrol-air gas generators or producers of that class in which a valve on the main air inlet pipe of the generator is controlled by the rising and falling movements of the gas bell or holder, and the present invention relates to a novel combination of parts for effecting such control, including a mercury seal valve in or on the air inlet pipe and tappet mechanism operated by the movements of the gas holder, the mechanism being of such a nature as to effect a quick opening or closing of the mercury seal valve. The valve and the casing thereof contain a quantity of mercury up to the level of an overflow aperture. The air inlet pipe is soldered, screwed, or otherwise suitably connected or let into the casing, and the valve is provided with a vertical spindle working in or guided by a bridge piece. A tappet chain which is connected to the gas holder passes through the slotted end of a pivoted striking lever integral with a balance lever carrying an adjustable counterweight. The valve-actuating lever operated by the tappet chain is also pivoted at its forward end extending through a slot formed in the valve stem and its rear end being provided with an adjustable balance weight. The boss of levers (the striking lever and integral balance lever) is provided with a projecting member adapted to bear upon the former lever at one side of pivot and hold the valve normally closed, but when the valve lever is moved by chain to open the valve the member bears upon the actuating lever at the other side of the pivot and holds the air valve open.



4484 Pather Iron and Steel Co., and Davies: Clutch specially adapted for rolling mills. 4882 Stevens: Roller skates. 5000 Graaf: Fluid diffusers in which the pressure medium is introduced also into the fluid container. 5134 Akt.-Ges. fur Anilin Fabrikation: Process for dyeing hairs, furs, and the like. [Date applied for under International Convention, October 23rd, 1909.] 5356 Holloway: Internal-combustion engines. 5586 Milne: Manures. 5651 Lammine: Wrought-iron annealing or like pot. [Application for Patent of Addition to 8349, 1909.] 5836 Grosclaude: Dirigible balloons. [Date applied for under International Convention, March 9th, 1909.] 5907 Rupley: Velocipede chairs, more particularly for use by invalids. [Date applied for under International Convention, March 9th, 1909.] 5936 Haddan (C. M. B. Wrench Co.): Socket wrenches. 6307 Strathern: Machines for producing weldless chains from steel and other metal bars. 6394 Christiansen: Buoyant wearing apparel. [Application for Patent of Addition to 13642, 1909.] 6605 Short, Short, and Short: Valves for gas containers employed in balloons or in airships. 6668 British Thomson-Houston Co., and Wedmore: Protective devices for electrical transmission and distribution systems. [Date applied for under Rule 13, October 18th, 1909.] 6840 Bogie: Disinfectant holder or container. 7065 Sundstrom: Devices for vending postage stamps and the like. [Date applied for under International Convention, March 22nd, 1909.] 7143 Stahl: Railway signalling devices. 7195 Martin and Baldwin: Shock absorbers for automobiles. 7257 Gillaspie: Sleds. 7278 Selg: Outlet passages or valves for filters and similar devices. 7319 Presser: Process for the production of oxides of nitrogen. [Date applied for under International Convention, June 1st, 1909.]

7399 Glover: Machines for use in bundling and binding sticks, chips, and the like to form firewood bundles and firelighters.

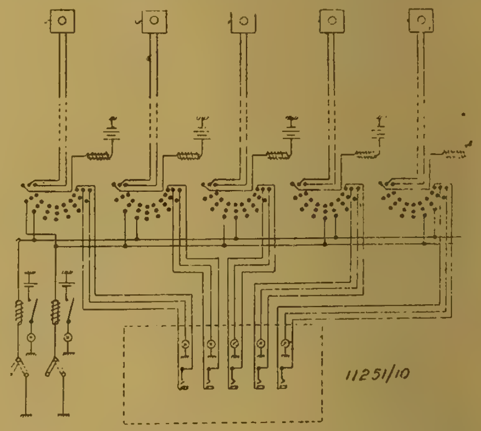
This invention relates to machines for facilitating the assembling of sticks, chips, and the like to form bundles, the compressing of such bundles, and the holding the same tightly compressed whilst being bound or wired, and for facilitating the arrangement and compression of sticks and chips for forming firelighters and holding the same tightly together whilst being bound or wired. According to this invention the rear or movable jaw is fitted in slides formed in prolongations of the sides of the front or fixed jaw and preferably at some height above the bottom, so as to be clear of the dust and small splinters which usually collect on the base plate between the jaws. The movable jaw is moved forward by an eccentric rod to which it is attached, or which may be cast in one piece with it, the slides affording sufficient play to accommodate the slight inclination imparted to the eccentric rod during its movement. The eccentric is formed with a square hole which fits on the square portion of the shaft on which it is mounted, the shaft having a journal portion on one side of the square part, the diameter of which is equal to or slightly greater than the diagonal of the cross section of the square portion, whilst the journal portion of the shaft on the opposite side of the square portion is of a diameter equal to or approximately equal to a side of the cross section of the square part. The operating handle is preferably cast in one piece with the shaft. If it is preferred to operate the movable part of the rear jaw by means of a toggle device actuated by a foot lever, the fixed part of the rear jaw may be formed with a tail piece on which the connection of the movable part to the adjoining link of the toggle device slides. In order to be able to compress bundles of different lengths in the same machine, loose or removable false bottoms are provided which can be dropped on to the base plate between the two jaws, or raised and lowered in the bottom of the space between the two jaws. Where the machine is used for holding and compressing sticks assembled to form firelighters, the loose bottoms are formed with recesses having suitably inclined surfaces for holding the lower ends of the sticks in position and with upright pieces or frames having notches or recesses for supporting the upper ends of the sticks in position. For twisting the ends of the wire, binding the sticks of the bundle, or of the firelighter together, a wire-twisting device preferably hinged to the lower end of the jaw is provided, so as to be able to turn down the twisting device out of the way for tying or wiring by hand or other purpose. The wire may be cut to length or unwound from a spool and passed through a hole in a spur wheel geared to a second spur wheel provided with an operating handle.



7647 Cline: Boxing gloves. 7648 Hussey: Drinking cups. 7653 Fuller and Croker: Coffee percolators. 7904 Carton und Faltschachtelfabrik Max Wolff: Package for inverted incandescent mantles. [Date applied for under International Convention, April 2nd, 1909.] 7994 Bamber: Shaving or painting brushes and the like. 8002 Firman: Feeding apparatus for tea, grain, or other produce or materials. 8086 Herzog: Machine for washing, damping, or dyeing cylindrical articles, especially bobbins or bobbins of yarn. [Date applied for under International Convention, April 2nd, 1909.] 8111 Lake (New Jersey Foundry and Machine Co.): Overhead weight-carrying devices. 8211 Sinding-Larsen and Storm: Process for completely or partially separating the components of mixtures of gases and apparatus for use therewith. [Date applied for under International Convention, April 7th, 1909.] 8357 Peddle: Surgeon's scissors. 8409 Siemens Bros. Dynamo Works Ltd., and Parker: Ventilation of continuous-current dynamo electric machines. 8749 Sharon: Folding paper cups. 8989 Heilmann: Reacting compensating brake with variable balancing for all kinds of vehicles on rails or roads. [Date applied for under International Convention, October 22nd, 1909. Application for Patent of Addition to 7324, 1909.] 9040 Stock: Motor ploughs. [Date applied for under International Convention, September 30th, 1909. Application for Patent of Addition to 8960, 1910.] 9083 Melhuish: Manf. of a preparation of lactose for use in brewing or priming ale, beer, and stout. 9094 Politz: Means for protecting tubes and vessels from galvanic or electric currents. [Date applied for under International Convention, April 22nd, 1909.] 9284 Soc. pour L'Industrie Chimique a Bale: Manf. of new dyestuffs of the anthracene series and of an intermediate product. [Date applied for under International Convention, April 17th, 1909.] 9430 Squires: Machines for manufacturing pneumatic tyres. 9588 Elsner and Meyer: Manf. of pure rubber or gutta percha from crude rubber, crude cutta percha, and the like. [Date applied for under International Convention, November 18th, 1909.] 9613 Dalpay: Combined hoes and rakes. 9833 Soc. G. Joachim et Cie.: Floors, partitions, and the like. [Date applied for under International Convention, May 13th, 1909.] 9869 Rogers: Typographical line-casting machines [Date applied for under International Convention, May 18th, 1909.] 10202 Sochor: Jib crane. 10330 Fery: Spectroscopes and spectrographs and refracting prisms used therewith. [Date applied for under International Convention, January 20th, 1910.] 10705 Brown, Gatenby, Gourlay, and Gourlay: Electric conduit threaders.

11251 Siemens Bros. and Co. (Siemens and Halske Akt.-Ges): Telephone exchange circuits.

In exchanges of this kind where automatic selector switches are used for connecting a calling line with a service station or with electro-magnetically operated connectors, it often happens that all the leads connected with the contacts of one selector switch are in use by other selector switches, in which case connection cannot be obtained with a service station or an electro-magnetic connector by the calling party. The present invention is for the purpose of ensuring transmission of a call under any conditions. According to the invention a separate set of leads and contacts is provided for each selector in addition to the aforesaid usual leads and contacts. The leads connected with these separate contacts are connected to only one calling line—that is to say, they are not, as in ordinary manner, in multiple with a number of selectors. The contacts and their leads are only found by the selector arm when the leads of all the other contacts are engaged, and they are connected with separate service apparatus not accessible to the common connecting leads, or preferably, even when the exchange is an automatic one, with a service station operated by hand. Thus the call is received immediately under all conditions and can generally be quickly dealt with.



11306 Busby: Spring pistols. [Date applied for under Rule 13, August 26th, 1909.] 11584 Moorman: Garbage receptacles. 11601 Olivieri: Device for picking fruit, pruning, and like purposes. 11754 Geoghegan and Moore-Irvine: Apparatus for aerial navigation. ([Date applied for under Rule 13, May 11th, 1909.]

11913 Arnaud: Variable-speed gears. [Date applied for under International Convention, May 19th, 1909.]

This invention relates to a speed gear of the type which is variable gradually and continuously by two rollers and two friction discs wherein the discs are movable transversely to vary the speed, and the object of the invention is to provide a device for automatically ensuring constant adherence between the driving roller and the discs. The invention consists essentially of mechanism for ensuring the engaging, the disengaging and holding in contact of the movable friction discs with the rollers comprising levers, the free ends of which are connected by a spring and along which lever movable rollers are displaced at the same time as the friction discs.

11914 Arnaud: Variable-speed gears. [Date applied for under International Convention, May 19th, 1909.] 11915 Arnaud: Variable-speed gears. [Date applied for under International Convention, May 19th, 1909.] 12015 Wilson: Vanes of steam turbines or the like. 12021 Bardens: Clamping device. 12076 Heenan and Froude Ltd., and Lewis: Propulsion conveyers, screens, and the like. 12129 Farbwerke vorm. Meister, Lucius, and Bruning: Manf. of beta-anthra-quinonylureas. [Date applied for under International Convention, May 19th, 1909.] 12338 Allgemeine Elektricitats Ges.: Centrifugal air pumps, compressors, and the like. [Date applied for under International Convention, May 19th, 1909.] 12369 Morton: Apparatus for the manf. of tufted fabrics. 12503 Rheinische Metallwaaren und Machinenfabrik: Vehicle wheel axles. [Date applied for under International Convention, Sept. 9th, 1909.] 13563 Beresford: Water closets. 13761 Belcher: Drive chains. [Date applied for under International Convention, December 16th, 1909.] 13898 Soc. Michelin et Cie.: Process for rendering impermeable fabrics for construction of balloons. [Date applied for under International Convention, June 11th, 1909.] 14153 Siemens Bros. Dynamo Works (Siemens-Schuckertwerke Ges.): Arrangements for preventing remanent magnetism in dynamo electric machines. 14353 Siemens Bros. Dynamo Works (Siemens-Schuckertwerke Ges.): Arrangements for obtaining a braking action in polyphase commutator electric motors. 14360 Utley: Apparatus for clarifying gelatine and other liquors. [Application for Patent of Addition to No. 28297, 1909.] 14796 Cann: Means of securing indiarubber tyres to the wheels of motor and other vehicles. 15158 Frey: Horseshoe. [Date applied for under International Convention, July 14th, 1909.] 16046 Vandervoort: Vehicle tyres. 16712 Stevens: Harness. [Date applied for under International Convention, July 13th, 1909.] 16757 Hudson: Valve arrangements for supplying oil and steam or compressed air for use in furnaces and the like. [Date applied for under Rule 13, July 6th, 1909.]

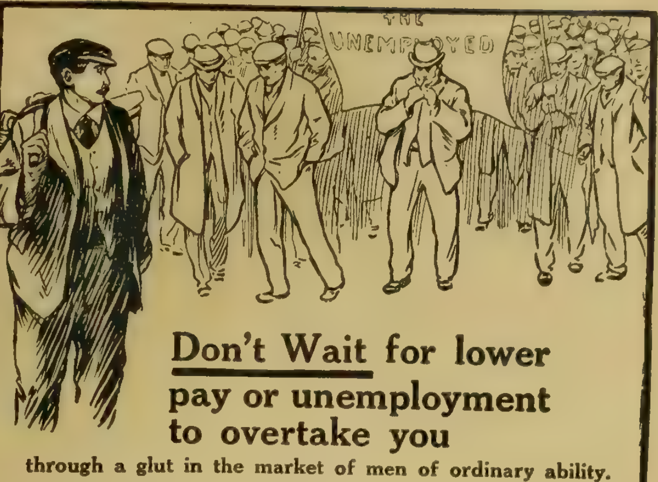
COMPLETE SPECIFICATIONS OPEN TO PUBLIC INSPECTION BEFORE ACCEPTANCE, UNDER THE PATENTS ACT, 1907.

1909.

23810 Goldstein: Manf. of absorbent coal. 29936 Kellermann: Pencil case with pyrophorous tinder box.

1910.

7719 Dieffenbach and Moldenhauer: Production of hydrogen. 8864 Wiegel: Game. 11581 Heimann and Schaffer: Method of working arc lamps in series with incandescent lamps. 12760 Belgian Pneumatic Tool Co. (Soc. Anon.): Valve mechanism for pneumatic tool engines. 13190 Bernhard and Niedermeyer: Crushers. 13901 Firm Robert Bosch: Sparking plugs for internal-combustion engines. 14010 Jones: Combined road map and signalling device. 15159 Heilmann: Arrangement for controlling the steering wheels of automobiles. 15523 Farbwerke vorm. Meister, Lucius, and Bruning: Manf. of a salmon-coloured vat dyestuff of the anthraquinone series. 15634 Aub: Electrodes of apparatus for electrifying the head of a patient. 15962 Bosc: Fillings or coverings for iron and steel floors. 16351 Plesch: Gullies. 16489 Vuilleumier: Automatic speed reduction gear. 16534 Brookins: Elevator safety devices. 16723 Murphy: Bottle-blowing machines. 16861 Gillar: Manf. of iron-framed windows. 17092 Lill: Photographic portrait apparatus with opaque frontal mirror. 17378 Heron: Buffer and method of making the same. 17791 Barrow: Steam boilers. 17798 Pokorny and Wittekind Maschinenbau Akt.-Ges.: Pneumatically-actuated percussive implements. 17835 Beaudouin: Automatic apparatus for projecting in an intermittent and endless manner lantern slides by series containing each a very large number of images. 17838 Bassett and Bassett: Ball roller caster. 17862 Belgian Pneumatic Tool Co. (Soc. Anon.): Pneumatic hammers or like tools. 17872 Ulysse: Cinematographic apparatus. 17883 Joachim: Fastening devices for buttons, ornaments, and the like. 17944 Carl Zeiss: Tubular spirit levels with a reflecting system that projects the images of both bubble ends close together. 18000



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PATENTS FOR SALE OR LICENSE.

THE Owners of British Patent No. 22113 of 1906, entitled "IMPROVEMENTS IN PARTY LINE TELEPHONE SYSTEMS," granted to the Select Telephone Manufacturing Company and W. M. Bruce, junr., are desirous of disposing of the Patent, or entering into a working arrangement under license with those likely to be interested in the same. In the alternative, the owners would be open to consider proposals to manufacture the invention to fill any requirements of the market in Great Britain on terms to be arranged.

The Patent covers an invention interesting to Telephone Companies, Contractors, and Telephone Manufacturers, and deals with arrangements for securing secrecy in party line telephones.

Detailed information as to the Invention will be found in the Patent Specification, of which a copy will be supplied to any interested party on request.

Full particulars can be obtained from, and offers made (for transmission to the owners) to, MARKS AND CLERK, 57 and 58, Lincoln's Inn Fields, London, W.C.

THE Proprietor of British Patent No. 23172 of 1905, for "IMPROVEMENTS IN OR RELATING TO ELECTRO-MECHANICAL SYSTEMS FOR THE PROPULSION OF AUTOMOBILES," is desirous of entering into arrangements with British manufacturers with a view to the granting of licenses under the Patent so far as the application of the system to Traction on Rails is concerned. In this propulsion system a separate explosion motor and a dynamo connected to a battery of accumulators are provided for each driving wheel of the vehicle.

Interested parties are invited to communicate with the undersigned for further particulars.—HENRY SKERRETT, Chartered Patent Agent, 24, Temple Row, Birmingham.

THE Owners of British Patent No. 17335 of 1907, entitled "IMPROVEMENTS RELATING TO MACHINES FOR PRINTING WALL PAPER AND THE LIKE," are desirous of disposing of the Patent, or entering into a working arrangement under license with firms interested in the same.

The Patent covers an Improved Machine for Printing Tapestry, Wall Papers and the like, and its special features are precision and rapidity of adjustment of the colouring mechanism.

Further particulars, together with copy of specification, can be obtained from "Box 137," Patents Working Dept., TECHNICAL PUBLISHING CO. LTD., 19, Southampton Buildings, London, W.C.

Wirtz and Hinne: Apparatus for kindling and extinguishing street lamps and the like. 18071 Molls: Machine for removing the teeth from card-clothing fillets. 18103 Hartmann: Apparatus for ringing bells. 18184 Mertens: Machine for printing lengths of material, textile fabrics, paper, or the like. 18188 La Tour, Rolando, Rolando, and Gintz: Variable-speed gears for use in connection with motor vehicles and the like. 18201 Emanuel: Gas-making apparatus. 18262 Schaeffer: Apparatus for the production of heated compressed air. 18293 Austin: Churns. 18315 Chavassieu: Process for the dissolution and subsequent coagulation of proteids and the application of the resulting products to industrial purposes. 18317 Ward: Grinders and the like. 18318 Ward: Indexing mechanisms for gear grinding machines and the like. 18371 Wickuler-Kupper-Brauerei Akt.-Ges.: Pasteurising and transport vessels. 18398 Accumulateurs Tudor Soc. Anon.: Process for packing for transport charged negative electrodes of accumulators. 18403 Darling: Staples for fence posts. 18433 Rhonisch: Shoe drier. 18479 Geb. Schmid: Process of renderinging jute and like fibrous materials woolly. 18513 Collins: Friction clutches. 18534 Burrows: Screw locks. 18547 Henning: Controlling devices for registering coin-counting or delivering machines and the like. 18601 J. G. Holtzwarts Nachf: Advertising posters.

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THE DESIRABILITY OF STATE AID FOR NEW OR LANGUISHING INDUSTRIES.

A GOOD deal has been heard recently with regard to the establishment of works in this country for the manufacture of beet sugar. The sugar beet can be grown in most parts of England, and the climate of the South of Ireland is one particularly suitable for its cultivation. The industry would be one of great value to farmers, and would probably enable many of those weekly leaving these shores, and transferring their energy and their capital to the Colonies and foreign countries, to remain at home and earn the due reward for their labour and capital. The engineering trade would also greatly benefit from the manufacture of beet sugar in this country in the call for machinery that would result.

Hitherto attempts to establish the sugar beetroot industry in England have been abortive, the necessary capital was not forthcoming, and, *mirabile dictu*, the only offers of assistance came from a foreign firm!

Another direction in which State assistance might be advantageously given is in the dairy industry. The term dairy, when used in its widest sense, indicates a place where milk is preserved and prepared for sale or for family use, or converted into cream, butter, cheese, etc.

Either mechanical or ice refrigeration should be employed in all dairies, both large and small; mechanically produced cold, indeed, being now universally acknowledged to be absolutely essential wherever a large quantity of milk has to be handled, whilst the small refrigerating machine of comparatively recent introduction can be advantageously employed in establishments with limited outputs, except in localities where ice can be stored at a figure as low as two to three shillings per ton, and artificial cold be so economically produced by this means as to render mechanical competition practically impossible.

Some of the British Colonies, and many foreign nations, encourage the use of refrigeration in dairies by the granting of subsidies, under certain conditions, for the erection of cold stores, and naturally considerable impetus has been given in such localities to the use of refrigeration.

Although no such official help is forthcoming in this country, nevertheless the almost unlimited market that exists for dairy products of prime quality has rendered the sinking of considerable capital in the dairy business a paying investment in the case of large concerns, but only in the latter. The small man is helpless; he can do nothing. The plant of machinery used in a modern up-to-date dairy is expensive, and very different from the few simple appliances deemed sufficient some quarter of a century ago. The establishment of the necessary cold store and refrigerating machinery is an impossibility to the average small farmer, and he and his family and such little capital as he possesses go to enrich some more far-seeing country, where a new or a languishing industry is tenderly nursed and helped to thrive and live, and not crushed out by over-taxation and neglect.

Here, again, there seems to be an opening for State aid. Not only would the small farmer be saved from expatriation, but the engineering trade would benefit. Probably not one refrigerating machine in six made by our engineers remains at home, and yet there should be here a large field for their use in the dairy side of agriculture. Some years ago a visit was made to this country and Ireland by a number of delegates of the Belgium dairy industry, and, in speaking of their experience, one of the members observed that if they owned such a country, so far from having to import dairy produce, they would not only have sufficient for their own consumption, but a large overplus for exportation.

Some little has been done in Ireland as the result of private enterprise by the establishment of co-operative creameries, but in this country nothing! And yet it pays in our Colonies and in foreign countries to foster industries; why should it not here?

Superheaters on the Furness Railway.—Presiding at the statutory meeting of the new Superheater Company in London yesterday, Lieutenant-General Sir Chas. E. Knox said the saving of fuel and the increase of efficiency by the use of superheated steam had been the object of almost innumerable experiments extending over many years. As a result of the trial on their railway, the Furness Railway Company had four locomotives fitted with the system, and they were in regular work on the line. A fifth engine was also being fitted, and he understood that they were more than satisfied with the working of the apparatus. The coal-saving effected on the Furness Railway was slightly over 18 per cent. The directors of the line have decided to fit up four more locomotives. The Superheater Company were fitting locomotives for various companies with their apparatus. They had no hesitation in saying that they would be able to show a saving in fuel of from 15 to 20 per cent. If the whole of the locomotives on home railways had been fitted with the new apparatus, they would have saved last year something like two and a half million tons of coal. Mr. Henry Foster Grierson, the managing director, said he did not join the company until he had satisfied himself as to the success of the apparatus.

Proposed New Dock at Renfrew.—At the annual banquet of the Clyde Navigation Trustees, Sir Thomas Mason, chairman, intimated, in replying to the toast of the Clyde Trust, that a special committee appointed to consider the question of providing graving dock facilities to accommodate the largest battleships now being built had decided unanimously to recommend the Trustees to proceed with the construction of a new dock on the Trustees' land at Renfrew. He heartily approved of the scheme. The First Lord of the Admiralty had assured him that, unless ships could be docked at the port where they were built, it was a grave question whether they would be sent there. He hoped the Trustees would receive the committee's report with unanimous approval and adopt a progressive policy, which had been so successful in the past. It was their duty to see that any vessel coming to or built on the Clyde could be fully equipped ready for sea.

Extension of the Ofoten Railway.—The British Vice-Consul at Bergen reports that, owing to the increase in iron ore traffic on the Ofoten Railway, it has been decided to incur expenditure for various improvements and purchases connected with the railway to the amount of about £43,000. The following are stated to be among the chief items of expenditure contemplated: Extension of locomotive works, etc., about £8,000; three large locomotives, about £12,900; trucks, about £2,600; new crossing station, about £8,800; improvement and extension of existing stations, about £4,700. The Vice-Consul adds that calls for tenders for supplies to the Norwegian State Railways are issued by the State Railways Administration in Christiana, and that application for further information on this subject should therefore be addressed to Christiana, not to Bergen.—*Board of Trade Journal.*

Construction of Reservoir.—According to *Indian Engineering* (Calcutta) of 13th August, arrangements are now being made to begin work on the construction of the Tendula reservoir and canal in the Central Provinces. There will really be two reservoirs, one on the Sookha and the other on the Tendula river, connected by a conduit excavated through an intervening spur, in which will be situated the waste weir and spill channel for both reservoirs. The reservoirs, the combined capacity of which will be 9,350 million cubic feet, will be formed by the construction of two earthen dams, one, across the Sookha *nala*, 8,300 feet in length, and the other, across the Tendula *nala*, 6,350 feet in length. The maximum height of the dams from foundation to crest is to be 110 ft., and the greatest depth of water in the reservoirs will be about 70 ft. The connecting conduit will be 4,600 ft. in length and 12 ft. wide at the bottom. The distribution system will consist of a main canal 37 miles long, the Sigma branch 24 miles long, and various distributaries of a total length of 203 miles. The estimated cost of the whole project is 10,000,000 rupees (about £670,000).—*Board of Trade Journal.*

Curtiss Biplane.—What is known as the action system of balancing is adopted in the new Curtiss biplane. The usual plan is when one side rises for the driver to push a lever over towards that side, and so tend to lean away from the rising side. The Curtiss is provided with balancing planes having a span of 9 ft. 11 in., and a chord of 2 ft. 9 in. at the extremities of the main planes, and midway in the gap 4 ft. of each balancer projecting beyond the extremities of the main planes. Each is controlled by wires attached to a lever, which forms the back of the pilot's seat, so that when the machine heels over he leans towards the rising side, the wires alter the balancers, and the aeroplane comes back to an even keel. In this way, keeping the body upright automatically preserves equilibrium. For tilting in a fore and aft direction the ordinary method is employed. The pilot has in front of him a wheel mounted on a pivoted pillar. Pushing the latter forward or pulling it backwards makes the forward end of the aeroplane fall or rise, while turning the wheel to right or left causes it, by means of steering cables, to be deflected to right or left respectively. The engine is one of Curtiss's own design, with an eight-cylinder V-type water-cooled motor coupled to a 7 ft. propeller.

STEAM ENGINE DESIGN.—XXVII.

(*Continued from page 294.*)

Cooling Towers.

The design of cooling towers being a specialised product, is quite outside the scope of this article, but as the cooling plant forms an integral part of so many condensing installations, a short explanation of the principles involved and the types of tower generally used will be of interest.

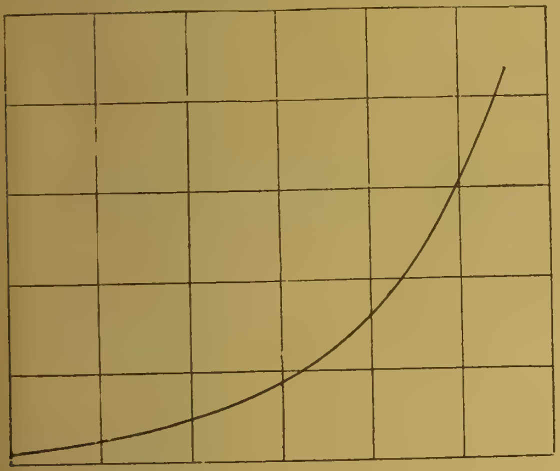


Fig. 143.

The usual construction is a high tower of wood or steel, arranged so that air can pass in through the bottom and out at the top, near which point the discharge water from the condenser is introduced. The water, by suitable nozzles and screens, is split up into fine sheets and sprays, so that as large a surface as possible is exposed to the air. At the base of the tower a sump receives the cooled water which drips from above.

The heat of the water is extracted in three ways—first, by radiation, which is very small; second, by heating the air, third, by evaporation. The chief effect is the third, but the second is an important part.

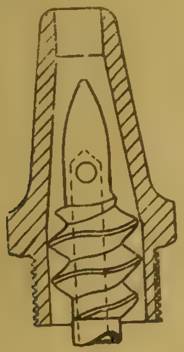


Fig. 144.

The vapour-carrying capacity of air increases very rapidly as the temperature rises. Consider the air entering the tower: the hot water dropping from above is accompanied with its vapour at a tension corresponding to its temperature. The air is heated and absorbs some of this vapour, thereby reducing the tension above the water, which will evaporate at a lower temperature in order to maintain equilibrium of vapour tension; this effect is progressive throughout the height of the tower. The great necessity is to keep the air constantly in motion, for, if stagnant, a condition of vapour tension equilibrium will be established as soon as the air is saturated.

The maximum water vapour carrying capacity of air at different temperatures is shown in the curve, fig. 143. It will be seen that at temperatures over 80 deg., the saturation point quickly increases. From a study of this curve the importance of knowing the usual humidity and temperature of the air in the locality in which the plant is to work will be recognised; obviously, if the air is saturated at entry, its vapour-carrying capacity is not so large as if it was only 50 per cent saturated.

The theoretic, and therefore very approximate, method of designing may be seen from the following formula:—

If W = pounds of water to be cooled from a temperature T deg. to a temperature T_0 deg;
t_1 and t_2 = initial and final temperature of air;
A = pounds of air required;
w_1 and w_2 = pounds of water in air at entry and exit;
Heat to be absorbed = $W(T - T_0)$;
Heat absorbed in raising temperature of air from t_1 to t_2 deg. (specific heat of air = 0·2375) = $A \times \cdot 02375\ (t_2 - t_1)$ B.T.U.;
Heat absorbed in evaporating $(w_2 - w_1)$ pounds of water (take latent heat = 1,000 B.T.U.) = $A\ (w_2 - w_1) \times 1{,}000$;
Therefore, $W\ (T - T_0) = A\ \{0{\cdot}2375\ (t_2 - t_1) + 1{,}000\ (w_2 - w_1)\}\ K$, where K = a constant determined from practice.

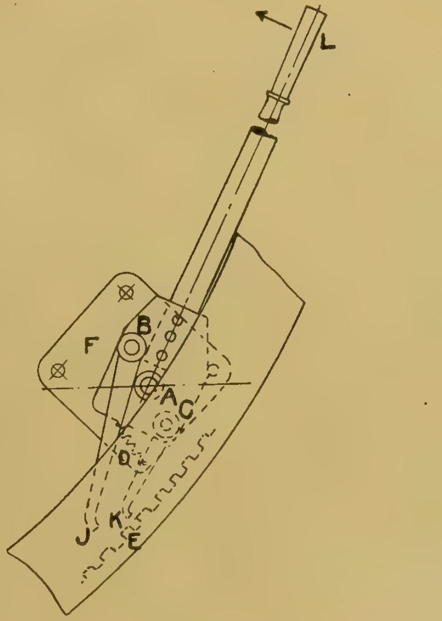


Fig. 145.

It is imperative that the air should be passed briskly through the tower; for this purpose either fans or natural draught may be used. The disadvantage of fans is the large amount of power which they consume, while for natural draught the tower only has to be made higher to give the necessary chimney effect.

The quantity of water lost by evaporation in cooling towers is from 80 to 100 per cent of the boiler feed.

Another method of water cooling is by spraying the water above a pond, allowing it to fall a moderate height so that the air can circulate through. A distributing nozzle, made by Messrs. Ledward and Beckett Ltd., is shown in fig. 144. The hot water is forced under a moderate pressure through the nozzle, which gives a rotating motion to the jet passing through, and by centrifugal force causes it to fly into drops. The cooling pond system is to be commended when space is ample, as the first cost of the installation is low, and water need only be supplied to the nozzles under 5 lbs. to

7 lbs. pressure. The space required varies from three to four square feet per horse power.

TURNING AND BARRING GEARS.

Every engine should be provided with some means of turning it independent of the main power, either for repairs or to bring the crank into a suitable position for starting.

Small engines often have holes drilled round the flywheel rim, into which a "tommy" bar may be inserted. As the size of engine increases, a greater leverage must be obtained; also, the turning device must be such that no danger is incurred by the operator in the event of the engine suddenly starting off or swinging over. Such an arrangement is shown in fig. 145; this type of gear is greatly favoured for all kinds of small engines, especially for those of the high-speed class. Referring to the drawing, E is a portion of the flywheel rim with a number of teeth or slots cast on. The stud A of fixed plate F carries a plate attached to the end of long hand lever L; on this plate are two studs B and A, from which levers J and K swing. When L is moved in the direction of the arrow, J will engage with the teeth on E, and as B is moving downwards will force the flywheel round in a clockwise direction; all this time C will travel upwards over the slots until L is over to the very left position. On pulling L to the right, C will travel downwards, engage with the slots, and so keep the turning movement up. The gear, as drawn, is in the off position; L is over to the very right, J rests on boss of L, and holds K up by a short chain D.

Very often, instead of placing the teeth inside the rim, they are on the periphery. The shape of slots may be like teeth (as drawn) or the ratchet type. The slot pitch varies from 2 in. on a 4 ft. wheel to $3\frac{1}{2}$ in. on a 18 ft. diameter wheel. On large engines the above gear becomes very laborious to work, and an arrangement giving much more leverage is necessary. A very common type of gear is shown in fig. 146. F is a section of the flywheel rim with internally cast teeth. By means of handles A A the worm wheel C is rotated through worm B. On the same spindle as C is keyed wheel D, which gears with pinion E, which in turn meshes with the teeth on the flywheel rim. To disengage, it is usually arranged that E can be slid along its shaft, or it is carried on a swinging frame which can be dropped out of gear.

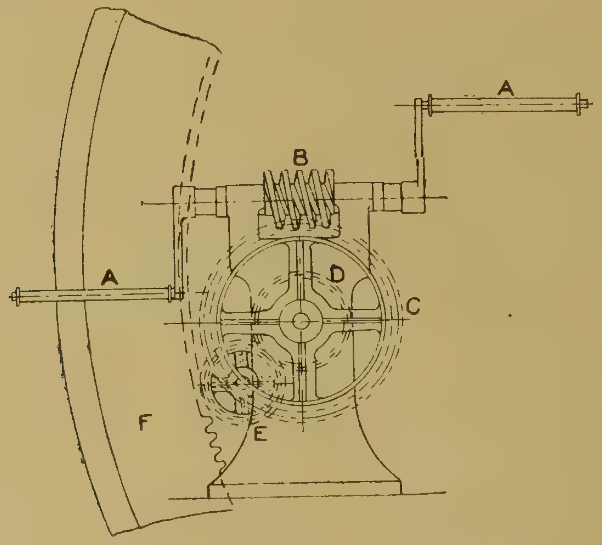


FIG. 146.

Very large engines nearly always have a steam turning gear; the arrangement shown in fig. 146 can easily be converted by shortening the cranks A and fitting a steam cylinder (cranks at right angles) on either side, giving a gear very much used.

The pitch of teeth on the flywheel may be the same as that given in connection with fig. 145, and it must be remembered that in deciding on the pitch, considerations of easy moulding enter largely into the design.

Marine turning gears, for large ships at any rate, are practically all of one type, and are nearly always driven by a separate steam engine, although sometimes they are driven by a chain from the reversing engine.

In fig. 147, J is the two-crank engine supported on the bracket F, which also carries a worm B direct coupled to the engine crankshaft. Worm B gears with wheel A, which drives large worm C, in turn gearing with worm wheel D, keyed on to the main engine crankshaft E. At the top of the vertical spindle there is a square G, on which a ratchet may be fixed for hand turning. The use of a special turning engine is hardly justified on small ships; a ratchet is quite sufficient.

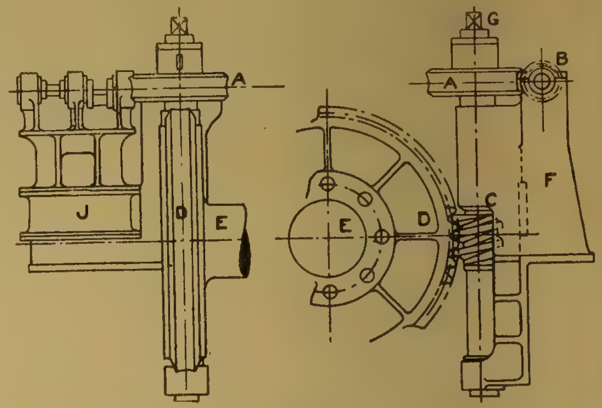


FIG. 147.

For three and four crank engines the resistance to turning R can be obtained from

$$R = 1{,}000 \text{ to } 1{,}400 \times D \text{ inch lbs.,}$$

where D = crankshaft diameter.

It is usual, as shown, to key large wheel D on one of the couplings. Always in naval and often in passenger ships the worm is forged steel and the wheel of bronze; in the merchant service, a cast-iron wheel and bronze worm is favoured.

$$\text{Pitch of teeth on large wheel, D} = p = \frac{4{,}300\ D}{b\,f}$$

b = 2·0 to 2·25 p.

f = 3,500 bronze,

= 3,000 cast iron,

= 5,000 steel.

The stress in the small wheel may be obtained from a consideration of the gear ratios; usually the reversing engine makes 1,500 to 2,500 revolutions to one of the main engine, and this must be done in about six or seven minutes.

It must be remembered that the effort at the engine crankshaft will be

$$\frac{R}{x\,\eta}$$

Where x = gear reduction (over all),

η = efficiency of gear 25 to 33 per cent.

(*To be continued.*)

ACCORDING to a Reuter cable in the *Glasgow Herald* a huge railway project, backed by extensive New York capital, for the construction of a railway which will traverse the entire length of Alberta from the international boundary to Peace River, a distance of 700 miles, and which will be connected with the Hill system in Montana, has just been submitted to and approved by the Alberta Government. Work on the first 100 miles has already begun.

AN IMPROVED LIQUID-FUEL FIRING SYSTEM.

The liquid-fuel firing system for steam generating purposes under consideration is designed to provide for the more convenient and efficient utilisation of liquid fuel in steam boilers, especially boilers for steam launches and other craft.

To effect the vaporisation or atomisation of the crude oils commonly used in liquid-fuel firing systems both steam and compressed air have been employed. For marine purposes the use of steam only is inconvenient owing to the irrecoverable consumption of boiler feed water, and is less economical than the use of air, whilst the use of air only necessitates a compressor driven independently of the main engine, or an air reservoir of inconvenient dimensions. It has also been proposed to arrange for steam to be used instead of air and steam in conjunction with air for atomising the oil in the event of breakdown to a blower which is driven independently of the main engine.

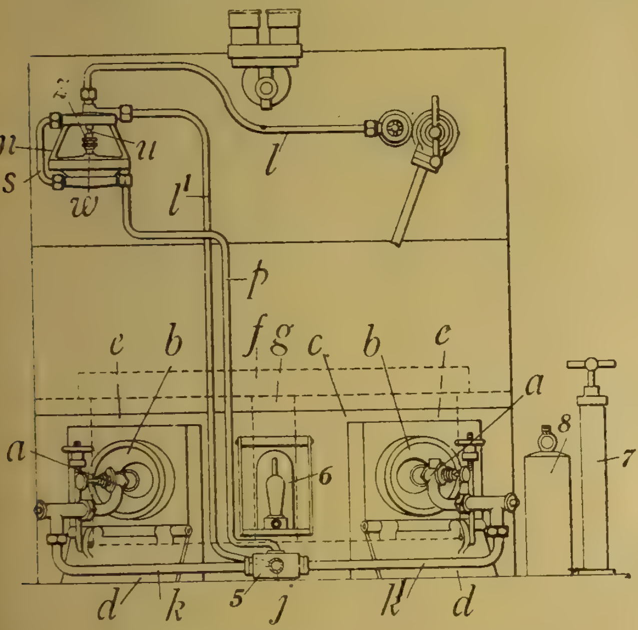


Fig. 1.

The system we are about to describe, which is the invention of Messrs. T. A. and W. E. Savery, of Newcomen Works, Bracebridge Street, Birmingham, comprises the utilisation of air from a compressor driven by the main engine for normal working and steam as an auxiliary and during temporary stoppages of the engine, together with means for automatically changing over from air to steam, and regulating the supply of steam to supplement any deficiency of air as required. There is also provided the automatic regulating device and firing arrangement hereinafter described.

The apparatus is shown in front elevation in fig. 1, and in part sectional side elevation in fig. 2; the latter is showing diagrammatically a water-tube steam launch boiler and engine fitted with the present system of firing. Fig. 3 is a vertical section showing an automatic regulator for controlling the steam supply to the oil burners.

A pair of burners or vaporisers *a* are employed. A convenient type of burner consists of an annular passage for the oil and one or more concentric passages for the air or steam. Each burner is mounted at the inlet of a conical aperture *b* of suitable refractory material in the firebox front or cover *c*, so that with the issuing jet of atomised oil and air or steam sufficient air is drawn in from the external atmosphere for complete combustion of the mixture. Additional air may be admitted through an adjustable valve or damper *d*. The firebox is lined as usual with refractory material, and an open-fronted chamber *e* is arranged at the back of the firebox opposite each burner, the cover or deflecting baffle *f* being provided to prevent direct action of the flame on the boiler tubes. A space is provided at the back as well as at the front of the cover piece of the chamber to obtain an advantageous distribution of the hot gases, and apertures are also provided in the part *f*. It will be observed that the chambers are divided by a central partition *g*.

The compressed air for the burners is obtained by means of any suitable compressor driven by the engine, which is shown diagrammatically at *h*; the preferred arrangement comprising a cylinder *i* mounted above and co-axially with one of the engine cylinders and a piston actuated by an extension of the rod in that cylinder, the valves being of any convenient type.

Whilst the engine is running normally, air only is supplied to the burners by the pipes *j*, *k*, and k^1, but when the engine speed falls below that required to produce an adequate quantity of air, steam is admitted by way of the pipes $l\,l^1$ to the pipes $k\,k^1$, and thence to the burner to supplement the air, and during temporary stoppages of the engine steam alone is supplied. The regulation or control of the steam is effected automatically. For this purpose a regulator *m*, shown in fig. 3, actuated by the compressed air, is employed. This regulator comprises a flexible diaphragm *n* forming one side of a compartment *o* communicating by a pipe *p* with the air pipe *j* from the compressor. In conjunction with the diaphragm *n* are a pair of smaller diaphragms $q\,q^1$, one of which *q* is situated immediately beneath and forms another side of the compressed air compartment *o*, and the other q^1 above the larger diaphragm in a chamber *r* to which the steam supply pipe *l* is connected. The underside of the lower steam diaphragm is put into communication with the upper side of the upper steam diaphragm q^1 by a byepass pipe *s*. Within the steam compartment *r* is provided a valve *t* controlled by a stem *u* actuated by the air diaphragm *n*, and also a plate or partition *v*, which prevents blowing out of the water in such compartment by the steam into the pipe l^1.

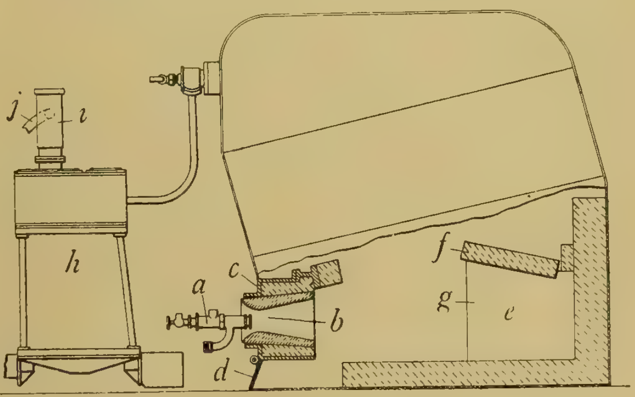


Fig. 2.

When the pressure in the air cylinder *i* is insufficient to actuate the air diaphragm *n*, the valve *t* is opened and steam is admitted from the boiler to the burner by the pipes $l\,l^1$, *k*, and k^1. With the engine at rest the burner is actuated by steam. But when the engine is running at sufficient speed the compressed air acting on the diaphragm *n* closes the steam valve *t* through the medium of the stems *u* and *w*, and holds the valve on its seating, so that air only is admitted to the burner along the pipes *j*, *k*, and k^1. When the engine is running slowly and the air pressure is insufficient to maintain the steam valve closed, the latter opens to an extent dependent upon the deficiency of air pressure, and passes a corresponding supply of auxiliary steam to the burner. The control of the steam and the change over from steam to air and *vice versa* is effected quite automatically. When running at maximum power output the fuel supply may sometimes require to be increased beyond what is obtainable with the normal air supply. In this case supplementary steam is admitted to the burners by a hand or automatically controlled regulator, or by suitably adapting the regulator above described to permit of opening of the steam valve independently of the actuation by compressed air.

Provision is made for adjusting the opening of the steam valve or the pressure required to actuate it, for which purpose the stems u and w are preferably screwed together, and on the stem w is arranged a spring x, which is supported by a bridge piece y and compressed by the nuts z. To adjust the opening of the valve, the stem u is rotated relatively to the stem w, whilst to vary the pressure required to open or close the valve the nuts z are suitably actuated. To enable the valve to be independently opened by the attendant for allowing steam to pass to the burners when air pressure is sufficient to close the valve t, a handle 2 with a screwed boss 3 adapted to abut on a shoulder 4 on the stem w and engage a screwed recess in the part y is provided. This device is also sometimes useful when starting up, as it enables the regulator to be put out of action and steam only supplied to the burners. The diaphragms n and q are connected by a continuation of the stem w. The use of the diaphragm q^1 avoids the provision of a gland through which the stem u can move, and so enables a steam-tight joint to be readily maintained around the stem. No glands are employed in any part of the regulator. The diaphragm q is required to neutralise the pressure of the steam on the diaphragm q^1, which would otherwise counteract the pressure of air on the underside of the diaphragm n. In order to prevent the passage of steam into the air pipe j and the accumulation of condensation water therein, a check valve is provided in a box 5 at the junction of the pipes j, k, and k^1, and access of water to the compressor or the discharge of water into the burners by the air is thus avoided.

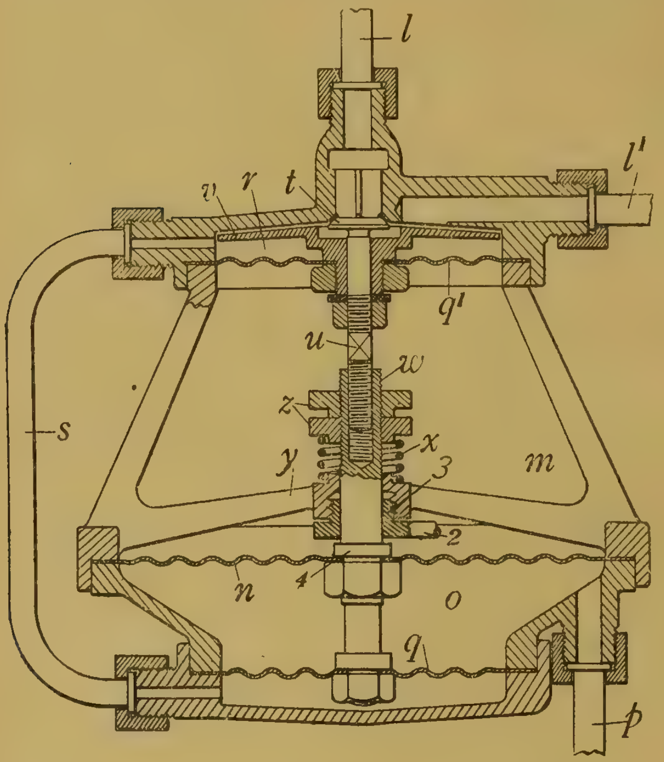


Fig. 3.

Starting is effected by a petroleum burner 6 operated from a hand air compressor 7 and a small oil reservoir 8, or by a fire or any other suitable and ordinary means.

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"Electric Motors—Continuous, Polyphase, and Single-Phase Motors—Their Theory and Construction." By H. M. Hobart. Second Edition, re-written, revised, and enlarged. London: Whittaker and Co. Price 18s.

The first edition of this work received a favourable impression from those engaged in the design, construction, and working of electric motors. The author is responsible for the design of many large installations, and his practical experience is of the greatest value as apart from mere theoretical evolution.

The subject being a progressive one, the practice changes, and the first edition, while being of a standard character at the time of its appearance, has had to be modified to bring it into line with present practice. Much old matter has been omitted, and the new volume includes many new designs. This is particularly the case with the chapters dealing with single-phase motors, and the development of motors for operation with polyphase and continuous current. The revision has been thorough throughout, much has been entirely re-written, and the whole volume considerably enlarged. It would be invidious to lay stress upon any separate portion of this work, as the whole represents a monument of painstaking efforts which electric motor designers and builders cannot too highly prize.

The book contains 748 pages, with about 800 illustrations, and to the publishers is due no little credit for their excellent production.

"Power and its Transmission." By T. A. Smith. London: E. and F. N. Spon. Price 2s. net.

This little work is intended to assist shop foremen, works managers, and others who have to do with the erection and care of engineering and power-driven shops. It gives some general information on the materials used, and the means by which the highest efficiency in running may be secured. Many managers hardly realise to what extent inefficient or badly-erected transmission gearing affects the annual cost of upkeep; moreover, they fail to recognise where the erection of gearing is at fault or where the working can be improved. It often means the difference between failure and success of a works.

The chief items dealt with comprise belting, shafting, pulleys, lubrication, woodcutting by circular saw, rope driving and wire ropes, and the information given is practical and concise. Two further chapters include some careful notes on the working of the four-cycle gas engine, and upon electric power driving, with an explanation of the more commonly-occurring electrical terms.

This handbook, though small, is a storehouse of reliable information, of value to not only the manager but every hand employed in the factory and workshop.

Books Received.

"Motor Boats Simply Explained." By John Douglas. Illustrated. London: Percival Marshall and Co. Price 1s. net.

"Windmills and Wind Motors: How to Build and Run Them." By F. E. Powell. The Model Engineer Series, No. 36. London: Percival Marshall and Co. Price 6d.

"Journal of the American Society of Mechanical Engineers." Vol. XXXII., No. 9., September, 1910.

THE OERLIKON ELECTRO-HYDRAULIC PORTABLE RIVETER.

In order to combine the advantages of electrical transmission and hydraulic power the Maschinenfabrik Oerlikon, of Oswaldestre House, Norfolk Street, E.C., have recently designed the portable riveter. Electricity is admirably adapted for conveying power to any portable machine, but no really effective way has hitherto been devised of using it to do the work required in riveting. For such work hydraulic pressure has been unsurpassed; hence the attempt in the present machine to utilise the good points of both systems. Referring to our illustrations, it will be seen that the riveter can be slung at either of two points, and can work at any angle either horizontally or vertically. The frame is a steel casting, with a gap having a depth of 30 in. and a width of 16 in. The lower snap is fixed, the other being operated by a piston working in a cylinder formed in the frame. An electric motor of 4 H.P. to 6 H.P. at 1,420 revolutions is mounted as shown, and drives a reciprocating pump by means of worm-reducing gear and a pair of connecting rods. A starting resistance for the motor is bolted to the frame close to the motor. The pump is a differential piston pump with a bronze-bushed cylinder, and makes 170 strokes of 1½ in. length per minute. It acts upon a mixture of water with about 40 to 45 per cent of glycerine, as this liquid does not freeze at temperatures higher than from 2 deg. above zero Fahrenheit to 13 deg. below zero Fahrenheit, and thus the machine can be exposed to any ordinary frost without danger of bursting. The capacity of the pump is equivalent to a circulation of about 2 gallons per minute.

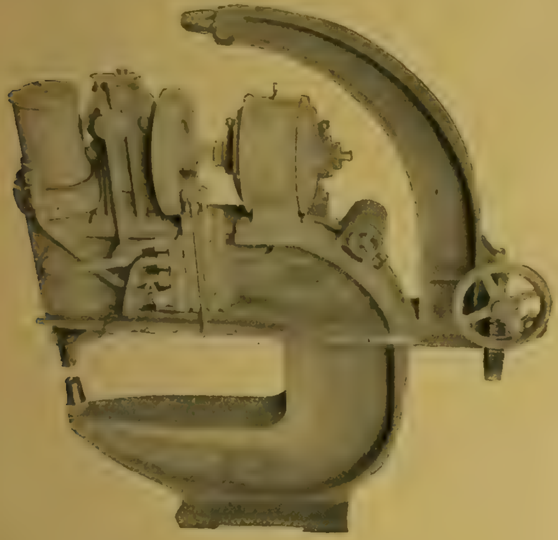
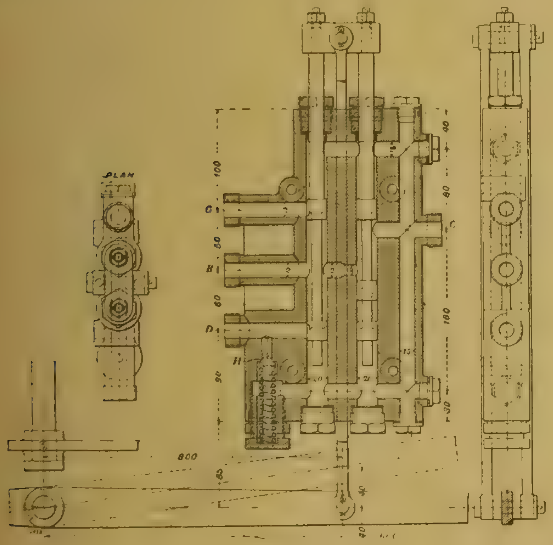


Fig. 1.



Figs. 3, 4, and 5.

Figs. 3 to 5 show the valve gear by which the riveting is controlled. The cylinder is built for a maximum riveting pressure of 90,000 lbs., the machine being designed to deal with rivets up to ⅞ in. in diameter. The piston is 160 mm. (6·3 in.) in diameter, and has a stroke of 2⅝ in. It is packed by means of rings, and prevented from turning round by vertical external guides. The snap is set eccentrically forward by 70 mm. (2¾ in.) from the centre line of the ram, so that rivets may be closed when close to flanges. The downward speed of the ram is 16·5 in. per minute, and the return 70 in. per minute, the pressure acting on the annular surface beneath the piston for the return stroke.

The pump, on its upward stroke, draws liquid from the reservoir above the riveting cylinder by means of the pipe A. On the down stroke of the pump the liquid is forced into the valve chest by the port B (fig. 3). If the hand lever is in its central position as shown, the liquid simply passes round the stems of the two valves, and away by the nipple C to the reservoir; consequently the ram remains at rest. With the hand lever in its lower position, the liquid entering at B passes round the first valve stem, and away through D to the ram cylinder, which it enters by the pipe E. The ram, therefore, descends, the water in the annulus, under the piston, escaping by means of F. This water enters the valve chest at G, and flows away to the reservoir by means of the upper transverse port and the nipple C. It will be noted that the full pressure may be maintained on the rivet as long as desired, as when the ram comes to rest on the rivet the water from the pump can escape to C by lifting the spring-controlled valve H. The spring on this valve is adjustable, and by it the maximum pressure possible on the rivet may be determined.

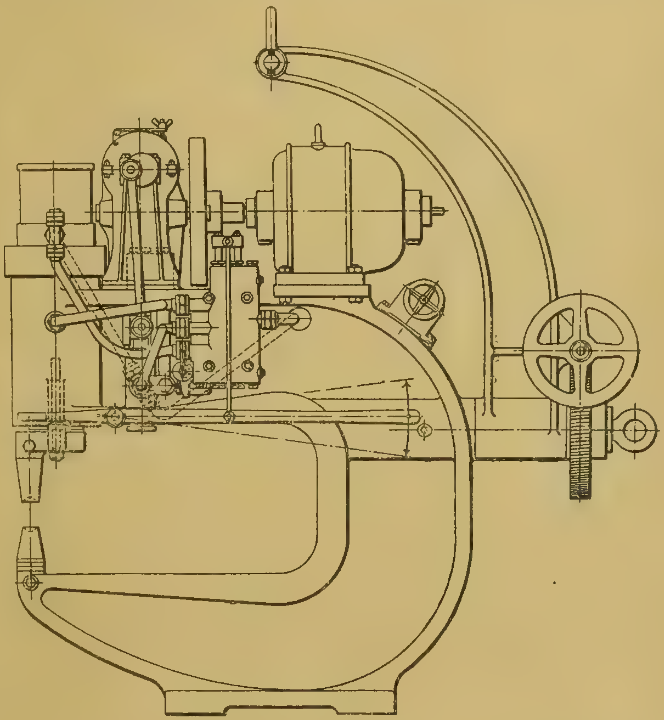
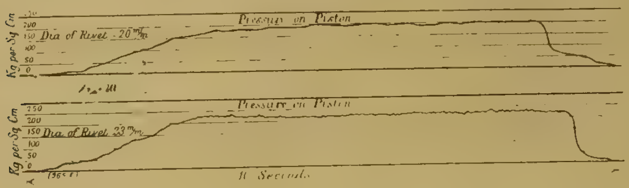


Fig. 2.

To raise the ram the hand lever is moved to its top position, and the water, entering at B, then passes out at G, and enters the annulus under the piston by F. The water above the ram escapes by E, and passes back to the reservoir by way of D, the lower port, and C. As the water entering the annulus is much less than that escaping from above the ram, the float in the reservoir will rise. This float is fitted with packing rings, and keeps the liquid in the chamber to whatever angle the riveter is tilted.

The diagrams reproduced in Figs. 6 and 7 show the variation in pressure on the piston during 10 seconds. It rises steadily, and is maintained almost perfectly constant for several seconds, squeezing the closed rivet. The vertical scale of the diagrams is 50 atmospheres, or 735 lbs. per square inch for each division, so that the maximum water pressure was about 3,400 lbs. per square inch. Fig. 8 gives curves illustrating the efficiency of the motor and machine. Curve I. is the percentage of the theoretical piston speed obtained at various working pressures, the faling off being due to the inevitable slight slip past the valves and C. Curve II. gives the relationship between the revolutions of the motor and the pressure; Curve III., the amperes taken by the three-phase motor at 50 cycles and 240 volts; Curve IV., the efficiency of the motor at various loads; Curve V., the power factor of the motor at various loads; Curve VI., the output of the motor in brake horse power for various closing pressures; Curve VII., the effective work in horse power done by the machine; Curve VIII., the efficiency of the worm gear; and Curve IX., the losses due to friction of the water. The vertical scale marked J represents amperes, and that marker N horse power. The machine is, as will be seen from the illustrations, very compactly built. Its weight is 2,750 lbs., which is naturally somewhat more than that of an ordinary hydraulic machine. Against this, however, considerable advantages are claimed. During a ten hours' run we understand that 1,000 rivets, ¾ in. in diameter, have been put in by three men only, although no special facilities for speed were arranged. Fig. 9 shows a section through some ⅞ in. rivets closed by the machine, the specimen having been polished and slightly etched to bring out its features.



Figs. 6 and 7.

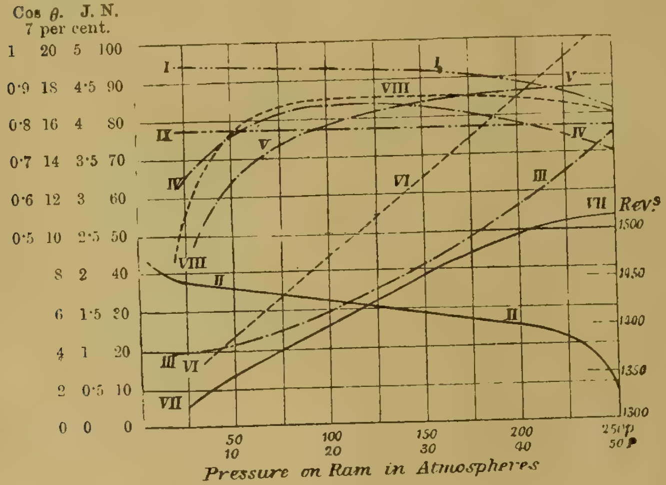


Fig. 8.

The Oerlikon Works build also riveters—of course, on the principle of above described system—of a very much bigger and heavier calibre. Figs. 10 and 11 illustrate, for instance, a machine for the tube and boiler industry. It embodies an essential feature for this large type of machine, viz., that of a sheet closer arranged concentrically with the snap. A great variety of other riveting machines for specific industries are also designed and built at the Oerlikon Works.

The advantages of the portable type of Oerlikon electro-hydraulic portable riveter are as follows:—

Labour saving: 1,000 ¾ in. diameter rivets have been effectively placed and finished during a 10 hours' run by three men only (two men carrying the rivets and parts to be riveted) without any special arrangements having been made to facilitate the work and accelerate same.—*Portability and easy handling*: The apparatus can be employed either in shops or on outside constructional work. It can be slung into any conceivable position on the crane hook, and it makes the work very get-at-able.—*Independent of locality*: No compressed air or hydraulic pipes are required, nor any pumping installations. The Oerlikon Riveter combines all these in a compact body and becomes therefore independent of localities. It can be used wherever a flexible cable may be connected by means of an ordinary plunger switch to an electric supply circuit. It is, therefore, adaptable for any standard or special jobs in factories or on outside work.—*Time period of dwell and pressure in pounds per square inch on rivet head*: These are adjustable to suit the size and diameter of the rivet, and to insure a perfect job, two features which are not found combined, so far as we know, in any other type of riveter.—*Readiness for immediate use*: The riveter, combining prime mover and plunger in one apparatus, is

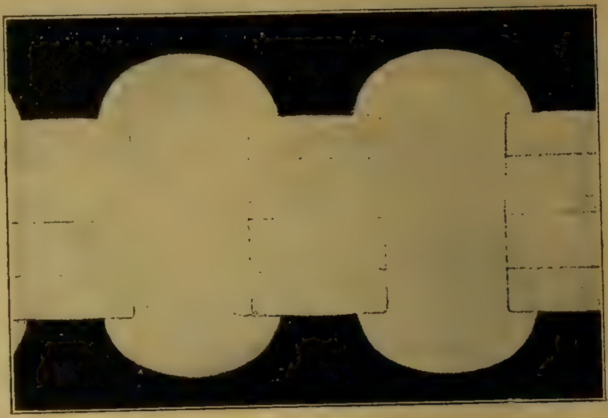
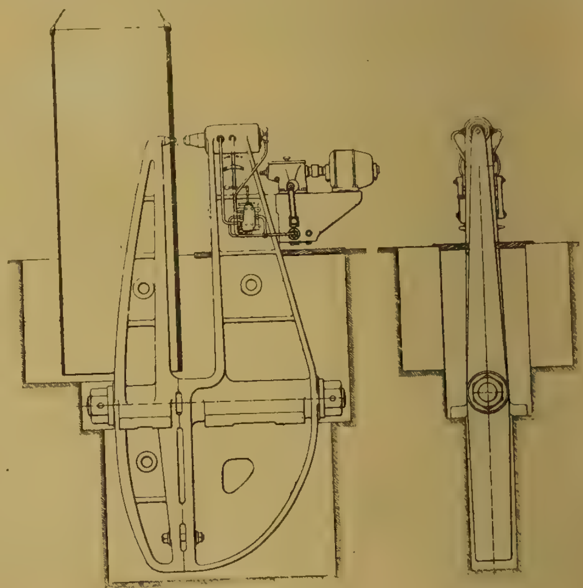


Fig. 9.



Figs. 10 and 11.

tested at our works and carefully adjusted, and is, therefore, ready for use immediately on delivery, either in shops or on outside work—an additional advantage to commend it to users.—*No risk of breakdown*: The Oerlikon Riveter is of extremely robust design, and as there are no connecting pipes which can be broken, leakages, etc., are therefore eliminated in this riveter. If there is a series of riveters at work, one may temporarily go wrong from some cause or another, without throwing the others out of commission, which would happen in the case of the centralising of the pumping station of either the hydraulic or pneumatic type.—*Price*: It will be found that the price of the Oerlikon Electric Hydraulic Riveter of the portable or stationary type compares very favourably indeed with that of the pure hydraulic or pneumatic type, if to the latter two the cost of the necessary pipe work and pumping station is added.

As regards the Oerlikon Electro-hydraulic Riveter of the stationary type, this tool possesses similar advantages to those mentioned in connection with the portable type of riveter, as in principle it is built exactly on the same lines. It is specially adapted for use in boiler and tube work, heavy railway and bridge work, shipbuilding work, etc., etc.

In this case also the idea of the centralisation of the riveting installation (adopted with pure hydraulic and pneumatic riveters) so excellent on paper, very often works out to a disadvantage in so far as leakages or breaking in the main pipe work, or the pumping installation throws the whole series of riveters out of commission, and these accidents frequently occur when shops are most crowded and work most pressing.

The independent action of the Oerlikon Electro-Hydraulic Stationary Riveter obviates all these inconveniences.

The Oerlikon Company's British and Colonial Department, at Oswaldestre House, Norfolk Street, Strand, W.C., is under the direction of Mr. G. Wüthrich, manager and chief engineer, from whom all further particulars relating to the above apparatus can be obtained.

BOILER EXPLOSIONS.

Abstracts from Recent Board of Trade Reports.

Explosion from a Steam Kettle.

Report of Preliminary Inquiry No. 1,938.—The explosion occurred at 6 a.m. on the 29th March last, at Slack Mills, Hyde, near Manchester. Messrs. The Slack Mills Company Limited, cotton spinners and manufacturers, are the owners of the steam kettle. The kettle, which was used for boiling water for the use of the employees at the mill, consisted of a cylindrical shaped copper vessel, 2 ft. 6 in. in diameter, and 3 ft. 6 in. in height, over all. It was heated by means of an internal steam coil. The sides and bottom of the vessel were made of sheet copper ⅛ in. in thickness, all seams being formed by single-riveted lap joints. The bottom was of conical shape, and the cover, which was $^3/_{16}$in. in thickness, was flat and unstaved. The side plating was flanged at the top to receive the cover, which was secured by means of ¼ in. bolts pitched 2 in. apart. The cover was in two parts, and was joined together by means of a butt strap which was soldered to one part and secured by copper rivets pitched 4 in. apart. The other part of the cover was connected to the butt strap by ¼ in. bolts pitched 3½ in. apart. All the bolted seams of the cover were made steam tight by means of asbestos jointing material. An internal coil, of ¾ in. bore, was provided in the bottom of the vessel, to which steam was supplied through a ¾ in. cock and pipe leading direct from one of the boilers, the safety valves of which were loaded to a pressure of 110 lbs. per square inch. The lower end of the coil passed out through the side of the kettle, and was connected to a drain pipe ½ in. in diameter, which conveyed the water of condensation from the coil to a small trap. A relief pipe, of ¾ in. bore, was fitted to the cover of the vessel, and was open to the atmosphere, to provide for the escape of any steam generated in the apparatus. Six draw-off taps were fitted to a branched pipe connected to the front of the boiler at the bottom, and a water supply valve was fitted near the top. The kettle was provided with a glass water gauge, and a large cock was fitted to the bottom for running off the liquor when the apparatus was being rinsed out. The cover bulged up at the centre, shearing all the bolts in the butt strap joint across the cover and 16 of those in the circumferential joint. The joints opened up where relieved by the failure of the bolts, allowing the boiling water and steam to escape into the kettle house. The explosion was caused by over-pressure due to the relief pipe being too small to allow for the escape of all the steam generated in the kettle when the heating steam was turned fully on. Four persons were injured by the explosion.

Explosion from the Starboard Main Boiler on s.s. Liverpool.

Report of Preliminary Inquiry No. 1,939.—The explosion occurred about 12-30 a.m. on the 16th March last, on board the steamship Liverpool, while lying in the Salisbury Dock, Liverpool. The boiler is the property of the Sligo Steam Navigation Company Limited, Sligo. The boiler is of the marine type, single ended, 12 ft. 8⅝ in. in internal diameter by 10 ft. 6 in. long, over end plates. It is built of steel, and fitted with three corrugated furnaces, each 3 ft. in internal diameter. There are in the boiler 66 stay tubes, 3¼ in. in external diameter by $^5/_{16}$in. in thickness, and 166 plain tubes, 3¼ in. in external diameter, by 9 W.G. (·144 in.) in thickness, all tubes being of B.B. iron. The usual mountings are fitted to the boiler, including two spring-loaded safety valves adjusted to lift at a pressure of 163 lbs. per square inch. On 13th March last, on the passage from Sligo to Liverpool, one tube in the top row of the starboard box was found leaking slightly, and this tube was renewed at Liverpool on 14th March. One of the plain tubes in the starboard box collapsed on the under side at the combustion chamber end for a length of about 27 in., and ruptured, the steam and water escaping through the opening thus made. The explosion was caused by the tube corroding on the water side until it became too thin to withstand the pressure. The corrosion was confined to the under side of the tube, the upper surface remaining practically as when new. A fireman and the chief engineer were injured by the explosion.

Explosion from a Heating-Tube in a Baker's Oven.

Report of Preliminary Inquiry No. 1,940.—The explosion occurred about 7-35 a.m. on the 4th April, 1910, at Woodman's Stores, Swanmore, Hampshire. The oven is the property of Messrs. Dyer and Sons Limited, whose registered offices are at 107, High Street, Winchester. The oven is a double-deck steam oven, and consists of three separate compartments; the top and centre compartments, which are of equal dimensions, form the ovens, the bottom one being the prover. The dimensions of the ovens are: Length 5 ft., breadth 4 ft., and depth 2 ft.; the prover being 5 ft. long, 2 ft. broad, and 2 ft. deep. The sides, front, top, and bottom of the oven are double, the space between the inner and outer casings, which is about 6 in., being filled with silicate cotton. The front and sole plates are of cast iron; the remaining parts of the inner and outer casings are constructed of wrought-iron plating about ⅛ in. thick. The ovens and prover are heated by means of 59 hermetically-sealed iron tubes, each of which contains about four and a half ounces of fresh water. The tubes, which are 6 ft. 6 in. long, $1^{5}/_{16}$in. in external diameter, and $^{13}/_{16}$in. in bore, are aranged in three rows with 19 in the top, 16 in the centre, and 24 in the bottom. All the tubes are made of best Staffordshire iron, butt-welded longitudinally, and cup-welded at the ends. The tubes are so arranged in the oven that they pass through the brick wall forming the front side of the furnace, exposing about 7 in. of each tube to the direct action of the flame or heated gases. The furnace, which is constructed of bricks, is about 4 ft. 4 in. long and extends from the bottom tubes to just above the top row, the bottom row forming the firegrate. The draught is regulated by means of the ashpit or furnace door and the damper, the latter regulating the passage by which the heated gases pass from the furnace to the flue leading directly into the chimney. Above the top flue, and separated therefrom by means of a single row of bricks laid on their flat, is a tank containing fresh water, which can be drawn off for ordinary purposes. There is also a pipe leading from the tank into the prover, so that a jet of steam may be introduced if necessary. Two mercurial thermometers are fitted, one to each oven, and these are the only gauges provided for the baker's guidance in regulating the temperatures and pressures in the tubes. The usual temperatures at which the ovens are worked are said to be about 350 deg. Fah. and 400 deg. Fah., in the upper and lower ones respectively. The back end of the eighth tube from the furnace door, in the centre row, burst with a loud report, and its contents escaped into the furnace. The tube failed along the weld, and then ruptured across the metal at the end and other side diametrically opposite to the weld, the length of the fracture being 12½ in. The explosion slightly displaced the fresh-water tank, and the stopper which closes the front of the top flue was blown out and fell on the bakehouse floor, about 8 ft. away from the oven. The brick wall forming the outside of the furnace, and against which the tube abutted, was also partly displaced. The explosion was due to the defective welding of the tube. The two edges of the metal forming the longitudinal seam of the tube being badly welded, in way of the failure, the tube was unable to withstand the pressure generated. No person was injured by the explosion.

Explosion from a Main Steam Pipe on s.s. Mary Ada Short.

Report of Preliminary Inquiry No. 1,941.—The explosion occurred on the 20th April last at about 4 p.m., when the vessel was in the English Channel, a short distance from Dover. The vessel is owned and managed by Messrs. J. Westoll, 13, John Street, Sunderland. The pipe was made from a solid-drawn copper tube 4½ in. in internal diameter, No. 6 S.W.G. in thickness, and 9 ft. 3 in. in length. The ends of the pipe were fitted with brass flanges, brazed on in the usual manner, and the end adjacent to the boiler was fitted with a solid-drawn copper sleeve about 12 in. in length. In February, 1910, a solid-drawn copper sleeve about 12 in. long was fitted at Barry to the forward end of the pipe. In April, 1910, the sleeve was removed at Constantinople owing to a fracture in it, and another solid-drawn copper sleeve was fitted, the pipe, after repairs, in each case being annealed and tested by water to 400 lbs. per square inch. The pipe fractured circumferentially for a length of 6 in. at the neck of the flange adjoining the stop valve on the starboard boiler. The boiler pressure was 160 lbs. per square inch, and steam escaped from the fracture in the pipe. The explosion was due to the material being unable to withstand the stresses set up by the movement of the vessel and machinery and the expansion of the pipe.

MAKING SMALL GRINDING WHEELS FOR INTERNAL WORK.

A not uncommon practice amongst operators of grinding machines who turn out accurate work is to make their own small wheels for use on internal work from fragments of larger wheels used for external work which have become worn down too small for further service. An advantage possessed by wheels made from these fragments or pieces is that they are found to cut more freely in smaller sizes than those bought. A difficulty usually experienced is the making of the holes, which operation is frequently effected by means of an old file tang or some such tool with only a moderate amount of success. The following method given by a writer in the *American Machinist* may prove of service to some of our readers who have to undertake such work:—

"Take a piece of thin steel tubing of external diameter approximately the size of hole required, and with a three-square rough file of fair size make three or four coarse teeth in the end of tubing after the manner of the teeth in a hollow mill, then chuck the tube in a drill press, and with a rather slow speed it will take a core clean out of the piece of abrasive in a second or two. The teeth in the tubing will need renewing after cutting through a few pieces; this can quickly be done with a few strokes of the file.

"The outside of the intended wheel should be trimmed up fairly concentric with the hole on a roughing bob, or with an old rough file before using."

NEW TYPE OF ALTERNATING-CURRENT ELECTRIC LOCOMOTIVE.

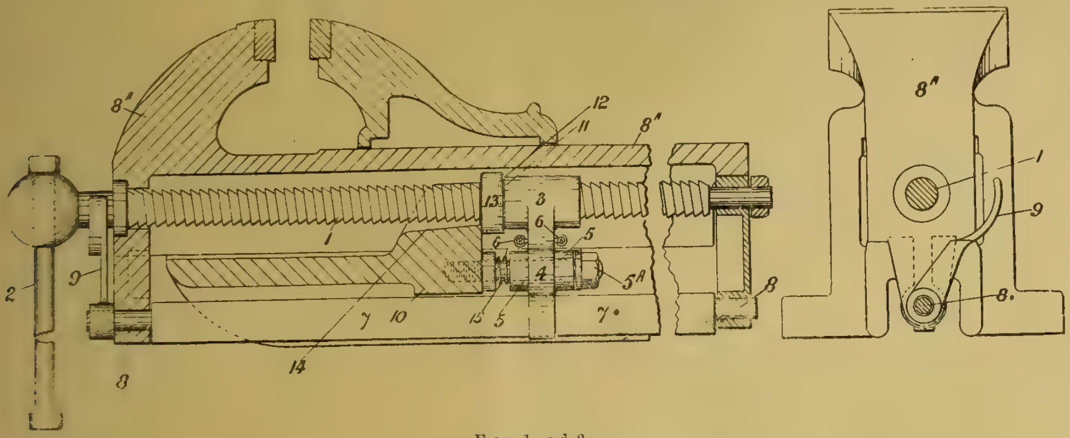
A discussion on a paper relating to the above subject recently took place between Messrs. Brecht and Sanzin on the subject of the best method of transmitting the motive power to the driving wheels, and according to the *Zeitschrift des Vereines Deutscher Ingenieure* the latter gentleman advised the employment of the system of parallel shafts with an auxiliary between the driving wheels, a dictum that Mr. Brecht did not entirely agree with, and said that, in his opinion, the arrangement was not a rational one in the majority of cases. The author interposed in the discussion, observing that not only should the effort of traction, which would apparently be considerable, but which in reality would be limited, be especially considered, but more particularly attention should be paid to centrifugal forces which, as is well known, increase in a ratio equal to the square of the speed, and which for high speeds may rise to considerable values. At a speed of 120 kilometres per hour the motor already makes from 350 to 400 revolutions per minute according to the diameter of the driving wheels, and the number of changes in direction of the shocks caused by the action of centrifugal forces is 12 or more per second for each side of the locomotive. With a weight of the spindle itself of 120 kilogs., 0·6 m. diameter of the shaft, and 1·8 m. diameter of driving wheel, the centrifugal force already reaches an amount of 1,250 kilogrammes. It will be seen that the action of these forces on the connecting rod heads is not to be neglected, the more so that the number of shocks in given time plays an important part in this connection.

THE LUBRICATION OF HOT ROLLS.

The journals of machines fitted with hollow rollers are frequently found to be troublesome to lubricate. In this direction the following abstract from the experience of a manufacturer, recently given in our American contemporary the *American Machinist*, may prove interesting to some of our readers: The order was for a machine that included three gun-metal rollers heated by gas to a temperature of about 700 deg., and it was found when running that oil or grease carbonised and cut the journals. A trial was then made of graphite and the result was found to be excellent. The method of applying the graphite to the journals was very simple; the channels for conveying the lubricant to the journals were cut in the boxes about ⅜ in. wide and ¼ in. deep, one on top and one at a little above and on each quarter. Besides this, a spiral groove of the same dimensions was cut for about two turns, commencing at about 1 in. from the other end of the box and near the bottom. The journals took about a dessertspoonful of graphite per day to each journal, and the machine attendant occasionally removed the cap from the cup, churning down a little of the graphite with the $^{3}/_{16}$ in. rod.

AN IMPROVED VICE.

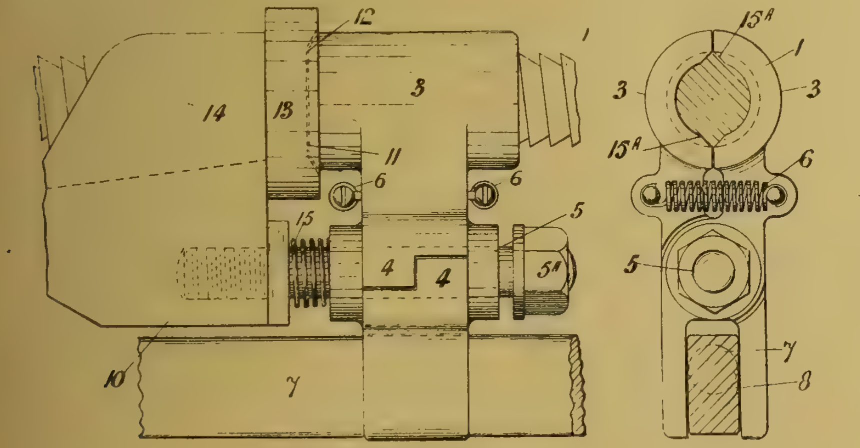
THE improved parallel vice shown in our illustrations is of the class in which the nut is made in two portions or halves pivoted together and closed on the operating spindle or screw by a tilting bar or rod, and normally opened by a spring, and so brought into or out of mesh with the spindle or screw, and when the nut and screw are disengaged the movable jaw of the vice can be rapidly slided up to the work, or the jaw opened or closed, and when so moved the nut and screw can be engaged and the jaw screwed tightly into position.



FIGS. 1 and 2.

The present improvement is the invention of Messrs. R. W. and L. H. Bateman, of Leeds, and is designed to achieve these desired results in a vice with extreme simplicity and at comparatively small cost, the invention comprising a divided nut closed by a spring and opened by an eccentrically mounted bar or rod, the divided nut when closed being held in this position owing to one of its ends being convex and engaging with a concave recess in the face of a disc or washer, or in the face of a buttress.

The vice is shown in fig. 1 in sectional elevation, and in fig. 2 in end elevation, with the operating handle removed. Fig. 3 is an elevation of part of the vice, the divided nut being in the closed position meshing with the operating screw and with its convex face engaging the concave recess, the jaws being closed or gripping work. Fig. 4 is an end view in elevation of the divided nut closed, and fig. 5 is a similar view of the divided nut open. The operating spindle or screw 1 of the vice is mounted in fixed bearings, and is rotated in either direction by handle 2 as ordinary.



FIGS. 3 and 4.

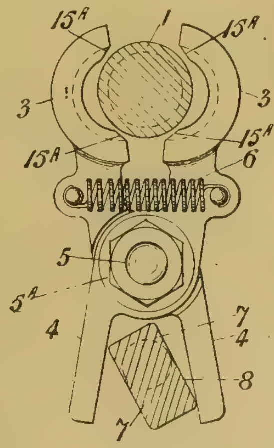


FIG. 5.

The nut comprises two halves or portions 3—3, each half or portion 3 being carried on a rocking limb or arm 4 mounted on a stud 5, after the manner of a pair of pliers. The proportions 3—3 are slidable on the stud 5, the amount of movement being limited between the nut 5A and the spring 15. The upper or nut ends 3—3 of the limbs or arms 4—4 are drawn together by a spring 6 (or springs), and when closed (see figs. 3 and 4) the two halves or portions constitute a complete nut, through which the screw passes. Between the lower or outer ends of the arms or limbs 4—4 there passes a tilting bar or rod 7 eccentrically mounted on its carrying studs 8—8, and operated or rocked by a thumb lever 9, or like device, and when tilted or rocked the eccentric rod or bar 7 bears upon the lower or outer ends of the limbs or arms 4—4, and rocking them on the stud 5, the tension of the spring 6 is overcome and the two portions or halves of the nut 3 are separated or opened (see fig. 5) and disengaged from the screw 1. On releasing the thumb lever 9 the spring tension closes the nut 3, and the latter meshes with the screw 1.

The studs 8—8 are supported in bearings or supports fixed or cast to the base of the movable jaw 8A of the vice, as shown in figs. 1 and 2. The rod or bar 7 being eccentric, operates upon and actuates each limb or arm 4 equally, and each portion of the nut 3 moves or opens or closes through a like arc, and disengages or engages the screw 1 with a minimum amount of movement.

The stud 5 carrying the arms or limbs 4—4 is fixed in the base piece 10 of the vice. The inner face of the nut 3 is convex, as at 11, and when the vice is closed or gripping the work the concave face 12 of a washer 13 interposed between the nut 3 and a buttress portion 14 of the vice. The convex and concave surfaces 11—12, when under pressure, exert a closing tendency on the nut 3, which is thereby maintained in a closed position, and for the time being is practically a solid or ordinary nut. When the jaws of the vice are relaxed, or the grip of the vice loosened, the nut 3 will rebound or automatically release itself from the concavity of the washer, and in order that the disengagement should take place gradually or smoothly a spring 15 is placed on the spindle 5 interposed between the boss of the nut 3 and the base 10.

The two halves or portions of the nut, instead of being pivoted below the screw and formed after the manner of a pair of pliers, may be hinged or pivoted above the screw, the operation and action being in each case the same. The nut 3 can be of any desired length, and the corners of each half or portion are removed as at 15A, so that the nut 3 disengages from the screw 1 with a minimum amount of movement.

The novel features comprised in this vice are: The use in combination with the operating screw of a vice of a divided nut closed by a spring and opened by an eccentrically-mounted tilting bar or rod. The use in combination with the operating screw of a vice of a divided nut with a convex face closed by a spring and opened by an eccentric or eccentrically-mounted tilting bar or rod and concave recess in which the convex face of the nut is drawn when the jaws are closed; and the use in combination with the operating screw of a vice of a divided nut with convex end or face and a corresponding concave recess with which the convex face engages, the nut being slidable on its carrying stud and slided thereon.

INDUSTRIAL BETTERMENT.[*]

(Concluded from page 364.)

5. THE HOUSING OF THE WORKMEN.

THIS subject is given little or no thought by the average employer. It should be realised, however, that the hours spent away from the factory affect those spent at work.

For this reason every assistance should be extended to the men to enable them to secure reasonable and sanitary lodgings, so located that the transportation to and from work will not be irksome or expensive. The workmen should arrive at the factory fresh and anxious to pick up their implements and get to work, rather than sleepy from a night of poor rest or tired from a toilsome journey.

Sometimes, owing to the isolated location of the plant or a dearth of lodging-houses in the neighbourhood, it will be advantageous to provide houses, and, should this be the case, care should be taken to see that they are supplied at a reasonable rental and that they are neat and attractive. A bonus for the best kept house and surroundings, paid monthly, will prove a good investment, as a saving in upkeep is thereby accomplished.

6. THE SOCIETY OF THE WORKMEN.

Man is a social animal by nature. It is desirable for his mental and moral health and growth that he associate with his fellows, and indulge with them in pleasurable recreation. Often it will be found that in the effort to assuage this craving bad associations are formed and it will be found desirable to assist the employees to form social organisations, offering rooms in the factory building for gatherings, where they can listen to educational or popular addresses, attend social gatherings where music and dancing are enjoyed. The attendance at all such gatherings must be purely voluntary, and the attractions of such a character as to "draw." When these affairs are left to the people themselves, extending only such assistance as may be requested, the best results are attained.

7. THE PROTECTION OF THE WORKMEN.

Every organisation, every group of individuals, contains at least one person whose ideas of fair-dealing vary so much from those of the rest that if he has a position of vantage over the others they will need protection from his acts. Every community contains people whose shrewdness is so over-developed that they take undue and unexpected advantage of every one with whom they come in contact. Protection against the grasping tendencies of such people is necessary on the part of those who are practically helpless from ignorance or lack of moral or financial ability to resist.

Every industrial enterprise or community contains men who are misfits—more successful as political leaders than mechanics, who, failing to obtain success in their trade, become disturbing influences and agitate trouble amongst those whose reasoning powers are less developed than their passions and sentimental tendencies. The latter must be educated to see conditions from a broad view-point, so as to penetrate the superficial arguments of the demagogue and ally their interests with those of the company, so that they can be mutual.

The services of an attorney placed at the disposal of the employees at a nominal sum will be of enormous benefit to them, and if the man is tactful and can secure the confidence of the workmen he can be a power towards keeping the organisation co-operative and loyal.

Petty subscriptions started in the works for all sorts of purposes, which sometimes become a drain upon the employees, can be controlled by prohibiting all except those permitted by the "works committee."

Bulletin boards on which are posted the minutes of the meetings of the various committees insure publicity, and establish public opinion, so that principles rather than rules govern the plant.

It is evident that in order to obtain the highest efficiency of the employee, his undivided and enthusiastic interest must be secured in his work. The employer must therefore do all in his power to contribute to his peace of mind, so that his thoughts will not be divided from his work.

The principal causes of worry which the employer can do much to relieve are the overbearing and dictatorial attitude of foremen, possible reduction of wages, loss of position, accident during occupation, and its resultant effect upon the fortunes of the family, loss of health from the effects of unsanitary conditions attending working operations. Some of the means by which relief can be secured have been mentioned, but in addition the employer may establish a fund for insurance against accident and sickness, and one for pensions for long service and old age.

How far outside of the factory the influence of the employer can be felt in these same directions will be a matter for the individual employer to determine. That he is responsible for having secured the presence of the employee in his factory is recognised, and it is, therefore, his duty to himself and to his company to secure the employee's highest efficiency; but as he is also accountable for having brought the employee into the community where the factory is located, it is also his duty to see that his efficiency is not secured at the expense of this individual or this community.

All of this means, besides a knowledge of competent management on the part of the employer, a full realisation of the obligations of citizenship not only as they apply to his employees, but as they are related to the State and the nation.

Many people fear that a crisis is impending in the conflict between capital and labour, and point to the standing armies, composed of the combinations of manufacturers on one side and the trade unions on the other.

I am not among those who look for a general revolution, although I expect there will continue to be many clashes at arms between these two bodies whenever a manufacturer becomes despotic or a labour union arbitrary. I have seen the results of representative methods of management and know that they are preventive of so-called labour troubles. I have seen how easily these methods can be introduced. What I hope and expect to see is an evolution of these representative methods brought about by the education of men in competent management in the economic schools now being established in the representative colleges.

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[*] A lecture delivered by H. F. J. Porter before the Graduate School of Business Administration, Harvard University, Cambridge, Mass.

AUTOGENOUS WELDING OF IRON AND STEEL.

The presence of oxide either dissolved or interposed in a weld greatly diminishes, according to a writer in the *Revue de la Soudure Autogène,* Paris, the mechanical resistance. It is impossible, says this authority, to count upon getting rid of the oxide by reason of phenomena of disassociation observable with regard to oxide of iron exposed to a high temperature. The reducing agents employed in the metallurgical industry are numerous. Besides manganese, silicium, and aluminium, there are actually prepared, either by an alumino-thermic process or by an electro-thermic process, special fluxes which react with great energy on oxides of iron. These are vanadium iron, titanium iron, titanium manganese, silicium calcium, etc.

It has been proposed to utilise for autogenous welding certain of the above substances, either in the form of powder or in admixture with the metal to be treated. But the results obtained have been uncertain, and the fundamental properties of the metals may become altered by their use. Manganese used by certain specialists for soldering steel gives certainly, from a point of view of the destruction of the iron oxides, excellent results, the affinity for oxygen which it possesses being, in fact, superior to that of aluminium. In conclusion, it may be observed that several of the deoxidising agents utilised in the metallurgical industry are capable of giving good results when used in the autogenous soldering of particular metallurgical products, but their use in any form whatsoever may result in very grave mistakes unless their practical use be preceded by an extended series of experiments for the purpose of establishing beyond doubt the essential conditions which should be observed in using any particular one of these deoxidising agents.

Autogenous welding has been defined as the uniting of metals by means of heat alone, without the intervention of any other metal. It would seem, however, that it would be more correct to say without the intervention of any different metal. A blacksmith's weld is said to be not autogenous because pressure is used to bring the parts together, but a foundryman's "burn" is really an autogenous weld, but the heat is obtained from a large mass of molten metal, whilst in autogenous welding as usually accepted the heat is obtained from extraneous sources, such as the heat produced by the combustion of acetylene with pure oxygen, which produces a temperature of 6,300 deg. Fah. The meaning of this temperature will be realised by the fact that if an ordinary thermometer registering up to the boiling point was 8 in. long it would have to be extended 21 ft. to measure this temperature on the same scale.

The reason for acetylene giving such an intense heat (says Mr. Henry Cave, president of the Autogenous Welding Equipment Co., in an article on "Welding in the Foundry," which lately appeared in the *American Machinist*), when burnt with pure oxygen is due to the large amount of carbon in its composition, and also to the fact that the nitrogen in the air is eliminated, resulting in the intense flame, which can readily melt a small section of a casting of any size.

It is necessary, he continues, where a weld of any thickness is required to remove the metal by making a groove, so that the flame can come in contact with the metal on the bottom, which is fused, and then additional metal can be added from a rod of the same metal until the whole becomes one solid mass. In this way metal can be added to increase strength or change the design, such as the addition of bosses, or to fill in places where the mould has not filled, to weld up blowholes, or to replace parts that have been broken off, or to weld up shrinkage or other cracks. Tests of cast-iron welds have shown a strength of 25,000 lbs. per square inch.

In considering the uses of this equipment, foundrymen should bear in mind that the value of their defective castings to them is not only the labour expended on making the mould, as is frequently assumed, but that the percentage of defective castings also means a proportionate increase of *pro rata* expenditures. This is particularly the case where a foundry is running to its full capacity, as the castings saved are a direct increase of production, without any material increase of *pro rata* expenses, and in many cases if the castings were scrapped and new ones made there would be the same percentage of loss in the new ones, and this also should be borne in mind in considering the possibilities of making a saving by the use of the oxy-acetylene torch.

This process also is considerably used in the steel foundry for removing risers. This is carried out by means of an oxygen jet, and is based on the phenomenon shown by the elementary scientific experiment of inserting a red-hot iron wire into an atmosphere of oxygen which will immediately cause it to burn. In cutting, a small spot is heated up by means of the oxy-acetylene flame, and a jet of oxygen is projected on to this hot metal from a separate orifice, the metal being burnt or oxidised away, where the jet strikes, with the result that a cut is made similar to that produced by a saw.

Extensive tests have been made as to the cost of carrying out this work, and it has been proved that steel risers can be cut up to 6 in. in diameter at a cost of 1 cent per square inch, whereas the cost of cutting by cold saw under the same conditions was 1·5 cents per square inch. The torch cut 150 square inches per hour, as against 27 square inches for the cold saw. The figures for the cost of cold sawing do not take into consideration power consumed or renewal of saws. I found that the cost of one of these cold saws, as exhibited at this convention is $1,100; the cost of the saw is $110.

The oxy-acetylene cutting equipment might cost considerably less than the cold saw, and it would be capable of carrying out the same amount of work as five of these saws, the floor space being proportionately less, so that there is a very great advantage in every way.

TRADE NOTES.

We are informed that **Messrs. Buck and Hickman Ltd.,** of London, Birmingham, and Glasgow, have been appointed sole agents for the universal and plain grinding machines of the Brown and Sharpe Manufacturing Co., Providence, R.I., U.S.A. All business relating to these machines will receive prompt and courteous attention from the firm.

Messrs. J. Halden and Co. Ltd., 8, Albert Square, Manchester, have just introduced a "sketching set square." It is designed to facilitate the drawing of centre lines and lines at right angles, parallel lines, lines at angles, and for isometric projection. The instrument is made of celluloid in four sizes, ranging from 1s. 3d. to 3s. 6d. each, and is adapted for the use of engineers and architects and for sketching in the ordinary manifold carbon copy book.

Three years ago the shareholders of **Palmer's Shipbuilding and Iron Co.** were faced with the unpleasant figures of a serious loss on the year's working. Until then the company had been prosperous, its profits maintaining the high average of £70,000 annually on a capital of £633,000; but owing to strikes and serious trade depression this highly satisfactory position was changed. The operations of the company for the year ended 30th June, 1908, resulted in a debit balance of £47,727. In the following year the debit balance was increased to £127,380 by a loss of over £80,000. The tide of adversity seems to be turning, and the accounts for the past financial year show a working profit of £12,552, which, however, is wiped out by the payment of debenture interest, etc., but the loss is only £11,353.

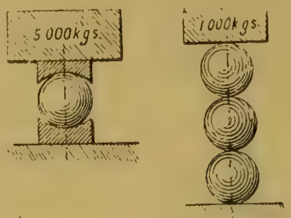
We have received the following letter from Messrs. W. P. Butterfield Limited, Shipley, Yorks :—

> Dear Sirs—I beg to inform you that I have converted my concern into a private limited company, with a capital of £30,000, of which shares are being taken up by my leading employees, so that they will have a more direct interest in their work beyond their weekly wages, and this will of course mean better workmanship and prompter deliveries.
>
> My works have considerably increased in size, and are fitted out with the best and most modern plant that money can buy, so on this account we can defy the keenest competition.
>
> The style of firm to be "W. P. Butterfield Limited," to whom all cheques must be made out and all communications addressed, and please note, no outside capital has been subscribed, and Mr. W. P. Butterfield acts as sole Managing Director.
>
> I trust you will continue to patronise us as you have done in the past. Thanking you most sincerely for past favours, yours very truly, (Signed) W. P. Butterfield.

We have received from the **British Manzel Oil Pump Co.,** Carlisle, their catalogue No. 10, dealing with Manzel's Auton-force and sight feed oil pumps for cylinder lubrication, etc.

THE FRICTION OF BALL BEARINGS.

The friction engendered in ball bearings is a rolling one, or, as it may be more accurately defined, is the resistance to rolling which takes place owing to the greater or lesser liability of the material to flattening or deformation. In an article on the above subject which lately appeared in *La Vie Automobile*, Paris, the writer observes that there exists two kinds of flattening or deformation—first, of the ball in the vicinity of the point of contact; second, of the surface upon which the ball rolls at the same point. The resistance to be overcome to produce rolling corresponds to the work due to the flattening or deformation of the parts in contact, work partially transformed in the last case into heat. It seems therefore that in order to obtain the best results the materials used should be the hardest obtainable which are liable to the least flattening or deformation, or in other words the contact surfaces should be reduced to a minimum. On the other hand, for a given load the flattening or deformation of the parts in the vicinity of the contact point, and consequently the work to which they are subjected, is proportionately more considerable in accordance with the smaller extent of this surface. Consequently, it is desirable to have the balls and the rings of great hardness, and in order that they may be able to support a heavy load with security, that is to say with a large margin beyond the limit of elasticity of the metal, concave paths or races should preferably be used. A ball of hardened steel, compressed between two spherical surfaces of a diameter slightly greater than that of the ball, will resist a pressure five to ten times greater than were the same ball to be compressed between two other similar balls, as indicated in figs. 1 and 2. From this may be deduced the necessity of having a suitable concave path or race in order to ensure the greatest possible resistance.



Figs. 1 and 2.

Regarding the question as to whether the interior ring and the exterior ring should be provided with the same groove. Referring to fig. 3, if the ball be placed between two plane surfaces, as indicated at I (fig. 3), the contact surfaces are two equal and very small circles. If the ball is placed between two circular rings, and consequently rests on one side (the interior ring) on a convex surface, and on the other on a hollow or concave surface, as shown at II. (fig. 3) the points of contact will be elliptical, the larger corresponding with the external ring and with its axis perpendicular to the rolling base, whilst the smaller has its axis parallel to the latter.

In the case of balls with concave rolling paths on both sides of the bearing plates or rings, for small contact surfaces, the forms of races or paths shown in III. (fig. 3), are both elliptical, but that of the exterior ring, being the larger, may be employed. In fact, the outer ball race or path is doubly concave or hollow, whilst that of the interior is concavo-convex, convex in the direction of rolling and concave in transverse section of the rolling path. If we now consider the two rings of the S.K.F. (Skefo Ball Bearing Co. Ltd.), the interior rolling path, which is of the ordinary form, will give an analogous point of contact to the preceding, whilst for the other or exterior ring, the surface of which is spherical, the point of contact will evidently be circular; that is to say, a circular surface the diameter of which is equal to the lesser axis of the ellipse shown at IV. (fig. 3). This circle may therefore be of the same profile as the elongated ellipse of contact with the internal ring, and the ball will thus work equally on its two contact points.

In an ordinary ball bearing, the interior ring is more heavily loaded than the external ring; in a bearing of the S.K.F. (Skefo Ball Bearing Co. Ltd.) the two are equally loaded. It results from this, that a greater radius of circle for the external race cannot be disadvantageous as regards the load or the result.

The question has been asked, why ball bearings are subject to wear, and acquire play or slackness? Theoretically there should be no wear of the parts, since there is no friction, but there is an upsetting or flattening action. The larger the contact surfaces the less rapid is this flattening action, from which it would therefore appear to be advantageous to augment as much as practicable the contact surfaces. The races will be subject to less flattening in accordance as the curved surface of the race is flatter.

In the case of ordinary ball bearings, the balls turn on themselves so that the same parts of the main rolling circle coming constantly into contact with the races on the bearing plates or rings, they have a tendency to assume an oval form, and to gradually become more and more oval. On the contrary, in a conical ball bearing, each ball has a pivoting motion as well as a rotary motion, and there is therefore a uniform flattening action. The conical ball bearing has the further advantage of being capable of being used as a thrust bearing; that is to say, of being capable of resisting thrust in an axial direction without the balls becoming wedged. The balls bear against the slope of the race. A ball-thrust bearing is nevertheless the worst of these bearings, by reason of the pronounced pivoting action causing wear and bad results.

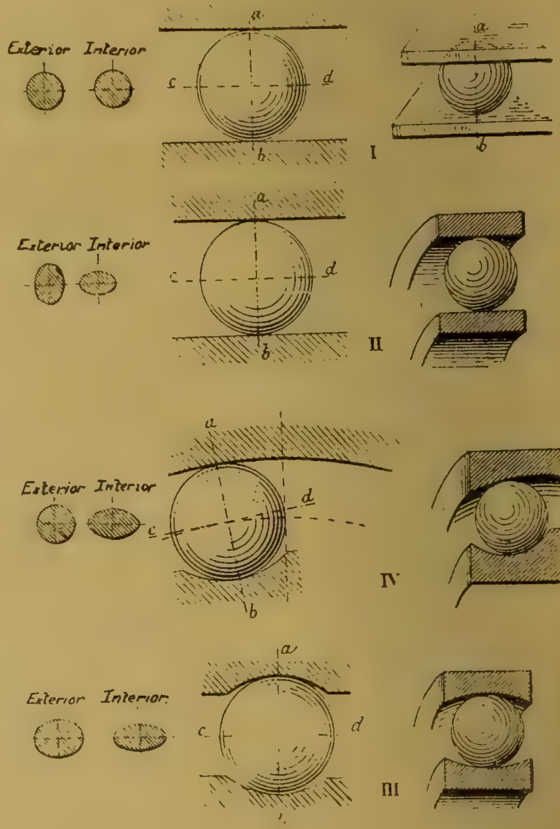
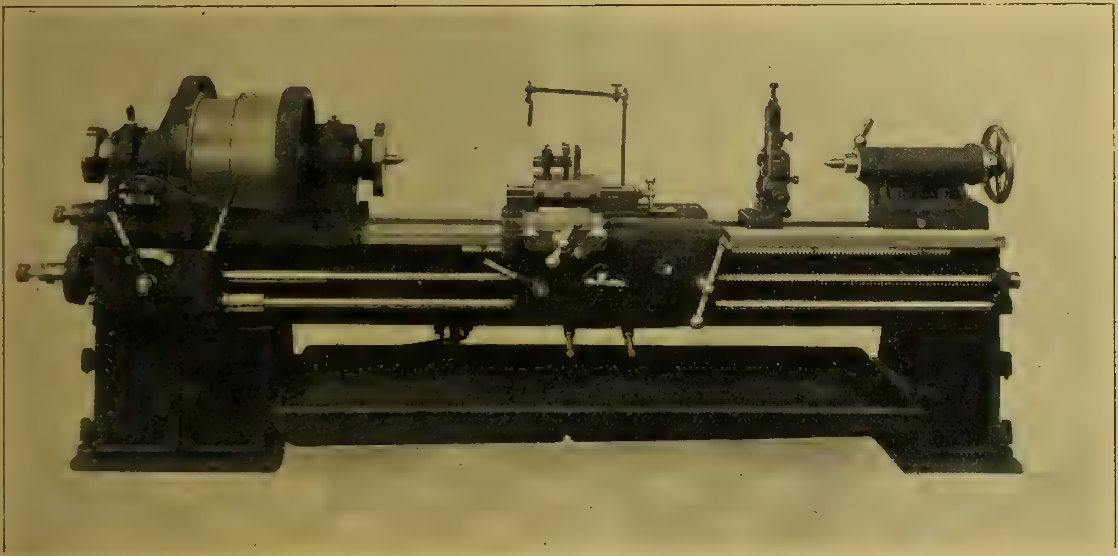


Fig. 3.

The following results were obtained from a series of experiments carried out by Mr. Paul Brühl, of the Rhineland Manufacturing Co., London, W., and were given in a

The Naval, Mercantile Marine, and General Engineering and Machinery Exhibition, Olympia, 1910.—II.

The Colchester Lathe Co. Ltd., exhibit a 6 in. centre "Mascot" lathe. This lathe is designed for screw-cutting, self-acting sliding and surfacing. A high-speed lathe in miniature, with interlocking feeds driven from separate shaft. All gears are machine cut, the rack and pinions being of steel. The bed is in one piece with the tray, which makes a very rigid casting, and besides other advantages, eliminates any possible distortion when bolted on to the legs. The headstock is designed so that no spanners are required either for the back gear or the screw-cutting reverse. The small step of the cone is of large diameter, ensuring efficient belt contact at all speeds, and making the lathe very powerful. The reverse is contained inside the headstock, and is constructed of forged steel gears. Guards are built on to the head as part of its regular equipment. The spindle runs in adjustable parallel bearings of gunmetal; it is fitted with a ball thrust, and has a 1 in. clear hole right through. The loose head will stand up against any work the lathe is capable of. The spindle is of large diameter and projects through the hand wheel at the back, so that no matter how far the spindle overhangs in front of the main casting it always has the full length of the loose head for bearing. The slide rest is indexed and can be swivelled to any angle. The top slide screw is always covered, and there are no recesses to harbour dirt or chips. The saddle is ⊥ slotted, and is arranged to present a planed flat surface for bolting work on to, when the slide rest, which can be taken off without disturbing anything else, is removed. The apron gears have bearings on each side, none of them overhang, and the worm boxes are oil retaining. The balanced handle for racking the saddle along the bed is geared down on to the rack, making this a very easy sliding motion. The feeds are taken from a separate shaft by dropping worms, which can be instantly engaged and disengaged. As they work with a trigger-like action, the cut can be stopped dead at any point. The feeds are interlocked from each other, the meshing of one automatically dropping the other out. The screw is provided with a double clamp nut, and is used for screw-cutting only; it therefore retains its accuracy and lasts very much longer than on those lathes where it has to perform the triple duties of sliding, surfacing, and screw cutting. In point of fact, this lathe will cut accurate screws long after the other sort are useless for this purpose. The lathe is supplied with catch plate, face plate, change wheels, and table to cut Whitworth and metric threads, travelling stay, spanners, and counter-shaft if for power.



LATHE BY THE COLCHESTER LATHE CO. LTD.

Messrs. J. Parkinson and Son, of Shipley Yorks., a brief mention of whose noteworthy exhibit was made in our last issue, show two lathes, one of which, the 8½ in. lathe, we have already briefly described, and of which we now give an illustration in fig. 1; three milling machines, one profiling machine, a gear-cutting machine on the generating principle, and a machine for sharpening the cutters used thereon, and a representative selection of their well-known "Perfect" and "Handy" vices. All the machines, excepting the smallest milling machine, are belted up and under cut, and their capacity demonstrated.

The 7½ in. lathe, shown in fig. 2, is of the popular "Twink" type, and is a most convenient lathe for motor repairers and makers. It is not only very sensitive in adjustment, but rigid under heavy cuts. This lathe has 2⅛ in. hole through spindle, and a special feature is the convenience by which the turning feeds are controlled and the turning and screw-cutting feeds interlocked. The turning feeds are gear driven, but there is a safety provision for preventing damage to feed gears in the event of a jamb.

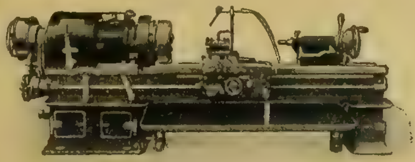


Fig. 1.

The object of greatest interest is undoubtedly the "Sunderland" patent spur and spiral-gear generating machine, here for the first time publicly shown. This machine, which is shown in fig. 3, is the invention of Mr. S. Sunderland, of Keighley, a well-known trade gear cutter, who has licensed J. Parkinson and Son to make them.

The principle of generating the teeth of gears by a single cutter is not new, but in this machine the cutter is formed as a rack with several teeth. The cutter reciprocates as in a shaping machine, and on each return stroke of the cutter it is fed slightly at a tangent to the pitch circle of the gear being cut; simultaneously the gear is rotated an equal distance, measured on the pitch circle, and thus the action of cutter and blank is exactly that of a rack and pinion in rolling contact. When the rolling action has taken place for the distance of one pitch or tooth and space, the blank is withdrawn from the cutter, the cutter returned to its original position, and the blank again brought in contact with the cutter. Thus, in each cycle of movements, the blank is brought into cutting position—blank and cutter roll in unison—the blank is withdrawn, and the cutter run back to starting point. All these movements take place automatically with a precision and certainty that is proved by the results obtained.

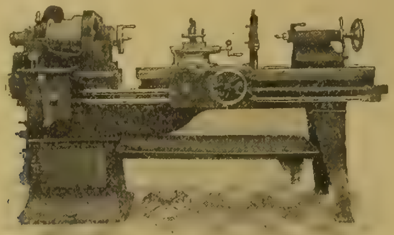


FIG. 2.

The machine shown is the smallest size yet made, but is capable of cutting either spur or spiral gears up to 18 in. diameter 5 D.P. in cast iron. Some steel chips or cuttings on view are instructive as showing what may be accomplished on larger-sized machines, and justify the claim that even better results are obtained on steel than on cast iron, and on coarse than fine pitches.

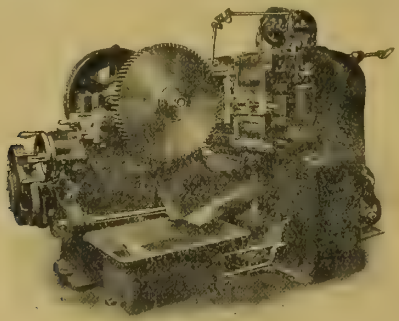


FIG. 3.

It will be understood from the foregoing description that however mechanically perfect the movements of the machine may be, the cutters themselves play a very important part in the production of accurate results, and in that respect the great superiority of the "Sunderland" cutter over the circular formed and hobbing cutters is manifest. The cutters are made of high-speed steel, and after hardening are finished by grinding all over in specially-contrived machines, so that the cutters themselves being accurate, the advantage of increased production obtained by multiple teeth is obvious. Only one cutter is required to cut all numbers of teeth of the same pitch, but if gears are required to be interchangeable with the gears of the B. and S. system, a special cutter is necessary for pinions with small numbers of teeth. Cutters may be had to suit any required pressure angle or tooth proportion, and one cutter only is needed to cut any number of teeth of the same pitch for roller chain.

The sharpening of the cutters is a very simple process, and may be done without alteration of form in a very few minutes on the specially-designed machine, one of which is shown in use.

The next most interesting machine is a plain milling machine, shown in fig. 4, having table movements 36 in. by 10 in. by 20 in., with all gear and single pulley drive. The driving pulley is 16 in. diameter, takes a 5 in. belt, and runs at 325 revolutions per minute. Using a 3½ in. diameter cutter on a cast-iron block 4 in. wide, this machine is capable of producing 4 lbs. of chips per minute, and when working on mild steel having a tensile strength of 30 tons to 35 tons, of 2 lbs. per minute. The machine has 16 rates of spindle speed, all driving gears are steel, no idler gears are in mesh, free-running wheels are bronze bushed, tumbler gears are not used, and no shaft except spindle is subjected to combined bending and twisting strains.

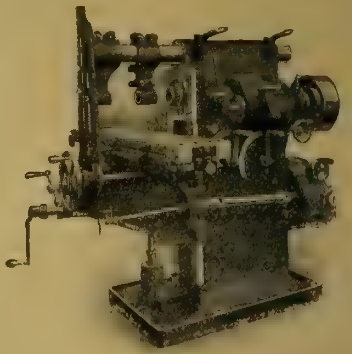


FIG. 4.

Next to this machine is a "Universal" miller (fig. 5) of the ordinary step-cone type, but fitted with the firm's patented system of independent-feed drive. A slotting attachment is shown in position on this machine, enabling those who have not yet proved the advantages of this combination to realise the possibilities of a slotting machine which can be swivelled through an angle of 360 deg., in conjunction with the accurate and convenient adjustments of the milling machine table.

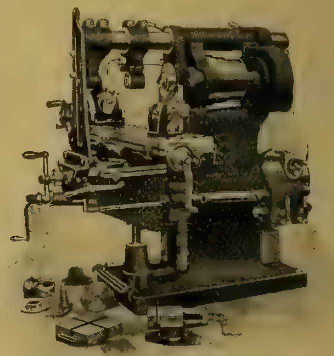


FIG. 5.

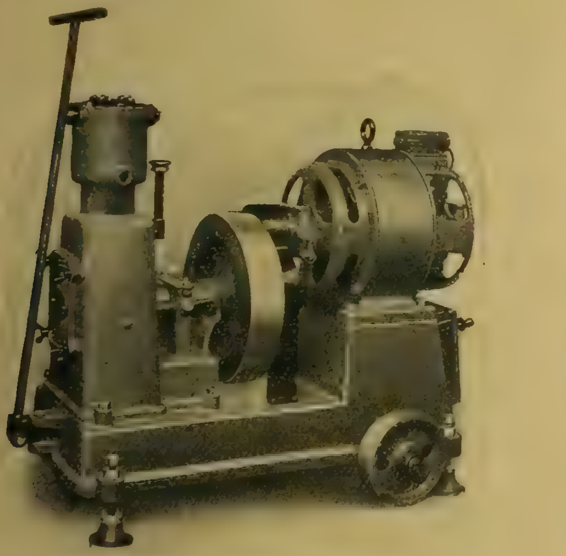
The range of vices include types of "Handy" and "Perfect" vices in the well-known Model F design, and also in the Model J or "Samsonia" style, which is of all steel.

Messrs. Broom and Wade Ltd., of High Wycombe, show examples of their air compressors. The two-cylinder air compressor made by this firm has mechanically-operated valves. These machines have the highest mechanical and volumetric efficiency obtainable. The valves are made of the finest nickel steel and are practically indestructible.

The pistons and cylinders are made of special close-grained cast iron, and as they are amply lubricated, the wear is quite inappreciable, and the leakage past piston, after years of constant running, will be found less than from most machines when first constructed. The pistons are accurately ground to fit the cylinders, and are fitted with the firm's special rings.

The bearings are fed with a rotary gear oil pump mounted direct on the end of the shaft. The simplicity of this oil pump will commend it to all engineers. There are no valves, plungers, eccentrics, etc., to wear and give trouble. It is positive in action, and has only one pipe connection to the oil well in the base. It delivers its oil through its own casing in a hole drilled through the crankshaft to each bearing and to the gudgeon pin bearing.

The compressors are suitable for belt driving or coupling direct to motors or engines, and owing to their perfect balance they are suitable for portable plants. Their durability, reliability, and the small amount of attention they require with the forced lubrication, find them a ready market for the large field in which compressed air is now used. Their compactness makes them particularly suitable for mining work. The lubrication is not affected when working on an incline.



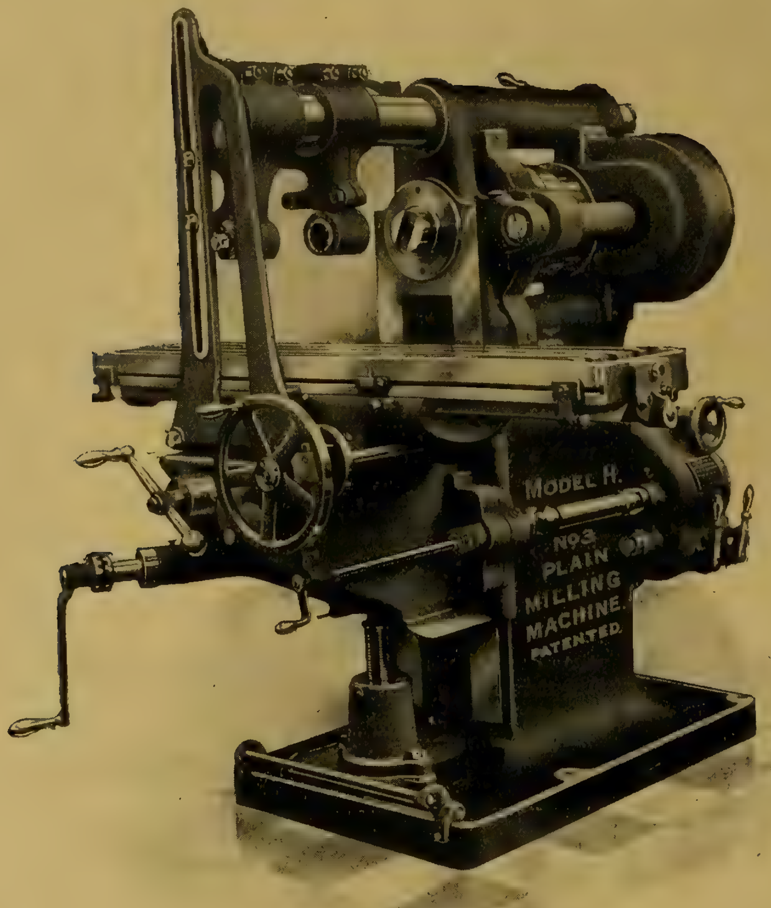
Broom and Wade Portable Air Compressor.

In the piston crankshaft bearing, etc., the best engineering practice is good enough for air compressors, and the above standard has been closely adhered to in the design of these compressors. It is in the design of the valve that it has been found necessary to break away from the common rut. The volumetric efficiency of the air compressor depends chiefly upon the inlet valve; the reliability of the air compressor also hinges upon the inlet valve. The delivery valve does not open or close with the same shock as the inlet valve; it can be smaller and have a smaller lift, air at the usual working pressure occupying less than one-sixth of the volume of the air entering the cylinder. These inlet valves are operated by a wiper worked by a link off the connecting rod.

The wiper works on a pallet with a rolling motion closing and opening the valve noiselessly at the correct period of the stroke, the air flowing freely through the cylinder until the end of the stroke, and by its inertia filling the cylinder slightly above atmospheric pressure. There is a large gain in volumetric efficiency caused by this complete filling of the cylinder in the place of the usual wire-drawing process of the automatic inlet valve. The volume of air delivered being an eighth greater, the mechanical efficiency being the same, this increases the overall efficiency of the compressor by 10 per cent. The life of the valve and seat working under these ideal conditions is practically indefinite. Now, on installing a compressor it is naturally desired that the maximum cubic feet of compressed air for a given H.P. should be obtainable, and a few pounds spent in the first cost is really not much consideration when it is realised that a compressor working 10 hours a day will practically cost as much for power the first year as the first cost of the machine, and this cost of power will go on year after year. The makers claim that these machines are more economical than the best compound machines at the usual working pressure of 90 lbs.

The Graphite Products Ltd., an illustration of whose stand we are enabled to show, exhibit a number of photographs of important structures throughout the country, the steel work and iron work of which is protected with Dixon's silica-graphite paint. Neachell's patent check rail grease box, designed for automatically greasing check rails by the passing of the train, the object being the reduction of friction and consequently the side wear on check rails and wheel flanges. This grease box is a new patent, and has not been out above 12 months. It is, however, being taken up by several of the leading railways. The company are also exhibiting, as of special interest to engineers, a new heat-resisting paint composed of the same pigment which is used in Dixon's silica-graphite paint and a special vehicle. This paint will withstand a temperature of 600 deg. Fah. to 800 deg. Fah., and is used for painting the interiors of steam turbines. Dixon's pure flake graphite is a solid lubricant well known to engineers, which is mixed with greases or oils. Its use reduces the lubricant bill considerably. Graphite is totally unaffected by heat, cold, acids, etc. Dixon's graphite pipe joint compound is used the same as red lead, but is non-poisonous. Joints are better made and easier broken than with any other material. Dixon's graphite greases consist of the highest grade grease and the purest flake graphite, and is made in six degrees of hardness for compression cups. Also graphite greases for special purposes, such as heat resisting, curves, wire ropes, motors, etc. Also a number of grades of graphite for foundry use, packing manufacturers, electrotyping, talking machine records, etc. K. and W. graphite cylinder lubricator (working), for feeding Dixon's special graphite No. 635 into engine cylinders. This lubricator will effect a saving of from 50 per cent to 75 per cent in the oil bill, also a saving in fuel and wear and tear. There are some hundreds of these lubricators

Stand of Graphite Products Ltd.



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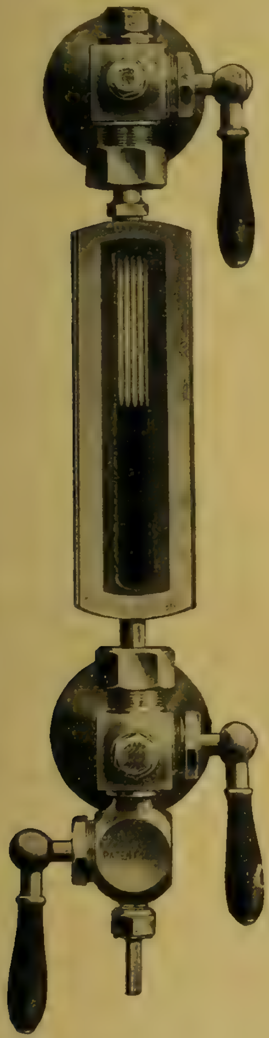
in use. Finally they exhibit samples of Dixon's solid belt dressing, a leather preservative which can be applied to a moving belt, and immediately stops all slipping.

Messrs. Klinger and Co., 66, Fenchurch Street, E.C., showed a number of their improved gauge cocks. Good as the asbestos-packed cock has proved to be during the years it has been before the engineering public, it is still far from completely satisfactory. It would appear that nothing can entirely eliminate wear and tear—particularly at the very spot where the asbestos packing is called upon for its best and most continuous service. Steam, water, high pressure, foreign bodies, and chemical conditions all conspire to wear away the comparatively small surfaces which move upon each other when the handle of the cock is turned, while the packing material itself has a tendency to wear away gradually all the time. Mere slackness may be remedied to a certain extent by the introduction of more packing, but, hitherto, any wear of the metal surfaces has entailed the dismounting of the fittings and their treatment in the engineering shop. These remarks apply to all asbestos-packed cocks devised so far, but with Klinger's improved cocks it is different.



Klinger "Reflex" Gauge Glass with Cocks Complete.

The new principle is applied to both upper and lower gauge cocks and the blow-off cock, as also to a variety of valves, test cocks, stop cocks, etc., and may be described as follows:—

The cock or valve body is hollowed out for the reception of a removable inner cup or shaped lining, the outside of which fits accurately into the said hollow. This lining is filled with the best quality asbestos packing, the plug

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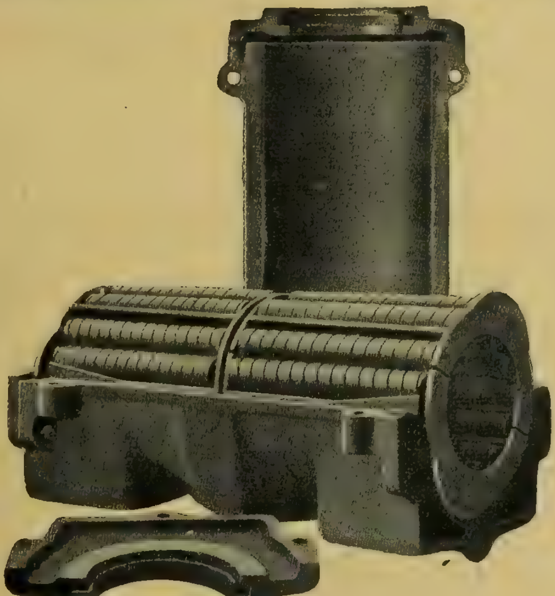

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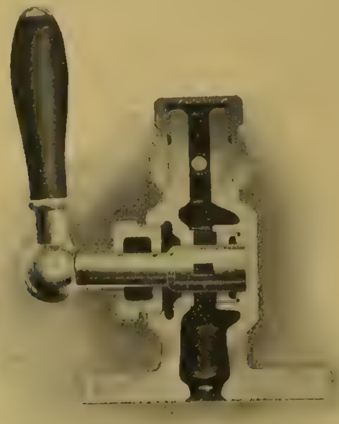
working in the centre in the usual manner. By means of this arrangement, whenever the packing becomes inefficient, the lining, with its contents, may readily be removed, and a new one, costing but a trifle, can be substituted, making the whole fitting as good as new. If the plug itself should become worn, this too can be replaced, as all parts are standardised.



Section of Klinger Gauge Cock.

The advantages of this invention are obvious. The gauge casing lasts indefinitely, and never needs to be discarded or even removed from the boiler. The delay caused by dismounting and sending the ordinary pattern cocks to be repaired is entirely avoided. Any mechanic can effect the change from old to new in a few minutes. The cost of the replace parts is infinitesimal. Our illustrations show a pair of Klinger's improved gauge cocks fitted with "Reflex" water gauge (attachable pattern), and a sectional view of the internal arrangements of the gauge cocks.

The British Oxygen Co. Ltd., of Everton Street, Westminster, have at their stand a selection of their specialities. Their stretch testing apparatus for cylinders consists briefly of a cast-iron chamber, in which the cylinder to be tested is suspended. An hydraulic pump employed for testing the cylinder; a gauge glass communicating with the bottom of the chamber, and an india-rubber joint ring, which is capable of closing and making a perfect joint round the shoulder of the cylinder. The method of testing is as follows: Both cylinder and chamber are filled with water to the exclusion of all air, and a perfect joint is made round the neck of the cylinder by inflating the india-rubber ring, which can be instantaneously done by water pressure from the ordinary main supply. When the cylinder is gradually subjected to the test pressure by means of the pump, its expansion is measured by the displacement of water from the chamber, and this displacement is indicated by the rise of the water level in the gauge glass, which continues until the maximum test pressure is obtained. The pressure is then released, and if no permanent stretch has been given to the metal, the water will return to its original level in the indicator. If, however, any permanent stretch has been caused, this will not be the case, and the cylinder would therefore be rejected as unfit for use. The value of this apparatus is obvious. Its employment insures that a cylinder is never strained beyond the "elastic limit" of its metal, and without this safeguard no hydraulic test is reliable.

Another interesting exhibit is their oxy-acetylene high-pressure blow-pipe, the system being shown at work during the day.

Messrs. R. Becker and Co., City Road, London, E.C., have on view a selection of their improved lever shearing machines. These machines are provided with a patent separating device, which makes it possible to easily cut in halves sheets or plates up to $^{11}/_{16}$in. thick of any width and length. The frame of the machine has a gap behind the shearing blades. Through this gap projects an arm secured to a bar, which is supported in two brackets on the left-hand side of the frame, and is capable of a longitudinal movement. A helical spring surrounding the bar always tends to move it towards the shearing blades. This arm engages with its right-hand end between the two cut portions of the work, so as to keep them apart.

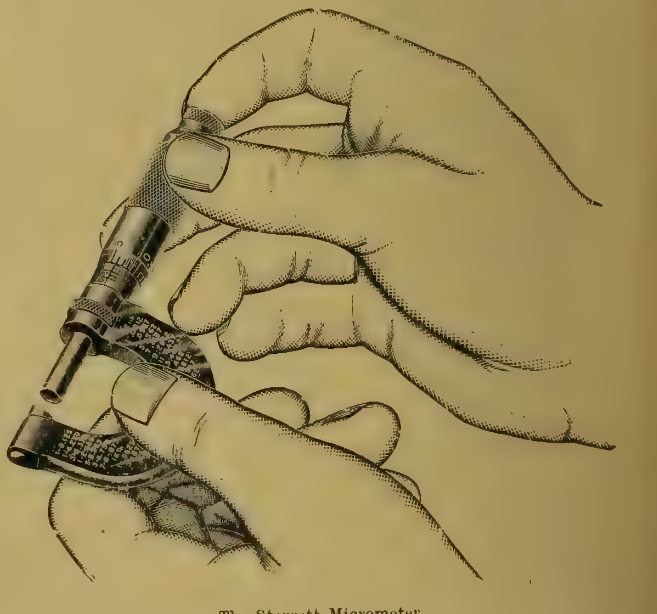
The working of the machine is as follows:—After a first cut in the plate has been effected and the shearing blade reached its topmost position, the gap in the frame of the shearing machine enables the plate to be advanced to the extent of a length of a full cut. As this advance is being effected, the arm is at the same time being pushed back to the back end of the gap, but without its having been able to engage between the two cut portions.

When, however, the shearing blade starts downwards for a new cut, the arm is caused by its helical spring to engage with its right-hand end between the two cut portions. By the time the shearing blade has reached its lowest position, the arm has advanced up to the shearing blades. When the shearing blade is raised for a new cut, the arm prevents the two cut portions from springing together, so that it becomes quite easy to feed the plate forward to the extent of the length of a full cut, until the plate has been completely cut. Another improvement is the adjustable holding-down foot for holding the plate perfectly level, and which can be brought close to the top cutter when cutting narrow strips.

The **L. S. Starrett Company,** of 36 and 37, Upper Thames Street, London, E.C., are showing an extensive line of tools for engineering, their principal line being precision tools.

They have on show a large assortment of micrometers, squares, rules, calipers, dividers, etc., and in addition to the regular line of their precision tools they are making a display of their extensive line of hack-saw blades.

One of the most interesting of their exhibits is their new quick-adjusting micrometer, which can be instantly opened or closed to any point within its capacity without impairing its accuracy and sensitiveness. Forty complete revolutions of the screw are required to open or close an ordinary 1 in. micrometer to its full length, taking approximately 20 seconds. This time is practically all saved by the use of this new micrometer.



The Starrett Micrometer.

To operate this micrometer it is only necessary to press with the finger against the end of the plunger, as shown in the illustration; this immediately releases the nut, disengaging it from the screw, when any adjustment within an inch may be made. Upon releasing the pressure, the nut instantly engages the screw, when a fine adjustment may be made in the usual way.

The Worthington Pump Co. Ltd., Queen Victoria Street, London, E.C., have on their stand a representative show of their specialities. The main features of the exhibit are:—

The arrangement of rotary or circulating pumps, working in connection with surface condenser. The centrifugal boiler feed pump and steam turbine. Although a considerable number of centrifugal feed pumps have been installed for boiler feeding, they have in each case been electrically driven, and the present is a new departure in using a steam turbine for driving the pump. Such a combination will be quite suitable in many cases where electric current is not available, or where it may be advisable to dispose of exhaust steam from other engines. Also the new type of "Arrow" meter, various forms of which are shown.

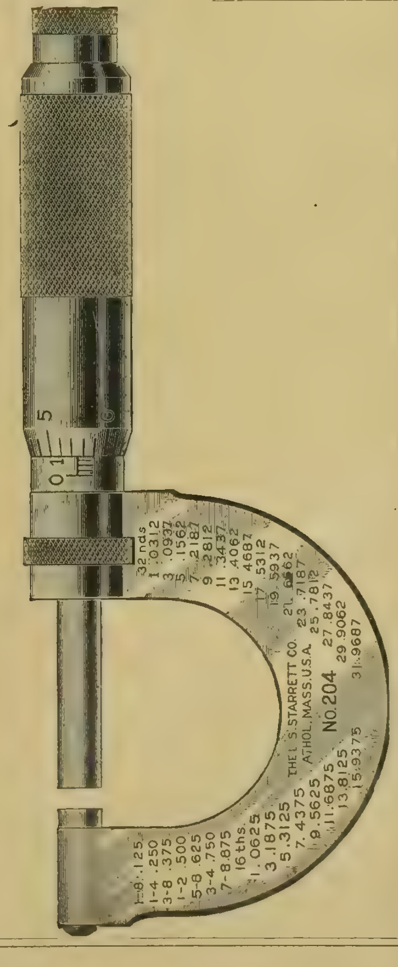
The design of modern condensing plant has been influenced to a very great extent by recent progress in centrifugal pump design, in so far that the Worthington Company are now building and can offer condenser auxiliary pumps entirely of the rotary design. In this arrangement a single motor or steam turbine drives, without the intervention of any gearing, the circulating, air, and hotwell pumps, the latter pumps being combined at one end of the shaft and the circulating pumps at the other. It is generally convenient to place the motor or steam turbine between the pumps, but modifications of this arrangement can be made without in any way affecting the working of the plant. A combined arrangement of surface condensing plant, as described, has now been at work with very successful results at the Newark-on-Trent works of the Worthington Company for some considerable time past, and the experience thus gained demonstrates that a plant of this type has the following distinct advantages over the older forms of surface condensing plant with reciprocating auxiliaries:—Lower first cost, low maintenance charges, greater economy of space, greater convenience in operation.

The last-named point is perhaps not the least important, as by the arrangement described it is possible to operate the condensing plant at a considerable distance from the main engines, should this be necessitated by the general disposition of the plant. In such cases the condensing plant can be completely controlled from the main switchboard, and by this means a very great saving accomplished in the running costs.

The Worthington high-lift pump is a natural development of the high efficiency low-lift pump, it being possible with this design to obtain the best results without necessitating the use of complicated guide vanes and passages. The pump is supplied for the purpose of boiler feeding, and this modern application of the high-lift pump is perhaps one of the most important and quite the most successful.

The comparison of the pressure curves taken from actual running of both direct-acting and centrifugal pumps shows conclusively the advantages gained by adopting the latter type.

The "Arrow" straight-flow meter is claimed to possess the following special points:—Greater capacity than any other meter, there being no reduction of the pipe diameter, nor diversion of the flow of water, nor any ports, consequently: The loss of pressure is insignificant; accurate measurement at all pressures due to elimination of end thrust on the "Arrow" wheel and the steady regular flow



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of water induced by the peculiar exterior form given to the bearing; simplicity in design and operation; perfect reliability; great durability due to the absence of end thrust on the wheel, and suitability for all pressures from a fraction of an inch water column up to 750 lbs. per square inch, and for all kinds of water. The "Arrow" meter is made in a variety of sizes, ranging from 2 in. to 48 in. bore, and in consequence of its great advantages it has not only practically driven the larger sizes of the common wing meter off the market, but its sphere of application has been largely extended.

The "Arrow" meter has been most successfully employed, and is recommended in connection with open conduits, syphons; ordinary and high-pressure mains, up to 750 lbs. per square inch; determination of the flow from springs or yield from wells; filter beds, drainage of mines; checking discharge of centrifugal pumps, district supply; fire service, turbines, condensing plants; measuring impure water, naptha, paraffin, solutions, etc. It works equally well in horizontal or vertical positions.

Carborundum Stand.—On this stand is shown a new oscillating semi-automatic tool grinder, of The Lumsden Machine Company Ltd., Alexandra Works, Gateshead. The machine consists of a heavy bedplate, part of which forms a water tank, and mounted on trunnions on this is a heavy swinging frame carrying the cylindrical grinding wheel. The tool carriage is mounted on the raised part of the bedplate, and is encircled by a large trough. The oscillating motion is effected by crank and connecting rod driven by belt through a gear box.

The spindle frame is of heavy box section mounted on removable trunnions, which are bored out and bushed with gunmetal, and form the bearings of the countershaft. The spindle is made from high carbon steel running in self-oiling phosphor bronze bearings with a ball thrust to take end pressure. The grinding wheel is of conical cup section and heavily mounted, being protected by a steel guard.

The tool carriage consists of a heavy compound slide rest, on which is mounted, on a circular base, a gimbal, carying the tool holder itself. By means of this the tool can be set at any angle in three planes. Spring-loaded plugs and sliding stops for each set of angles enable the operator to reproduce any predetermined angle without referring every time to graduated scales. A feature of considerable importance is that tools can be round-nosed to any given radius before removing from the tool holder. The holder will take from 1 in. square to 6 in. by 3 in., and cranked tools up to 4 in. by 2 in. with 4 in. set, and all the other various forms, without the use of attachments.

The oscillating motion is effected from a gear box giving three rates of oscillation, suitable for large or small tools. The stroke can be instantly varied from 0 in. to 6 in. while the machine is in motion. The gear box is belt driven from the bottom countershaft, and is controlled by friction clutch. Water or cutting compound is circulated to wheel and tool by a pump driven direct on the end of the countershaft. The tank is divided into compartments to settle the grit, thus saving wear in the pump. The trough encircling the tool carriage catches all splash.

The drive is self-contained in the machine itself, the countershaft running through the trunnions. The fast and loose pulleys are on the outside, and the belt is controlled by foot lever. It is equally convenient to drive direct by motor.

Messrs. Pfeil and Co., 159, St. John Street, E.C. had on their stand a representative collection of the "Reinecker" machine tools. Amongst these we noticed an automatic spur gear planing machine, which is especially suitable for car gears. Gears can be planed on these machines with various pressure angles. Gears with normal or abnormal height of teeth can be produced, and as in the bevel gear planer the teeth of the pinions can be thickened and a corresponding increase made in the tooth space of the wheel.

Gears with involute teeth planed on these machines are truly remarkable for their exceptional accuracy and smooth finish. Gear pairs, especially those of high-gear ratio, produced by this method run exceedingly easily in either direction, without the slightest sign of interference, and so noiselessly that, in this respect, they far excel any gears which have been hitherto produced.

The machines are fully automatic. On completion of the return stroke, the gear blank is divided one tooth farther till the complete tooth form is attained. The planing tool is extremely simple, and its flanks consist of flat planes inclined at 75 deg. to the horizontal. It can easily be kept in good cutting condition by a tool holder supplied for the purpose of holding it while grinding. Three planing tools suffice to cut all pitches, which in comparison to the expensive hobs and cutters of other methods is an appreciable advantage. If, however, a large production is the chief aim, one planer tool alone can be used, but in this case a separate tool for each pitch is necessary. Gears with corrected teeth are also easily machined and, in addition to this, by an ingenious arrangement of the machine, the involute curves can be cut with a controllable increase of acceleration (*i.e.*, with a controllable rate of change) above normal, which ensures the most noiseless running of the gears.

One of the most striking exhibits at the Olympia Exhibition was the "Watkin Switch." The **Adams Watkin Company,** of 36, Victoria Street, S.W., which has recently been formed to take over the manufacture of these useful appliances, show a large number of different types of dimmer switches for controlling a single light only or for any number of lights.

The essential feature of these switches consists of the resistance material used, which is a solid composition containing various ingredients, of which the principal is carbon. The switch is arranged so as to closely resemble the ordinary tumbler type, and is of very small dimensions. It contains four or more resistance units built up of this material, and the action is to include one or more of these units in series with the lamp to be controlled In this manner an electric light may be lowered to any convenient brilliancy, in the same way as has been commonly done in the case of gas, and with the same economical results.

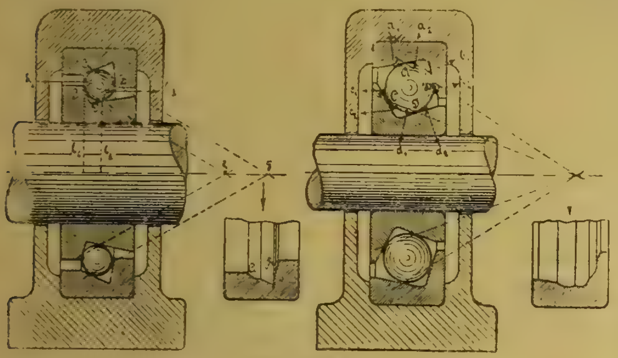
The prices are very reasonable, and the switch, which is a British invention, is of the robust mechanical construction characteristic of our country. These instruments supply a distinct want, and it should not be long before we may expect to see them in pretty general use.

In conclusion, although this year's exhibition is perhaps not quite as representative or as complete as some of those that have been held in recent years, there are many interesting and instructive exhibits besides those which we have briefly described in our columns, which space unfortunately forbids our even briefly reviewing.

The exhaust from a gas engine may, if passed through a suitable exhaust gas boiler, evaporate as much as from 2 lbs. to 2½ lbs. of steam per brake horse power hour. Where this steam can be utilised it may effect a substantial economy. Very few such boilers, however, are in use. One reason is undoubtedly that these boilers are subject to serious corrosion in many cases, particularly where, as frequently occurs, cold water is used for feeding purposes. If, in addition, the boiler is shut down at week-ends, it may be very cold when starting and will sweat. The exhaust gases being corrosive, especially if producer gas is used, a dilute acid is formed which has serious effects on the plates. A method of partially overcoming this corrosion, which is not often used, consists in feeding the boiler with water from the jackets. This water is at perhaps 120 deg., and its temperature prevents sweating. On the other hand, there is no hot water when the engine first starts after a prolonged stoppage, and unless the boiler can wait half an hour or so some artificial means of heating the boiler should then be adopted.

paper read by him before the Central Thuringian Society of German Engineers, May 8th, 1909:—

We start, says the author, with a bearing as shown in fig. 4. Each of the two rings touches the balls at two points, the outer rings at the points A and B, the inner ring at the points C and D. Experiments made with such bearings run under load showed at once that the temperature rose rapidly and a dangerous point was soon reached. From this it became clear that the design of the bearing was faulty; nevertheless, such a bearing was run to destruction to ascertain the result. After a few days, it emitted an unpleasant and deafening sound. On taking it to pieces it was found that the balls had changed colour in some places, and were chipped. The outer as well as the inner rings showed chipping on the races, and deep grooves had been formed in the races, as shown on the outer ring in an exaggerated manner. The heating that had taken place, owing to which the balls had changed colour, was proof of considerable friction. The balls must have been slipping instead of rolling.



FIGS. 4 and 5.

From this we come to experiments to ascertain the conditions requisite to ensure the balls rolling.

We will take it that the inner ring revolves, and that the outer ring is stationary. The ball, touching both rings at the points A, B, C and D, will now revolve once around the axis A B, as the points A and B on the ball are for the moment the only ones not moving. The speeds K*c* and K*d*, at the points C and D of the ball, will therefore be proportionate to the distances of these points from the axis A B:

$$\frac{\mathrm{K}c}{\mathrm{K}d} = \frac{hc}{hd} \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

In the same way as the points C and D are points on the ball, they are also points on the inner ring, and if the balls are to roll instead of slip, the speeds of these points as such must be the same as that as points on the ball. If, therefore, we designate the speeds of the points C and D of the inner ring J*c* and J*d*, then—

$$\left.\begin{aligned} \mathrm{J}_c &= \mathrm{K}_c \\ \mathrm{J}_d &= \mathrm{K}_d \end{aligned}\right\} \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

The inner ring, however, revolves round the axis E F, therefore—

$$\frac{\mathrm{J}_c}{\mathrm{J}_d} = \frac{l_e}{l_d} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Hence, and from equations (1) and (2), it follows—

$$\frac{h_e}{h_d} = \frac{l_c}{l_d} \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

This would be so only if the points A, B, C, D were on the periphery of a sphere, *i.e.*, if the lines A B and C D intersected in the axis E F.

It is now at once plain why the bearing fig. 4 ran hot. A bearing improved to obviate this is shown in fig. 5.

This bearing was now run, and it was noticed that it still heated, though not to such an extent. On taking it apart it was found that the balls had changed colour somewhat, and that the outer and inner rings were chipped at the points carrying the load, as shown roughly in fig. 5, on the outer ring, though to a less degree.

There was no doubt that though the points A, B, C and D were now correctly chosen, friction had still taken place. It was necessary, therefore, to discover the cause of this friction, and a method of preventing it.

We had, up to now, made an error in taking it for granted that the balls touched both races at the points A, B, C and D. The contact of the balls with the races was not at points, but along flats. Hardened steel balls have considerable elasticity. They become more or less flattened at the points of contact, according to their size and the nature of the load. In the case of large balls, flats to the extent of several millimetres develop. When the ball is relieved of the load, it resumes its original form, unless its maximum elasticity has been exceeded. While under load, it is no longer a perfect sphere.

Shown in an exaggerated manner, as in fig. 5, the ball has a flat

a_1 a_2 at the point A,
b_1 b_2 „ B,
c c_2 „ C,
d_1 d_2 „ D.

The original points A, B, C and D will then roll, but all other points of the ball in contact with the races must slip, seeing that they are not on a perfectly spherical surface.

The surface over which the points of the ball slip will be greater as their distance increases from the axes A B and C D respectively. As against the outer ring, all points of the ball make one revolution around the axis A B, and as against the inner ring around the axis C D. The points a_1, a_2, b_1, b_2, c_1, c_2, d_1, d_2, will therefore, for the most part, slip. At the same time, however, it must be borne in mind that the specific load on the balls decreases as the points of load get further from the points A, B, C, D. It is now clear that the slipping will vary according to the form of the race. Our object is achieved when the balls are in contact at two points instead of four, and when the points of contact are on spheres whose axes correspond with the axis of the shaft.

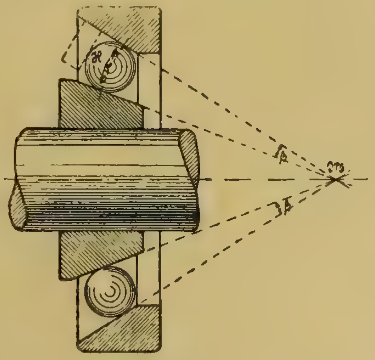


FIG. 6.

We thus come to the ball bearing, fig. 6. Here, however, it must be borne in mind that force H tends to drive the balls outwards. Provision could be made as shown dotted in the fig. to counteract this, but here again slipping would arise, which is just what has to be avoided. The value of the force H depends on the angle β, and disappears as the angle decreases.

(*To be continued.*)

AUTOMATIC LIGHTHOUSE.—The inner Farne Island has now a lighthouse which looks after itself. New automatic machinery has been installed which turns the acetylene gas on at dusk and off at dawn. It is calculated that the gear will only need attention once in six months.

THE BRITISH ASSOCIATION.

Professor Ripper read two papers before the British Association, one on the testing of lathe tools and another on metal cutting. Professor Ripper has devised still another method of testing tools. Instead of conducting a test with all conditions constant and then other tests with only one condition altered, which is usually considered to be the scientific method of procedure, he varies one condition during each test itself. Thus he decides on a standard, but arbitrary—depth and feed of cut, and, starting at some moderate cutting speed, 30 ft. per minute for high-speed steels, increases the cutting speed in small regular steps of 1 ft. per minute each minute until the tool fails. By plotting cutting speed against time a curve is obtained from which the total weight of metal cut off before failure of the tool can be calculated. This weight he takes as a measure of the cutting efficiency of the tool. The results obtained are stated to be remarkably consistent. Professor Ripper states that his experiments give no support to the Herbert figures showing that a tool might be more durable at high than at low speeds.

Professor Ripper's second paper on metal cutting deals with files. The introduction of Messrs. Herbert's file-testing machine caused a great stir in the file-making industry, of which Sheffield is the principal home. The Herbert tests seemed to show very great differences of cutting power between similar files, and also frequently seemed to show that cheap "inferior" files were in reality superior to special high-grade files. Every shop manager can produce similar results obtained in actual practice both as regards files and cutting tools. Naturally, however, the Sheffield filemakers were disturbed by the Herbert results, and they asked Professor Ripper to investigate the matter. As a result, Mr. Ripper points out that in the Herbert machine, contrary to hand filing, the file returns each stroke over exactly the same ground, furrow to furrow and that, in consequence, the work frequently glazes over before the file is really blunt, and the machine records an apparent failure of the file. To remedy this, a device for shifting the file slightly was added to the machine, and more regular results were obtained. Mr. Ripper, however, stopped his tests at an arbitrary point instead of proceeding until failure occurred. The new tests, moreover, do not dispose of Mr. Herbert's statement that a cheap file is not always inferior to a very expensive one.

LAUNCHES AND TRIAL TRIPS.

Messrs. Smith's Dock Co. Ltd. launched from their yard at South Bank, Middlesbrough, on the 2nd inst. a steel screw steam trawler, which has been built to Lloyd's highest class.

Renee Marthe.—Messrs. Osbourne, Graham, and Co. launched on the 2nd inst. from their yard at Hylton the steel screw steamer Renee Marthe, which they have specially constructed to the order of M. Fernand Bouet, of Caen. The vessel is a single decker 259ft. by 35ft., built to carry 2,100 tons on a very shallow draught, and is of the self-trimming collier type. Rooms for the captain and officers are tastefully fitted out in hardwood, and are of large size. The steamer is fitted with the most modern appliances for economical and quick working of the cargo. She has been constructed to Lloyd's highest class, and also complies with the requirements of the French law. After the launch the vessel proceeded to the works of the North-Eastern Marine Engineering Co. Ltd., Sunderland, for her machinery, which has been designed to drive the vessel a speed of 10 knots, loaded.

Gripfast.—Messrs. John Crown and Sons Ltd., Sunderland, launched on the 2nd inst. a steel screw steamer, built to the order of the Newbigin Steam Shipping Co. Ltd., of Newcastle-on-Tyne, for their coasting and general trade. The vessel is designed with self-trimming hatches to carry a dead weight of about 1,500 tons on a light draught of water. Engines will be fitted by the North-Eastern Marine Engineering Co. Ltd., of Sunderland.

Maianbar.—The Ardrossan Dry Dock and Shipbuilding Co. launched on September 3rd a twin-screw steamer, built to the order of the North Coast Steam Navigation Co., Australia. The dimensions of the vessel are: Length, 155 ft.; breadth, 28 ft.; depth, 10 ft. She will be fitted for passenger and goods traffic on the Australian coast, and has been built to British Corporation special class under special survey. Machinery will be fitted by Messrs. Rowan and Co., Glasgow.

Fridland.—On the 3rd September the steel screw steamer Fridland, built by Messrs. Wm. Gray and Co. Ltd. for Messrs. Axel Brostrom and Son, of Goteborg, was taken for her trial trip. The vessel has been built to Lloyd's highest class, and is of the following dimensions: Length overall, 415 ft.; breadth, 52 ft. 9 in.; and depth, 28 ft. 6 in. She has been specially designed for the owners' Swedish iron ore and general trade, and has poop, extra long bridge, and top-gallant forecastle. The cellular double bottom extends throughout, and large aft and fore peak tanks and deep tank in the after hold are fitted for water ballast. These, with side ballast tanks of about 1,400 tons capacity, give about 3,100 tons in all. Special pumps, pipes, and valves are fitted so that the whole of the ballast can be filled or emptied in less than 10 hours. The side tanks (McGlashan's patent) extend from the after hold to the fore hold, a length of 247 ft., in way of which the ship has double sides which add to her strength and safety. They are specially designed for self-trimming; the wings being carried well into the hatch coamings. Twelve steam winches are fitted, two strong masts, four derrick posts, 12 derricks with derrick gear, and two derricks for 10 and 15 ton lifts, steam steering gear and hand gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler of main boiler pressure, steam winch condenser, telescopic masts with fore and aft rig, boats on deck overhead, extra ventilation, room for installation of wireless telegraphy, electric lighting, and steam heating throughout. The machinery consists of a first-class set of triple-expansion engines and boilers, the cylinders being 27½ in., 43½ in., and 73 in. diameter, with a piston stroke of 48 in.; there are large port openings to ensure an easy passage of the steam and so obtain the maximum efficiency from it. The main condenser has also been designed to maintain a high vacuum in all seas, whilst special attention has been given to ensure a high temperature in the boiler feed water. During the trial a vacuum of 28 in. of mercury was maintained. Steam is generated in three large steel boilers adapted to work at a pressure of 180 lbs. per square inch. The engine room auxiliaries are very complete and include a number of duplex pumps of the builders' "C.M.E.W." type, one of their large atmospheric type winch condensers, Weir's pumps and heater, etc. A speed of 12½ knots was maintained, the performance of ship and machinery being highly satisfactory.

Boverton.—There was launched from the shipbuilding yard of Messrs. John Blumer and Co., North Dock, Sunderland, the screw steamer Boverton, for Messrs. Evan Thomas, Radcliffe, and Co., of Cardiff. She is of 4,750 tons deadweight capacity, of single-deck type, with poop, bridge, and forecastle, is fitted for rapid loading and discharging, has absolutely clear holds, and very large hatches. Water ballast is provided in double bottom and also in after peak tank. The accommodation for captain is in a large house on top of saloon house, the officers and engineers are in houses on the bridge deck, and the crew are berthed in the poop. The ship is in every respect thoroughly up to date. Engines will be fitted by Messrs. Blair and Co. Ltd., of Stockton; winches and steering gear by Messrs. John Lynn and Co. Ltd., of Pallion; and windlass by Messrs. Emerson, Walker, and Thompson Bros. Ltd., of Dunston.

Clydemhor.—Messrs. John Fullerton and Co., Paisley, launched recently a steamer, built to the order of Mr. J. B. Couper, Glasgow. The vessel, which is of 1,050 tons deadweight capacity, will be fitted with triple-expansion machinery of 850 I.H.P. by Messrs. Ross and Duncan, Govan. She was named Clydemhor by Mrs. J. Muir Grierson, Glasgow.

St. Lawrence.—Messrs. Wm. Simons and Co. Ltd. launched from their works at Renfrew on 6th September, to the order of the Director of Works of the Admiralty, a "Simons" patent cutter suction hopper dredger, named the St. Lawrence, of 2,000 tons hopper capacity. Dredging clay and other hard material by means of a spiral cutter is only a recent development in dredge building, the St. Lawrence being the first of her type constructed in the United Kingdom. Her arrangements are as follows: An independent set of triple-expansion engines for driving the dredging pump, with a complete installation of auxiliary machinery, are fitted in a separate engine room immediately in front of the hopper compartment. Steam for the propelling and pumping engines and all machinery throughout the dredger is supplied by three marine type steel boilers. The dredging pump is of the most massive and powerful description to withstand the shocks which may be sustained when dredging in clay mixed with stones. The suction pipe is carried on a girder led through a well forward, and is of sufficient length to enable dredging to be done at a depth of 65 ft. below water line. The dredger has also been designed for cutting its own flotation. The cutter at the mouth of suction pipe is driven through a line of shafting fitted on upper side of suction frame, and gearing actuated by a set of independent compound condensing engines. In addition to the usual winches for mooring from the deck at bow and stern, a special winch is placed amidship, from which the moorings are led along the suction frame to fairleads at lower end. The hopper is fitted with "Simons" patent arrangements whereby the contents of the hopper can be discharged either through the floors in the ordinary way or over side by the pump for land reclamation. In addition to loading into its own hopper, the vessel is arranged to discharge into barges moored alongside, or through a pipe line. Two sets of triple-expansion surface condensing engines are fitted aft for propelling the vessel at a speed of 10 knots per hour. The auxiliary machinery in the propelling engine room is of the most up-to-date character. The dredger has been built under special survey by Lloyd's and to their full requirements.

City of Bombay.—The City of Bombay, built by Palmer's Shipbuilding and Iron Co. Ltd., Jarrow, to the order of the Ellerman Lines Ltd. (Hall Line Ltd., managers), was taken to sea on September 7th for her official trial. The vessel was run for several hours, and attained a speed on the measured mile of 12½ knots, the engines working very smoothly throughout, and everything being very satisfactory.

Explorer.—Messrs. Charles Connell and Co., Scotstoun, launched on 6th September the steel screw steamer Explorer, built to the order of Messrs. T. and J. Harrison, Liverpool. The new vessel, which has been built to Lloyd's highest class, is fitted with the latest appliances for the rapid and efficient working of cargo.

Ingleside.—On September 8th the steamship Ingleside, built by the Tyne Iron Shipbuilding Co. Ltd., of Willington Quay-on-Tyne, to the order of Messrs. The Rowland and Marwood's Steamship Co., Ltd., of Whitby, was taken for her trial trip off the Tyne. The vessel, which is 360 ft. by 50 ft. by 25 ft. 10 in., carries 6,400 tons dead weight on the exceedingly light draught of 21 ft. 6 in. mean, and on her trial attained an average speed of over 10 knots fully loaded. The engines, which have been constructed by Messrs. John Dickinson and Sons Ltd., Palmers Hill Engine Works, Sunderland, have cylinders 24 in., 40 in., and 66 in. by 45 in. stroke, with two large single-ended boilers 180 lbs. working pressure, and they were run on a series of different speeds so as to obtain progressive speed results, and the trials were in every respect a complete success. This vessel is interesting as being the second vessel built on the Tyne on the "Isherwood" system of longitudinal framing.

Szent Istvan.—The Clyde Shipbuilding and Engineering Co., Port Glasgow, launched recently a steel screw steamer, built to the order of the Royal Hungarian Sea Navigation Co., "Adria," Fiume. The dimensions of the vessel are: Length, 345½ ft.; breadth, 45¼ ft.; depth, 25 ft. She was named Szent Istvan by Miss Welch, Clunebank. The vessel was superintended during construction by Mr. Alexander Holland. After the launch she was placed in the company's dock to receive machinery, which has been constructed by the builders.

Ryburn.—On the 10th September the steel screw steamer Ryburn was taken to sea for her trial trip. She has been built by Messrs. Wm. Gray and Co. Ltd. for Messrs. J. E. Murroll and Son, West Hartlepool, and takes Lloyd's highest class. Her principal dimensons are: Length overall, 342 ft.; breadth, 46 ft.; and depth, 24 ft. 4 in. Triple-expansion engines have been supplied from the Central Marine Engine Works of the builders, having cylinders 24 in., 38 in., and 64 in. diameter, with a piston stroke of 42 in., and two large steel boilers adapted for working at a pressure of 180 lbs. per square inch. A speed of 11 knots was obtained, the engines running smoothly and well on the run round.

NAVAL NOTES.

H.M.S. Blanche.—The speed trials of H.M.S. Blanche have just been concluded. This is the third vessel of the "Boadicea" class. She is 385 ft. long by 41 ft. 6 in. breadth by 13 ft. 6 in. draught, and 3,360 tons displacement, and was built at Pembroke Dockyard. The order for the machinery was placed by the Admiralty in the hands of Messrs. R. and W. Hawthorn, Leslie, and Co. Ltd., St. Peter's Works, Newcastle-on-Tyne, and consists of an installation of Parsons turbines, having one high-pressure ahead and one high-pressure astern turbine on each wing shaft, and one low pressure ahead with which is incorporated one low-pressure astern turbine on each of the centre shafts—that is to say, there are four lines of shafting in all. In this vessel the latest Admiralty practice of dispensing with a separate cruising turbine has been carried out, and by doing so an improved engine room arrangement in the limited space available has been possible. The turbines are supplied with steam by 12 Yarrow boilers of the latest improved type. On the full power trial the mean of 18,542 S.H.P. was developed on 502·7 revolutions per minute, the coal consumption being 1·02 lbs. and oil ·404 lbs., which is equivalent to a coal consumption of 1·58 lbs. per S.H.P. During this trial also a series of runs were made over the measured mile, and a speed of 25·67 knots was obtained with an S.H.P. of 19,755, the engines working at 516 revolutions per minute and the boilers being only subject to an air pressure of 1·1 in.

Whilst practising in the Bristol Channel, off Port Talbot, one of His Majesty's torpedo boats lost a torpedo, the cost of which is about £800. It is supposed that, after being fired, it dived and stuck in the mud. The coastguards are making a search for it along the coast lying between Porthcawl and Port Talbot.

NOTICES OF MEETINGS, &c.

September 23rd.—The North of England Institute of Mining and Mechanical Engineers. An Excursion will be arranged to the Blackhall Colliery. Trains will leave Newcastle-upon-Tyne Central Railway Station at 1 p.m., and Sunderland Railway Station at 1-40 p.m., for Blackhall Rocks Station.

September 24th.—Association of Engineers-in-Charge. Visit to the Naval, Mercantile Marine, and General Engineering Exhibition. Reception at 5-15 p.m. Lecture at 7-45 on "Wireless Telegraphy, its Maritime Importance," by G. Langler Bullocke.

The Institute of Municipal and County Engineers. Midland District Meeting to be held at Redditch. At 10·35 a.m., the members will be received at the Railway Station. At 10-40, Inspection of Railway Bridge Improvements. At 11-0, Inspection of Enfield Cycle Works. At 12-0, Proceed to Council House. At 12-15 p.m., District Business, Minutes, &c.; Election of Hon. District Secretary; Discussion of paper submitted by Mr. A. J. Dickinson, entitled "Municipal Works of Redditch." At 2-15, Inspection of the Destructor, Electricity Works, and Depot. At 3-0, Visit Sewage Works in course of construction.

September 26th to 30th.—Iron and Steel Institute. Reception of members at Buxton for the Buxton Meetings.

On September 27th a meeting will be held at the Old Theatre, when a selection of papers will be read and discussed. In the afternoon a visit will be made to the works of the Midland Railway Co., at Derby. A visit is also arranged to the Royal Crown Derby Porcelain Works.

On September 28th some papers will be read and discussed in the morning. In the afternoon an excursion will be made to Chesterfield, to visit the works of the Staveley Coal and Iron Co. A visit will also be made to the Broad Oak Iron Works.

On September 29th an excursion will be made to the Crewe Works of the London and North-Western Railway Co. An alternative excursion will be made to Manchester to visit the University, the Town Hall (where the Madox Brown Frescoes will be on view), and Ryland's Library.

On September 30th His Grace the Duke of Devonshire will invite the members and their ladies to a Garden Party at Chatsworth.

The following papers have been offered for reading: (1) "On Electric Steel Refining," by D. F. Campbell, London; (2) "On the Hanyang Iron and Steel Works," by G. Chamier, Hankow, China; (3) "On Manganese in Cast Iron and the Volume Changes during Cooling," by H. I. Coe, B.Sc., Birmingham; (4) "On Sulphurous Acid as a Metallographic Etching Medium," by E. Colver-Glauert, Berlin, and S. Hilpert, Charlottenburg; (5) "On the Theory of Hardening Carbon Steel," by C. A. Edwards, Manchester; (6) "On the Influence of Silicon on Pure Cast Iron," by A. Hugue, B Sc., Birmingham, and T. Turner, M Sc., Birmingham; (7) "On the Preparation of Magnetic Oxides of Iron from Aqueous Solutions" by S. Hilpert, Charlottenburg; (8) "On the Manufacture of Rolled 'H' beams," by G. E. Moore, Loughborough; (9) "On the Utilisation of Electric Power in Iron and Steel Industry" by J. Elink Schuurman, Baden, Switzerland; (10) "On the Briquetting of Iron Ores," by C. de Schwarz, Liége; (11) "On some Experiments on Fatigue of Metals," by J. H. Smith, Belfast.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 15th September, 1910.

Greenock.—*First class:* M. S. Kerr, J. W. Marriott, H. Morrison, A. Martin, J. R. Simpson, J. Austin. *Second class:* J. H. Douglas, W. Freeland, J. Hutcheson, S. McLuckie, A. R. Nicol, R. Thomson.

Hull.—*First class:* S. Winter, H. P. Paulson.

Liverpool.—*First class:* J. H. Tiltman, W. Decons, J. Smith, J. T. Brown, L. Godefroy, A. C. Macnab. *Second class:* R. H. Clitherow, E. J. Gebbie, A. Southworth.

London.—*First class:* R. J. Macbean, H. J. Wood, J. W. Ramsay, H. R. Forrest, V. R. Earnshaw. *Second class:* J. J. Corlett, P. R. Cowesens, H. L. Edwards, E. G. A. Kite, A. F. Lonsdale, M. J. Ruthven, J. Taylor, R. E. Taylor, D. Wright.

North Shields.—*First class:* W. G. S. Ryles, J. Atchison, G. W. Skitch. *Second class:* F. J. Blanchflower, T. Forrest, J. Goodall, E. G. Hall, W. S. Morgan.

Mauretania's Record.—The Cunard Line state that the Mauretania has beaten her previous record made in September last year by ten minutes, her time being four days, 10 hours, 41 minutes. On this run, however, she has steamed four miles less than on her last voyage.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2275. **Centrifugal Pump.**—I have a centrifugal pump, direct driven by steam engine through flanged coupling. I wish to find a simple formula for calculating the strength of bolts in the coupling, to enable same to withstand the B.H.P. given off by the engine shaft when driving the above pump. Is not this generally termed the "tractive effort"?—Grateful.

Answer.—If "Grateful" will consult *The Practical Engineer*, Vol. xli., page 406, he will find very useful data *re* the strength of shafting and formulæ relating thereto. In this instance the horse power (H.P.) is known, and also the number of revolutions per minute. Then we have

$$T\,M = \frac{H.P. \times 12 \times 33000}{2 \times \pi \times N} \text{ revs. per min.} \quad . \quad . \quad (1)$$

where T M is the "twisting moment" or "torque" in inch-pounds being transmitted through the shaft.

To find size of bolts, let D be the diameter of the bolts and f the allowable stress. Then shear force on one bolt will be $\cdot 7854\ D^2 \times f$, and the resisting moment of each bolt to shear will be

$$\cdot 7854\ D^2 \times f \times R \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

where R is the radius of the bolt circle

If there are N_1 bolts, the total moment of resistance will be

$$\cdot 7854\ D^2 \times f \times R \times N_1 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

This quantity must equal the T M obtained from (1), *i.e.*,

$$T\,M = \cdot 7854\ D^2 \times f \times R \times N_1 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

therefore
$$D = \sqrt{\frac{T\,M}{\cdot 7854 \times f \times R \times N_1}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

or, of course, from equation (4) a diameter may be fixed, together with most suitable pitch circle, and the necessary number of bolts N_1 may be found.

Example: A certain motor runs at N revs. per min. and transmits horse power (H.P.), and from equation (1) it is found that the T M is 15,710 pound-inches. If we use four bolts on a 5½ in. diam. pitch circle, what diameter should they be if the shear stress is not to exceed 10,000 lbs. per square inch? From equation (5)

$$D = \sqrt{\frac{15{,}710}{\cdot 7854 \times 10{,}000 \times 2 \cdot 75 \times 4}}$$

which shows that the bolts should be ·424 in. diam. if the above conditions are to hold good.

For this job, of course, ½ in. bolts should be used.—G. E. H.

2276. **Blast Furnace.**—Could some of your readers inform me whether the blast temperature, percentage moisture in blast, and the combustion temperature reached in blast furnaces can be conveniently related, and, if so, how exactly?—Tap.

2277. **Keying, Shrinking, etc.**—Can anyone give some reliable figures comparing keying, shrinking on, and hydraulic pressing of wheels, etc., on shafts as regards cost, time of fitting, reliability, general convenience; indicating also limits and limitations of each method?—Miner.

MISCELLANEA.

"The Tendencies of Modern Coking Practice" is the title given to No. 12 issue of the "Coal Trade Pamphlets" by the *Colliery Guardian*. This states the case in a very clear and concise manner, and the subject includes the use of coke oven gas as an illuminant, benzol as a substitute for petrol, illustrated notes on carbonising, with a comparison of the processes. The pamphlet is published at one penny.

We are informed that the Institution of Automobile Engineers has now taken the important step of removing from its present address (Caxton House) to a suite of offices of its own, situated on the ground floor of No. 13, Queen Anne's Gate, S.W. Here the council meetings will in future be held, and there is also a reading room for members, where the technical papers can be seen and where members will be welcome at any time.

A Smokeless Locomotive.—From time to time we hear of the invention of a smokeless locomotive. The discovery is reported to have been now made from Chicago, where one of the new type, burning bituminous coal, is said the other day to have drawn a train of cars 28 miles without letting off smoke or gas. The trial journey was watched by a number of railway men, who professed themselves highly satisfied. It is also stated that the new device will save from 35 to 60 per cent of the normal fuel consumption.

At the annual general meeting of the Association of Engineers-in-Charge, the chairman, Mr. A. E. Penn, was able to give a very satisfactory account of the association. The whole of the retiring councillors were returned unopposed. The Chairman, in returning thanks for their re-election, regretted there had not been a contest for some of the vacancies, as new councillors brought new ideas and had many ideals to bring forward. Referring to forthcoming events, he was pleased to be able to announce that the president-elect was Capt. H. Riall Sankey, R.E. (ret.), M.Inst.C.E., etc.

Evening Education in London.—The London County Council evening schools, technical institutes, and schools of art re-opened on the 19th inst., and the evening classes at the polytechnics will re-open on the 26th. During the winter session, 1909-10, some 170,000 young men and women enrolled themselves as students at evening classes of all kinds and a large proportion maintained a regular attendance throughout the session. In the schools instruction is provided for every kind of student, young or old, employer or employee. The fees charged at ordinary evening schools are well within the reach of most young wage earners and vary from 1s. to 5s. for the whole session, and in many cases no charge is made for apprentices or improvers. At the polytechnics, technical institutes, and schools of art the fees are, as a rule, a little higher.

Seventeen tram lines have the Brooklyn Bridge as a terminus, and it will be readily understood that if delay occurs in the service across the bridge it is felt over the whole city. A great many delays were found to be due to the cars not being in good condition, and a determined effort to minimise failures during the last three years has had an astonishing effect. According to the *Electric Railway Journal*, writing on the authority of the engineer in charge of the traffic department of bridges, New York City, the delays per 100 cars have been cut down from 49 seconds to 9·9 seconds, and the average time of delay from 4·4 minutes to 2·2 minutes. The net result is shown by the fact that the number of cars running has been increased by 40 per cent during the 5 p.m. to 6 p.m. rush hour; and the reliability of the service has improved so much that in 1909 the rush hour schedule was operated 82 per cent of the time, whereas in 1907 it was operated only four per cent of the time. Improvements of this order of magnitude would very soon pay for the extra cost of supervision and maintenance, and finally might lead to the actual reduction of working costs.

The new building of the Northampton Polytechnic Institute, London, E.C., session 1910-11, has proved a very valuable addition to the accommodation of the polytechnic, and has allowed developments in several directions which have been previously hampered by lack of space. In the electrical engineering department the new generating station, which has been installed at a total cost of about £6,000, will be available for the instruction of senior students. This station will be formally opened on the 12th October, and is thoroughly equipped in all details for the generation and distribution of continuous and alternate currents. The work of this department will during the coming session be in charge of Mr. F. M. Denton. In this department also there are consolidations in the courses in telegraphy and telephony. The classes in submarine cable work are being continued and more advanced classes are projected in radio-telegraphy, although this subject has always been treated hitherto as an advanced subject in the work of the polytechnic. In the mechanical engineering department the subject of aeronautics is being developed for the coming winter and extended to the day courses. In the evening courses and classes, the subject of aeronautics will now be placed in the charge of Mr. F. Handley Page. In the technical chemistry department there are modifications in the day courses which are intended to bring the instruction in electro-plating more into line with the actual requirements of the trade. These modifications have been made in consultation with some of the leading employers. The pioneer evening class in metal colouring, which was held last session having proved a success, is being continued this session with some developments. In technical optics arrangements have been made to extend the advanced work in sight testing and physiological optics, and to develop the classes in other directions to meet the growing requirements of the trade and of the certificating bodies.

PATENTEES' CHRONICLE

OF

Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

SEPTEMBER 12th, 1910.

21133 Motor car wind screen. Gregory.
21134 Feeder. Baldwin.
21135 Lubricator. Thomas.
21136 Piano player. Mowbray.
21137 Printing on pottery, etc. Miles.
21138 Cooking utensils. Taylor.
21139 Reciprocating engine. Lanchester.
21140 Electric coupling. John.
21141 Electric battery lamp. John.
21142 Vacuum cleaner. Griffiths.
21143 Railway signal. Taff.
21144 Garden syringes. Robinson.
21145 Re-reeling machine for paper, etc. Merrick.
21146 Combined curb and dog. Dainty.
21147 Warp tread separating device. Thompson.
21148 Weighing machine. Ciarkowski.
21149 Trace rings. Mogren.
21150 Spinning machine spindles. Lawson.
21151 Automatic weighing device. Beresford.
21152 Gas heater. Ransome.
21153 Pneumatic tyred wheels. Wilkinson.
21154 Ball clutch. Wolfe.
21155 Vacuum cleaner. Seddon.
21156 Reaping, etc., machine. Weathered.
21157 Electrodes. Dowdell.
21158 Elevator safety device. Bates.
21159 Stopping and re-starting aeroplanes, etc. Dunlop.
21160 Adjustable wrench. Schmidt.
21161 Advertising, etc., device. Drummond.
21162 Marine steam turbine. Turnbull.
21163 Mechanical pilotage of shipping. Verity
21164 Cask taps. Bates.
21165 Cylindrical, etc., block manf. Murray.
21166 Draughtsman's curves. Tatchell.
21167 Rest for the physique. Cowburne.
21168 Recording tachometers. Bachoffer.
21169 Electrically propelled vehicles. Hyndman.
21170 *Computing machine. Quentell.
21171 Valves, etc. Snell.
21172 Motor car driving device. Junge.
21173 Gas pipes. Westaway.
21174 *Electric switches. Sidler.
21175 Stocking suspenders. Geist.
21176 Motor car brake. Leindorf.
21177 Buttons. Banholzer.
21178 Wine glass, etc., stands. Buschborn.
21179 Timber truck. Ziermann.
21180 Aerial propeller. Mack.
21181 *Pipe coupling. Schürmann.
21182 Utilisation of waste indiarubber. Higgins.
21183 Potato digger. Lacey.
21184 Gas manf. Higgins.
21185 Flushing cisterns. Levick.
21186 *Shaving mug. Clark.
21187 Steel tyre cover. Barber.
21188 *Fluid-pressure engine. Pittler.
21189 *Aeroplanes. Helsing.
21190 *Refrigerators. Partridge.
21191 *Drying device. Reyscher.
21192 Nut locking device. Schroder.
21193 Letter closing device. Machill.
21194 Power system. Kirkland.
21195 Turbine. Pigott.
21196 *Work holder. Whitaker.
21197 *Ore cooling hearth. Edwards.
21198 *Furnace. Edwards.
21199 Dye manf. Newton.
21200 Dye manf. Newton.
21201 Dye manf. Newton.
21202 Dye manf. Newton.
21203 *Railway shunter pole hook. Heard.
21204 *Valve regulator. Lake.
21205 *Small arm bullets. Mauser.
21206 *Treatment of ores. Harden.
21207 Resilient tyres. Lamble.
21208 *Grain sowing device. Metzler.
21209 Internal-combustion engine. Brewtnall.
21210 *Treatment of distillation gases. Mueller.
21211 *Folding sleigh, etc. Heuermann.
21212 *Potato planting device. Jagstaidt.
21213 *Transformer mechanism. Wolter.
21214 *Rat, etc., poison. Blanc.
21215 *Aeroplane balancing device. Lewis.
21216 Tyres. Lemarchand.
21217 *Pocket lighter. Battey.
21218 Riding whip. Malfatte.
21219 Brassing metal tubes. Coles.
21220 *Safety razors. Willett.
21221 *Tidal hydraulic power plant. Hanes.
21222 Gas controlling apparatus. Yates.
21223 *Hand tacking tools. Marks.
21224 *Scales. Marks.
21225 *Heel manf. Boult.
21226 *Franking machine. Fischer.
21227 *Folding receptacles. Segal.
21228 *Type casting machine. Degener.
21229 Pincer lasting machine. Bates.
21230 *Leather skiving knives. Fortuna Machine Co.
21231 Aeroplane balancing. McMullan.
21232 *Gramophones. Boyd.
21233 *Heat transmitting device. Jensen.
21234 *Internal-combustion engines. Matti.
21235 Motors. Rogler.
21236 Internal-combustion engine. Batt.
21237 *Utilisation of sulphurous acid. Collett.
21238 *Filing apparatus. Hick.
21239 Welding, etc., device. Murray.
21240 *Electricity meters. Strelow.
21241 Mustard, etc., pots. Britten.
21242 *Valve regulator. Lake.
21243 Relating to aeroplanes. Lean.
21244 *Shoe lacings. Duquette.
21245 Miners' electric lamp. Oldham.
21246 *Signalling device for ships. Lefcokilos.
21247 Letter stamper. Palmer.
21248 *Wire netting clip fastener. Hardie.
21249 Shelf supporting bracket. Houghton.
21250 Wooden stanchion pointing machine. Benner.

SEPTEMBER 13th, 1910.

21251 Beer manf. Wethered.
21252 Lantern screen. Cousens.
21253 Photo focus finder. Brett.
21254 Pump, etc. Frampton.
21255 Mineral water syphons. Fletcher.
21256 Projectile. Frewen.
21257 Relating to petrol supply device. Jackson.
21258 Castors. Skinner.
21259 Ships' deck crane. Patterson.
21260 Metal coating device. Bayliss.
21261 Fan. McLean.
21262 Change speed gear. Herbert.
21263 Detachable wheels. Bagnall.
21264 Carriage door lock. Ainsworth.
21265 Bearings, etc. Starley.
21266 Circuit breaker. Gavan.
21267 *Iron, etc., pulley spoke manf. Fraser.
21268 *Acid, etc., production. Neill.
21269 *Shuttle check for looms. Ruthardt.
21270 Motor driving wheel. Rowe.
21271 Folding furniture. Parkins.
21272 Bottle. Kerman.
21273 *Grid bars. Wehle.
21274 Quotation forms. Hoase.
21275 *Rubber heels. Heimbach.
21276 *Car couplers. Durbin.
21277 Pens, etc. Hammett.
21278 Driving gear. Essberger.
21279 Luncheon cases. Scott.
21280 Stove enamels. Peters.
21281 Ammonia production. Williams.
21282 *Wire stays for garments. Spirella Co. of Great Britain Ltd.
21283 *Filter beds. Stiff.
21284 Adding apparatus. Alexander.
21285 Telephone transmitters. Western Electric Co.
21286 Controlling flow of liquids. Summers.
21287 Gas taps. Faiers.
21288 Paper filing box. Fletcher.
21289 Detachable wheels. Pugh.
21290 Detachable wheels. Pugh.
21291 Disinfecting telephones. Watson.
21292 Spades, etc. Wilkinson.
21293 *Corset busk. Buffard.
21294 Sewing machine. Boult.
21295 Ladders. Wightman.
21296 Carpet sweeper. Smith.
21297 *Valve gear for power hammer. Hamilton.
21298 Internal-combustion engine. Watts.
21299 Box corners. Rose.
21300 Dust pan. Rose.
20301 Boxes. Rose.
21302 Motor wind screen. Clarke.
21303 *Rotary engine. Jacobs.
21304 Impregnating mass. Calvert.
21305 Cellulose products. Calvert.
21306 Roller bearings. Hall.
21307 Cut flower support. Sargent.
21308 Valves. Jefferies.
21309 Boots, etc. Alsop.
21310 *Electric switch. Siemens.
21311 Wireless telegraphy apparatus. Sácek.
21312 *Furnace tongs. Loubriat.
21313 *Conduit joints. Billé.
21314 *Trucks. Lake.
21315 *Cement preparation. Durandy and Co.
21316 *Ferro-concrete structures. MacDonald.
21317 *Neck scarves. Sampliner.
21318 Sliding window sashes, etc. Dennett.
21319 Boot, etc., heels. Heinag.
21320 *Pump, etc. Pinkert.
21321 *Engine. Woolf.
21322 *Door closing device. Duggar.
21323 *Rotary motor. Weinland.
21324 *Rotary motor. Weinland.
21325 *Turbine. Weinland.
21326 *Electric lamp.
21327 Bottle stands. Hucks.
21328 *Telephone diaphragm. Baehr.
21329 Separators. Sutcliffe.
21330 Amusement device. Wilkins.
21331 *Making artificial dentures. Luce.
21332 Treatment of ores. Scott.
21333 *Furniture construction. Lindley.
21334 *Eyeglasses, etc. Brinkhans.
21335 *Cable slipping device. Felton.
21336 *Ships' wave motor. Fisher.
21337 Collapsible tubes. Hertslet.
21338 *Spring. Bell.
21339 *Electric motors. Johnson-Lundell Electric Traction Co.
21340 Knitting machine. Cotton.
21341 *Submarines. Jack.
21342 Boot inner sole. Martinson.

SEPTEMBER 14th, 1910.

21343 Hay cart. Donnon.
21344 Driving belt. Adair.
21345 White ant destroyer. Robinson.
21346 Boot lasting. Perkins.
21347 Washing basin. Huffell.
21348 Flying machine control. Bennett.
21349 Bayonet socket. Roberts.
21350 Strong rooms. Wakefield.
21351 Golf ball. Bevan.
21352 Pulley wheel. Gowland.
21353 Pillow case. Harker.
21354 Collapsible hand garden light. Kaye
21355 Photo album. Trolga.
21356 Motor wind screen. Gill.
21357 Ice manf. Laurenson.
21358 Pipe joint. Yarrow.
21359 Telephonic apparatus. Johnson.
21360 Tyre cover. Scott.
21361 Looms. Clayton.
21362 Pocket knives. Priestman.
21363 Throttle control. Perrot.
21364 Change speed gear. Perrot.
21365 Meat slicer. Spink.
21366 Heating apparatus. Dodd.
21367 Table game of football. Gillespie.
21368 *Chairs. Frank
21369 Fire alarm. Voigtlaender.
21370 Photo production. Robbie.
21371 *Suction dredgers. Lobnitz.
21372 Aeroplanes. Freund.
21373 Spinning machine. Gaunt.
21374 Potato steamer. Sadler.
21375 Pressure indicator. Rosenhan.
21376 Jeweller's trays. Hartnett.

21377 Gramophones. Middleton.
21378 Non-slip horse shoe. Fleexman.
21379 *Hackling machine. Liebscher.
21380 Music holder. Dale.
21381 *Resilient wheels. Pessina.
21382 Aeroplanes. Rüesch.
21383 *Carburetter. Hertel.
21384 Envelope. Cotton.
21385 *Tyre. Braidwood.
21386 Non-slip device for horses. Fagan.
21387 Cinematographs. Gee.
21388 *Telephone apparatus carrier.. Siemens.
21389 *Electromedical electrode holders. Siemens.
21390 *Free wheel, etc. Sachs.
21391 Gas generator. Roberts.
21392 Rubber mould construction. Killen.
21393 Pneumatic tyres. Walker.
21394 Pneumatic tyres. Ure.
21395 Wheels. Ure.
21396 Advertising device. Harris.
21397 Weighing apparatus. Haimovich.
21398 *Boiler feed apparatus. Chambers.
21399 *Polyphase commutator machine. Siemens.
21400 *Bobsleighs. Kny.
21401 *Insoluble condensation production. Pollak.
21402 *Soil solidifying. Koepe.
21403 Golf ball. Gibson.
21404 Gas generator. Higgins.
21405 Talking machine records. Herzfelder.
21406 *Woodworking machine. Ribayron.
21407 Gas mantle. Pinel.
21408 Electric wire clip. Nield.
21409 *Ammonia recovery. Rotermund.
21410 *Colour photography. Ives.
21411 *Bleaching liquid.
21412 *Calculating machine. Klein.
21413 *Firearms. Justice.
21414 *Therapeutic preparations. Kalle and Co.
21415 *Roller skates. Barker.
21416 *Igniter. Deimel.
21417 Spanner, etc. Galley.
21418 Street decoration. Marks.
21419 *Safety appliance for ships. Fugazzi.
21420 Roller blotters. Kenna.
21421 Internal-combustion engine starter. Clarke.
21422 Water filter. Campbell.
21423 Water waste preventer. Buckmill.
21424 *Pump. Pratt.

SEPTEMBER 15th, 1910.

21425 Pipe joint. Girling.
21426 Blind locking attachment. Brown.
21427 Letter box. Francis.
21428 Luggage grid for motors. Matthews.
21429 Combined flues and producer. Tyle.
21430 Driving clutch. Baker.
21431 Feeding spoons. Langman.
21432 Non-skid for motor cars. Gough.
21433 Tyres. Haslam.
21434 Lozenge cutters. Robins.
21435 Expansion engine. Nicholls.
21436 Cycle forks. Ridgway.
21437 Valves. Thomas.
21438 Weaving wire netting. Simpson.
21439 Pipe joint. Oldfield.
21440 Spinning ring. Spinners.
21441 Applying labels to boxes, etc. Rose.
21442 Toy. Wallis.
21443 Gas burner. Glover.
21444 Non-refillable bottle. Freeman.
21445 Poison bell. Heaton.
21446 Hospital tent. Godfrey.
21447 Vessel for keeping liquids, etc., hot. Silver.
21448 *Hot water apparatus. Brierley.
21449 Motor cycle side car. Harrison.
21450 Cleaning device. Hall.
21451 Wireless telephone. Kramer.
21452 Road pavements. Blake.
21453 Chair castors. Jacobs.
21454 *Cutlery buffing machine. Joy.
21455 Relief of deafness. Pairpoint.
21456 Electric switch. Summers.
21457 Pin point protector. Vennall.
21458 Toast rack. Rolleston.
21459 Apparatus for writing invoices. Soyle.
21460 Scales. Southerton.
21461 Gas meter. Sutherland.
21462 Acetylene gas lamps. Lucas.
25463 Reflecting lamps. Lucas.
21464 Box ventilator. Macnaghten.
21465 Reinforced concrete. Werner.
21466 Railway signalling. Jefcoate.
21467 *Boiler. Rhea.
21468 Cooking stoves. Morrison.
21469 Electric heating elements. Morrison.
21470 *Tanks. Berlin Anhaltische Maschinenbau Act.-Ges.
21471 Fireproof flannelette. Williams.
21472 Drier. Weiss.
21473 Dye manf. Newton.
21474 Tobacco pipes. Orlik.
21475 *Chain grates. Flössel.
21476 *Relating to furnaces. Grahl.
21477 Chair bed. Crowther.
21478 Treatment of flour. Loring.
21479 Dental chair. Dallas.
21480 Cigarette. Kemp.
21481 Gas lamp. Watkinson.
21482 Tyres. Luca.
21483 Treatment of fruit. Harvey.
21484 Carriage window blinds. McLaren.
21485 Paper cutting. Vickery.
21486 Hatpins. Coqui..
21487 *Lubricators. Berna Commercial Motors Ltd.
21488 Measuring device. Winter.
21489 Talking machine. Hanson.
21490 Flying machine. Ningler.
21491 *Kneading machine. Wuest.
21492 *Measuring instrument. B. T.-H. Co.
21493 Treatment of copper. Vantin.
21494 Paper feeding mechanism. Crobt.
21495 Castor hubs. Pountney.
21496 Flying machine. Hardie.
21497 Tyres. Cross.
21498 *Stuffing box. Clement.
21499 Chestnut roaster. Mathwin.
21500 *Internal-combustion engine. Kemp.
21501 Switchboard. Ricketts.
21502 Puttees. Mermet.
21503 Printing telegraphs. Jones.
21504 Mill rolls. Davies.
21505 Dress fastenings. Schroeder.
21506 *Reversible garments. Gutkind.
21507 Sight for firearms. Dawson.
21508 *Gas and air mixer. Lake.
21509 Seed sowing apparatus. Smith.
21510 *Dog, etc., rearing device. Raywood.
21511 Massaging apparatus. Lean.

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21512 Submarine signalling. Whalley.
21513 Steam boiler. Bone.
21514 Destruction of town's refuse. Adamson.
21515 Wearing apparel. Tilston.
21516 Internal-combustion engine. Scott.
21517 Gradient meters. Tapley.
21518 Number recorder. Bailey.
21519 Electric lamps. Webb.
21520 Knife cleaner. Seddon.
21521 Violin neck pads. Alcock.
21522 Overheat electric wire hangers. Speight.
21523 Spinning machine. Burtinshaw.
21524 Looms. Pilling.
21525 Sewing machine. Coakley.
21526 Dough working machine. McConnell.
21527 Acetylene gas generator. Weatherhead.
21528 Self-acting mules. Hough.
21529 Roving frames. Dixon.
21530 Guns. Maleham.
21531 Wire manf. Johnson.
21532 Lock nuts. Harrison.
21533 Turbine blades. Carr.
21534 Can opener. Jessop.
21535 Shaft. Collins.
21536 Sash fastener. Griffiths.
21537 Milk. Ashe.
21538 Motor cycle attachment. Armstrong.
21539 Curtain holders. Greene.
21540 Hairpin manf. Page.
21541 Keel blocks for launching ships. Melville.
21542 Advertising device. Parsons.
21543 Grinding mills. Fairweather.
21544 *Card game. Collis.
21545 Door lock. Marston.
21546 Lamp shade, etc.
21547 Power transmission system. Munro.
21548 Oil engine lamp. Brooks.
21549 Water chute. Morgan.
21550 Shock absorbing wheels. Boult.
21551 Foster mothers. Johnson.
21552 *Collapsible hamper. Tomlinson.
21553 Dust bin lid. Julius.
21554 Railway block telegraph indicator. Blackall.
21555 Root, etc., extractor. Storm.
21556 Piston ring. Chadwick.
21557 Cooking utensils. Macdonogh.
21558 *Fluid pressure device. Westinghouse
21559 *Organ pipe valves. Hopferweiser.
21560 *Artificial stone manf. Mahler.
21561 Cheese cutter. Moses.
21562 *Musical instrument. Lake.
21563 Soluble alkaline silicate production Rouse.
21564 *Railway sleepers. Victor.
21565 Gauging machine. Comings.
21566 Rifles. Godsal.
21567 Die printing press. Croker.
21568 *Gas mantles. Robin.
21569 *Railway carriage seat. Jacobson.
21570 Tramway paving device. Smith.
21571 *Bottle closure device. Malze.
21572 *Belts. Desmoliéres.
21573 Optical lantern apparatus. Wright.
21574 Light reflectors. Tyler.
21575 *Printing press. Mathys.
21576 Window cleaning device. Howard.
21577 Daylight developing tank. Friedl.
21578 Hoist for heavy gun ammunition. Dawson.
21579 Slide valve. Say.
21580 Hatpin. Comber.
21581 Ball bearings. Say.
21582 Loose leaf binder. Whitehead.
21583 Electric transformer. Siemens.
21584 Dynamo. Mavor.
21585 Propulsion device for vehicles. Thornycroft.
21586 *Linen drying device. Willans.
21587 *Motor vehicles. Cox.
21588 Horse shoes. York.
21589 Feeding trough. Moss.
21590 Closing device for vessels. Fanta.
21591 *Warp dressing machine. Turlur.
21592 Gear wheels. Say.
21593 Measuring device. Manning.
21594 *Chain grate. Hof.
21595 *Removable rims. Boklen.
21596 Mouse trap. Simpson.
21597 *Wheel bearings. Perkins.
21598 Glazing bars. Gray.
21599 *Liquid heating device. Gockel.
21600 Tap fixing device. Newton.
21601 Pipe fixing device. Newton.
21602 *Adding machine. Bordt.
20603 *Electric furnace.
20604 Gas burner. Pollatschek.
20605 Flexible expanding bracelets. Simons.
21060 *Change-speed gear. Lang.
21607 Oven heating. Kirkby.
21608 *Water tube boiler. Mackenzie.

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21609 Blotters, etc. Buckell.
21610 Canvas for self-binder and reaper. Malcolm.
21611 Air purification. Keith.
21612 Locking device. Shorrock.
21613 Arc Lamp. Moul.
21614 Door springs. Wass.
21615 Food manf. Greaves.
21616 Bridge marker. Levason.
21617 *Padlock. Mandkishore.
21618 Golf club heads. Jonas.
21619 Dark room. King.
21620 Centrifugal machine. Broadbent.
21621 *Window casement. Burdon.
21622 Design transfers. Appleby.
21623 Watch scribbling disc. Glover.
21624 Puttees. Lupton.
21625 Cardboxes. Stevenson.
21626 *Stone sawing. Peckover.
21627 Grain sack stacking. Simon.
21628 *Cyanogen compound production. Heys.
21629 *Looms. Hibbert.
21630 Weaving machine. Fielding.
21631 Gas production. Whitfield.
21632 Shaft couplings. Wilcox.
21633 Clutches. Wilcox.
21634 Rubber treatment. Costa.
21635 Footballs, etc. Scrivner.
21636 Window grip. Hunter.
21637 Ladies' hat securing device. Bandfield.
21638 Baby carriages. Redfern.
21639 Tyres. Stewart.
21640 Carpet, etc., cleaner. Marsh.
21641 Refuse destructor. Leask.
21642 Barber's chairs. Haworth.
21643 Game. Kelso.
21644 Heat utilising device. Pryor.
21645 Looms. Scroggie.
21646 Taps. Anderson.
21647 Tobacco pipes. Goldsmith.
21648 Kettles. Warner.
21649 Carriage door lock. Bowen.
21650 *Candle shades. Kruse.
21651 Trousers stretchers. Bauer.
21652 Yarn winding. Higginson.
21653 Yarn winding. Higginson.
21654 Bottle washers. Woodhead.
21655 Reinforced concrete. King.
21656 Hatpin point protector. Edser.
21657 *Reaction towers. Steuler and Co.
21658 *Adding apparatus. McLean.
21659 *Sound box for gramophones. Veit.
21660 Tapping tool. Henderson.
21661 Rulers. Morris.
21662 White lead manf. Burton.
21663 *Perforating templets. Jones.
21664 *Ships' course recorder. Spalazzi.
21665 Electric heating apparatus. Berry.
21666 Rock drill. Tippett.
21667 *Miners' lamp. Kesseler.
21668 Removing boiler tubes. Sutter.
21669 Ironing machines.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to October 24th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1908.

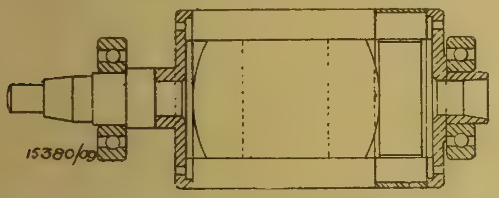
27668 Chaddock: Elastic-fluid turbines. [Post-dated June 12th, 1909.]

1909.

4590 Holman and Holman: Jigging mechanism for operating conveyers, separators, and the like for ores and other substances. [Post-dated August 24th, 1909.] 9009 McLean: Pneumatic boot trees. [Post-dated October 18th, 1909.] 11244 Corthesy and Langan: Turbines. 11288 Hampson: Willows or other fibre-cleaning machines and apparatus for use therewith. [Cognate Application. 11289, 1909.] 11289. *See* 11288, 1909. 11359 Kamo and Naka: Method of freeing petroleum oil from smoke-producing elements. 11708 Lanston Monotype Corporation Ltd. (Bancroft and Indahl): Driving or stamping presses. 13625 Merton and Ridge: Roasting furnaces. 13985 Coles: Fuel-economising apparatus for steam boiler furnaces. 14251 Weiser: Stills.

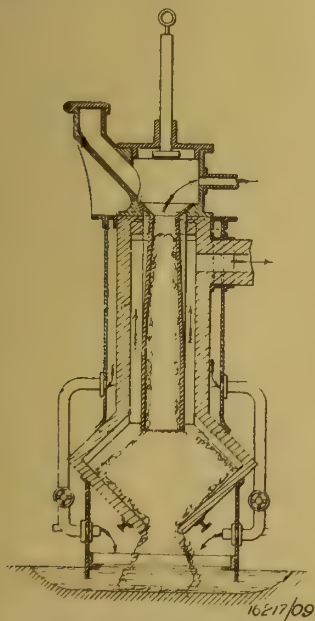
15380 Simms, and Simms Magneto Co., formerly Simms Manufacturing Co.: High-tension magneto electric machines. [Post-dated January 3rd, 1910.]

This invention relates to high-tension magneto electric machines such as are used in connection with magneto electric ignition gear for internal-combustion engines and in which the condenser is arranged in the armature coil. The main features of this invention consist in an arrangement wherein the cheeks of the armature are extended and the condenser located within the extended ends, the ends and the condenser being enclosed in a ring, and packing being provided between the condenser and the cheeks.


15380/09

16217 Reynolds: Gas producers.

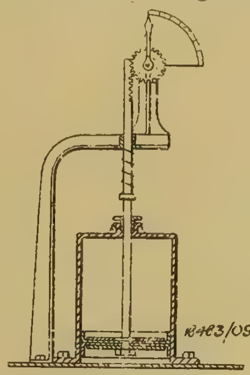
According to the invention the blast passes transversely across the bottom of the furnace or hot zone, is combined with a regenerator chamber or recuperator and a kiln superposed thereon, or with a pair of reversible regenerator chambers and a pair of kilns, the valve arrangements being such that part of the fixed gases of the producer passes through a regenerator chamber to a chimney, while the remainder passes through the charge of limestone or other material to be calcined in the corresponding kiln, the second kiln in the case of the duplicate apparatus being closed and the blast supplied to the producer entering through the second regenerator chamber. Upon reversal the blast enters the producer through the regenerator chamber previously heated by the passage of the producer gases, the corresponding kiln being closed, and the fixed producer gases divide themselves between the other regenerator chamber and kiln. By using an excess of air nitrogen oxide may be formed with or without the assistance of electric arcs or flames in the passages leading to the kilns, such oxides combining with the lime produced in the kilns. The gaseous products of the distillation zone may be separately dealt with in the known manner for the recovery of the more valuable light hydrocarbons.


16217/09

16237 Dunlop: Apparatus for transmitting power by compressed air. [Request under Section 19 of the Act not granted.] 16312 Wetter (Chemische Fabrik Grunau, Landshoff, and Meyer Akt.-Ges.): Process for the manf. of anthraquinone. 16332 Johnson and Billington: Electricity meters. 16348 Plant: Lasting machines for boots and shoes. 16353 Sterne: Pneumatic springs or cushions. [Post-dated January 13th, 1910.] 16375 Ekenberg: Desiccation of milk and milk preparations. 16413 Darch and Marsh: Contents bill board.

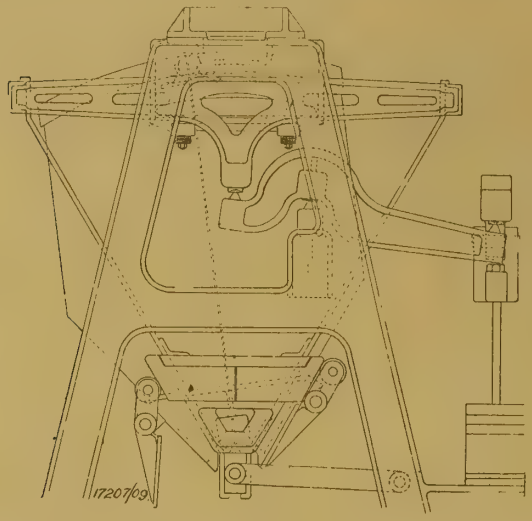
16463 Preston and Thompson: Apparatus for indicating the draught or tonnage of ships.

This invention relates to improvements in apparatus for indicating the draught or tonnage or weight of cargo of ships, and has for its object to provide an improved apparatus of the kind comprising a hydrostatic device which is in direct communication with the water in which the ship floats and is responsive to the pressure variations due to variations in the depth of immersion of the vessel. It is known to employ a piston working in cylinders, the pressure of the outside water being applied on one side of the piston, and the latter being caused to recede more or less into the cylinder against the action of a spring contained in the cylinder, the indicating hand being articulated to the piston rod by a pin and slot connection. According to this invention the piston rod carries a rack which gears with a toothed wheel adapted to drive or turn an indicating device, and by this means the movements of the indicator are rendered more accurately representative of the various depths of immersion of the ship. Instead of arranging the spring in the cylinder, it is advantageous to arrange it around the piston rod whereby it can be readily observed, adjusted, or replaced.


16463/09

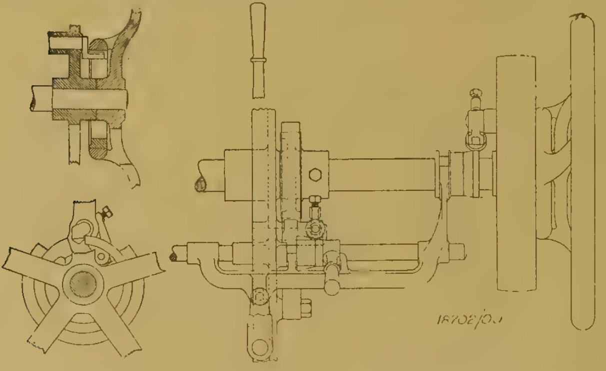
17207 Fraser, and W. J. Fraser and Co.: Automatic weighing machine. [Post-dated January 24th, 1910.]

The object is to provide an improved automatic weighing machine of that type comprising a tank or vessel divided into two equal compartments or divisions to receive from a stationary inlet the material or substance to be weighed and in which the weight of the material or substance is made to be instrumental to impart to the tank at the proper times vertical and horizontal movements, the former serving at one extreme of its movement to lock the tank so as to prevent horizontal movement and at the other extreme to unlock the tank to permit horizontal movements thereof, whereas the horizontal movement of the tank serves to place one or other of its compartments below the stationary inlet whence flows the material or substance to be weighed, hinged doors being arranged at the base for automatic discharge. It consists briefly in a brake device for preventing the tank tilting over with such rapidity when released that damage might result from its impact against the stops which limit its movements, and in the particular construction of machine shown.



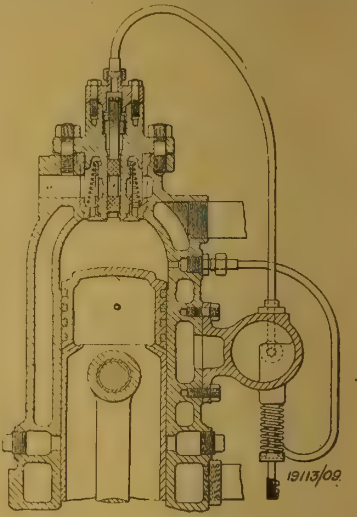
18379 Brock: Reinforced concrete structures. 18555 Hamer: Controlling device for lifts. 18661 Robinson: Apparatus for purifying air. 18667 Temple: Method of suspending stockings and socks in wear. 18675 Medway and Scott: Automatic switch gear for the remote control of electric motors. 18698 Roots: Screw and nut mechanism and the like.

18702 Rose, and Rose Bros. (Gainsborough) Ltd.: Clutch. This invention relates to clutches of the type comprising a pulley loosely mounted on the shaft to be driven and an expansible ring, which by the movement of a lever actuated by a sliding tapered collar is adapted to engage a rim secured to the shaft so as to transmit a motion of rotation from the loose pulley to the aforesaid shaft. The invention comprises a pulley loose on the main shaft and a coned part capable of sliding thereon, a wheel, rim, or equivalent secured to or in connection with the main shaft, a transversely severed and expansible ring having one end secured to the aforesaid loose pulley, and a crank pivotally mounted on the loose pulley and operated by the sliding coned part so as to act on the expansible ring and cause it to clutch the wheel, rim, or equivalent.



18709 Morris and Howard: Reversible seats. 18727 Hemming and Kennett: Brick and like kilns. 18730 Fawcett, Preston, and Co., and Dinsdale: Mineral oil and like burners. 18756 Turquand and Turquand: Electric battery lamps. 18786 Thomson: Pneumatic safety lock for railway carriages and such like vehicles. 18805 Garrett: Non-skid devices for motor road vehicles. [Cognate Applications. 24955, 1909, and 853, 1910.] 18822 Ransford (Leopold Cassella and Co. Ges.): Manf. of sulphide dyestuffs derived from carbazole. [Samples furnished under Section 2 of the Act.] 18843 Major: Clutches. 18847 Viry: Electrical devices for controlling movements from a distance and methods of mounting the same. [Application for Patent of Addition to 18624, 1909.] 18849 Boult (United Shoe Machinery Co.): Inseam-trimming machines adapted for use in the manf. of boots and shoes. 18931 Roots: Fluid-pressure engines. [Cognate Application. 29337, 1909.] 18937 Fairweather (Underwood Typewriter Co.): Calculating machines especially designed for use in connection with typewriting machines. 18945 Beindl: Process for the production of hydrocyanic acid and cyanides. 18954 Lake (Parker-Clark Electric Co.): Filament or resister for heating units or lamps. 18976 Dunkley: Construction of flying machines. 18997 Nash: Cement kiln. 19037 Cowper-Coles: Reflectors. 19042 Florio: Telescopic standards for lamps. 19046 Yarwood: Propellers and tractors for aerial and marine vessels. 19088 Newton (Farbenfabriken vorm. Friedrich Bayer and Co.): Manf. and production of methylene ketones. 19090 Murphy: Means for rectifying electric currents.

19113 Kings: Fuel inlet valves for internal-combustion engines. This invention relates to fuel inlet valves for two-stroke cycle internal-combustion engines of the type in which the fuel is blown past the inlet valve into the combustion chamber by means of air or other gas which is compressed in an auxiliary chamber in connection with the combustion chamber. The invention consists essentially in adapting the charge of fuel to be blown through the fuel inlet valve into the cylinder at the commencement of the compression stroke, an auxiliary chamber being provided into which a supply of gas may be compressed from the cylinder during a compression stroke, the chamber being fitted with a valve-controlled inlet and an outlet to the fuel valve provided with a mechanically-operated valve.

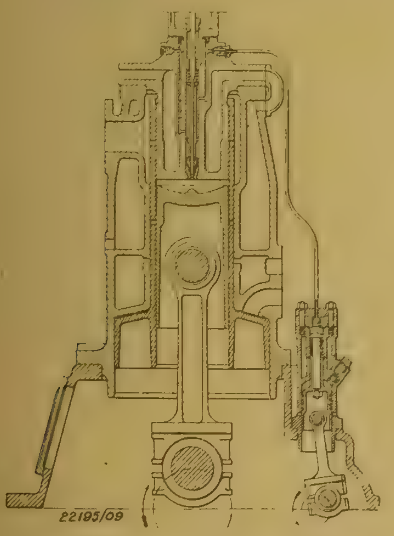


19142 Keegan, and Dunlop Pneumatic Tyre Co.: Attachment for supporting and holding the spare tyre-carrying rims or wheels on motor vehicles. [Cognate Application. 6498, 1910.] 19156 Schettler: Machines for measuring the superficial area of leather and like material. 19162 Mercer: Valves. 19169 Simon: Automatic recording apparatus for measuring gaseous fluids. [Date applied for under International Convention, November 2nd, 1908.] 19172 Maxim: Inhaler. 19174 Nieser: Atmospheric gas burners. 19188 Coleman: Apparatus for drying and heating sand, stone chippings, and like materials. 19225 Hollingworth (Crompton and Knowles Loom Works): Automatic weft-replenishing looms. 19241 Hollingworth (Crompton and Knowles Loom Works): Automatic weft-replenishing looms. 19276 Oliver: Apparatus for preparing casting moulds for casting turbine cylinders and other large cylindrical or tubular castings. 19296 Bayer: Spools for music sheets. [Date applied for under International Convention, August 21st, 1908.] 19305 Duckham: Machines for discharging and charging gas retorts or coke ovens. 19339 Interoceanic Engineering Co., and Jackson: Coupling apparatus for railway and like vehicles. 19344 Justice (Plant): Insole-covering and reinforcing machines. 19352 Newton (Lamson Consolidated Store Service Co.): Pneumatic ammunition-conveying apparatus. 19355 Hodson (Hodson): Portable sawing machines. 19370 Stamm: Lasting machines for boots and shoes. 19420 Dicks: Production or manf. of metal rods or tubes from billets. 19423 Reform-Schloss Ges., and Bartmann: Safety device for hats or other head gear. 19425 Richards: Loading and unloading device for ships and the like. 19436 Holroyd: Construction of road and other surfaces. 19446 Winter: Machines for applying bottle seals. 19456 Fritz Schulz, jun., Akt.-Ges., and Philipp: Vessels for containing volatile or other liquids. 19468 Sterne: Vehicle wheels. [Post-dated February 14th, 1910.] 19570 Pearce: Men's braces or suspenders. 19660 Farrand: Coin-freed apparatus for supplying or measuring a current of electricity. 19685 Lloyd and

Plaister: Fire escapes. 19759 Boult (Sulzer): Rotary rock drills. 19933 Savery and Savery: Liquid-fuel firing systems. 19937 Nager: Starting of multi-cylinder internal-combustion engines. [Date applied for under International Convention, September 7th, 1908.] 20015 Sucher and Schittmeyer: Automatic self-locking railway coupling. 20021 Cowper-Coles: Means for ensuring the combustion of smoke in furnaces. [Post-dated March 1st, 1910.] 20067 Butler and Gibbings: Metal conduit tube couplings or junction articles or boxes of electric cables. 20173 Tattersall: Construction of wings or organs for the sustention and flight of aerial vessels or flying machines. 20207 Curran: Fire arches for the furnaces of the locomotive type of boiler. 20260 Jackson: Hulling, shelling, grinding, or crushing machines. 20451 Challis: Covered vessels for containing food and the like. 20465 Coomber: Hot or cold air inlet or ventilator. 20557 Cowper-Coles: Means for consuming smoke in boilers. 20658 Surmont: Acetylene generator. 20863 Waterhouse, Phillips, Phillips, and Hughes: Children's cots with falling sides. [Application for Patent of Addition to 3274, 1909.] 20919 Maxaner: Apparatus for removing dust from air, vapours, or gases. [Date applied for under International Convention, September 14th, 1908.] 21[illegible] Fairweather (Electric Shoe Polisher Co.): Shoe-polishing and brushing machines. 21094 Bodley and Industries Ltd.: Non-refillable bottles. 21120 Kindermann: Air-purifying apparatus. 21140 McCubbin and Garden: Blackboard or like apparatus for scholastic and like purposes. [Application for Patent of Addition to 10468, 1908.] 21575 Schmidt: Tobacco pipes. 21594 Armstrong: Bicycle and motor cycle spring forks. 21601 Thomas: Pockets for billiard and like tables. 21687 Mayall: Carrier or container for cotton, wool, silk, linen, cords, tapes, and the like. 21729 Herring: Rotary pumps. 21748 Strelzoff: Device for reversing, decreasing, and increasing the speed of and stopping the rotation of paddle wheels and screws, and for actuating the rudder of steamships. 21934 Thompson (Elliott): Registering devices for use in connection with ships' telegraph apparatus and the like. 21937 Mark Dawson and Son Ltd., and Smith: Method and means for mounting and connecting the bobbins in cap-spinning and twisting machines. 22114 Fisher: Machines for washing and wringing clothes and the like. [Date applied for under International Convention, September 28th, 1908.]

22195 Willans and Robinson Ltd., and Peache: Fuel-injecting apparatus for internal-combustion engines.

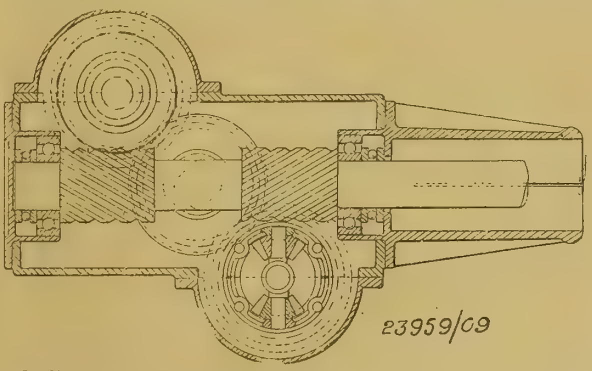
Relates to the injection of fuel in a two-cycle internal-combustion engine of the Diesel type in which the requisite amount of oil or other fuel is before each working stroke of the engine pumped into a chamber situated in the head of the engine cylinder and provided with a fuel valve, the shank of which passes out of the chamber through a packed gland, while the valve which may open outwardly or inwardly is held to its seat by a spring, the tension of which can be regulated. According to this invention this chamber is kept filled with air at a pressure slightly below that required for injection purposes by means of a separate air compressor which maintains the required air pressure and raises it periodically to an intensity sufficient to open the valve and inject fuel into the working cylinder. This air compressor is driven off the crankshaft of the engine or mechanism that works in synchronism with the crankshaft and is made compound—that is, with two or more stages of compression, while its driving gear is so arranged that the compressor piston reaches the top of its stroke when the main crank has passed its dead centre by about 45 deg. The compressor is so proportioned that the necessary injection pressure is reached in the high-pressure cylinder when the main crank is on its dead centre. A non-return valve on the high-pressure cylinder of the compressor retains the pressure in the fuel chamber and pipe connection so that the contents of this chamber remain at a pressure just below that necessary for injection until the compressor again raises the pressure. To ensure this retention of pressure a second non-return valve may be fitted to the delivery pipe beyond the non-return valve just mentioned.


22195/09

22282 Nightingale: Fire guards. 22319 Lake (Bour): Block signalling apparatus for railways applicable to the automatic stopping of trains or the like. 22394 Talbot: Converters or vessels for refining iron and steel. 22444 Timings: Manf. of frames for photographs, pictures, mirrors, and the like. 22610 Ogden: Dry closets and means for disinfecting the same. [Date applied for under International Convention, November 28th, 1908.] 22638 Strong: Machines for making cone or kite-shaped bags. 22706 Sunguroff: Aerial propellers. 22754 Spink and Lease: Meat and like slicing apparatus. 22760 Wood: Manufacture of trunk locks. 22835 Streich: Automatic musical instruments. 22943 Strange: Means for the manf. of strips or sheets of metal. 22991 Morton: Machines or apparatus for dividing dough or like substances. 23059 Morgan: Shelf and other like brackets. 23165 Guest: Umbrellas. 23221 Marr: Necktie supports and the like. 23226 British Thomson-Houston Co. (General Electric Co.): Fluid meters. 23232 Stanley, Stanley, and Stanley: Pencil sharpeners and the like. 23324 Lake (Electric Press Bulletin Co.): Telegraph bulletin printers. 23455 Dessauer: Method of taking photographs with Rontgen rays. 23482 Aird: Gas fires. 23625 Deiss: Processes for the manf. of cellulose. 23698 White: Window roller blind fittings or mountings. [Cognate Application. 4721, 1910.] 23766 Hugendick: Process for the continuous distillation of tar. [Date applied for under International Convention, October 17th, 1908.] 23790 Harrison: Steering of vessels. [Cognate Application. 28976, 1909.] 23800 White: Window roller blind fittings or mountings. 23888 Spayd and Spayd: Exhaust valve mechanism for four-stroke cycle internal-combustion engines.

23959 Lamplough: Transmission of power by worm gearing, suitable for the live axles of motor cars and other purposes.

This invention relates to that class of worm gearing in which the end thrust on the driving shaft is absorbed or neutralised by providing such shaft with a pair of worms, one right handed and the other left handed, which gear with worm wheels fixed on two parallel shafts at right angles to the driving shaft. Heretofore these parallel shafts have been located on the same side of the driving shaft. According to the present invention one of the parallel shafts and its worm wheel is arranged on one side of one of the worms and the other of such parallel shafts and its worm wheel on the opposite side of the other worm, and these parallel shafts are connected by toothed gearing with the shaft to be driven, by which means not only is the end thrust on the driving shaft obviated, but also any side thrust on the bearings of the worm shaft.

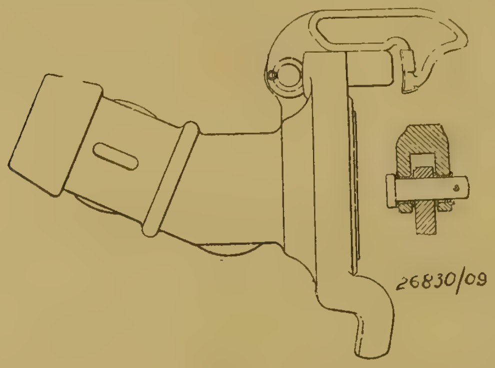

23959/09

24138 Wilson and Wilson: Jig for building and brazing front forks for cycles, tricycles, and the like. 24170 Freer and Willis: Floors for roller skating rinks. 24466 Cole: Canopies for motor road vehicles. 24584 De Caudemberg: Process of making a cement for the manf. of artificial paving blocks and the like. 24600 Fuller: Submarine torpedo boats. 24667 Leggott, and W. and R. Leggott Ltd.: Securing and liberating emergency exit doors. 24741 Brightmore: Bacteria filtering beds for the prevention of subsequent putrefaction. 24865 Hailwood: Miners' safety lamps. 24955. *See* 18805, 1909. 25068 Bateman and Bateman: Vices. 25089 Thornhill: Mechanical toys. 25133 Hoy, Downes, and Grierson: Furnaces. [Date applied for under International Convention, November 4th, 1908.] 25213 Benz: Umbrella runners and top notches. 25221 John and Joseph Taunton Ltd., and Taunton: Table attachments for invalid and other bedsteads. 25302 Robert

Dempster and Sons Ltd., and Toogood: Coke trucks, barrows, or conveyers. 25661 Allen: Acetylene gas generators. 25836 Joseph Booth and Bros. Ltd., and Booth: Stone breakers. 25890 Barton: Steam traps. 26045 Walton: Reciprocating engines. 26048 Sheward: Construction of electric lamp holder. 26053 Silverman and Atkinson: Razor-blade holders for sharpening or stropping purposes. 26136 Davison: Cask and barrel stands or tilters. 26439 Kindscherf: Means for attaching auxiliary tyres to the wheels of vehicles. 26442 Schiffers: Nap raising and dressing machines. 26487 Soc. in Accomandita per l'utilizzazione delle Invenzioni Ing. Beer: Railway block signalling systems. [Date applied for under International Convention, November 17th, 1908.] 26526 Jones, and Interchangeable Brake Block Co.: Brake blocks and holders for railway and tramway vehicles. 26612 Delmas: Turning mechanism for motor cars. [Date applied for under International Convention, November 17th, 1908.] 26657 Parkin and Williams: Non-inflammable celluloid or celluloid substitute. 26661 Webb, Brettell, and Adamson: Hatchway fittings of ships' refrigeration holds or chambers. 26779 Leon and Lewis: Telephone transmitters.

26830 Gresham: Flexible pipe couplings.

This invention relates to flexible pipe couplings, and consists mainly in the two flanged socket-like parts or half couplings for affixing to adjacent ends of the flexible pipe, and are made from malleable cast iron or other steel or iron and are provided with the usual jointing rings or washers, also with malleable cast iron or other steel or iron fingers or inter-engaging pieces for union purposes and locking hooks which, when brought over the flanged-like meeting faces of the coupling, effectually draw or clamp the same together. The hooks swivel upon pins of which one is provided upon each half coupling. Each hook in its eye or journal portions is fitted with a bush or bushes of brass or its equivalent. The bushing is preferably effected by means of two short lengths of tubing, each length being flanged at one end. When the tubing is in position the inner or forward ends are flanged or beaded over, so holding the bushes firmly in place.



26873 Stevenson: Boxes for containing mantles used in incandescent gas lighting, incandescent electric lamps, and other fragile articles. 26945 Drury (Deegan): Lock for the differential gear of traction engines and the like. 26997 Jacobs: Hunting stock tie. 27041 John and Joseph Taunton Ltd., Taunton and Dunn: Means for connecting the metallic meshes or mattresses of bedsteads and cots to their framings. 27059 Thompson: Artificial eye extractors. 27145 Wardwell: Bobbins and like holders or supports for thread, yarn packages, and the like. 27224 F. H. Ayres Ltd., and Kearns: Hydraulic rowing machines and other similar athletic exercisers. 27267 E. de la Brosse et Fouche: Construction of gas or steam turbines. [Date applied for under International Convention, April 8th, 1909. Request under Section 19 of the Act not granted.] 27380 Hammarlund: Apparatus for recording or registering mechanical movements. 27457 Gaede: Apparatus for producing high vacua. [Date applied for under International Convention, January 2nd, 1909.] 27761 Justice (Plant): Heel-saving machines. 27762 Justice (Plant): Shoe-sole edge setters. 27948 Lamplough: Means for converting reciprocating into rotary motion. 28080 Bump and Hawkins: Method and appliance for fastening sheets of paper together. 28111 Mason and Masters: Means for lubricating gas exhausters. 28154 Geipel: Steam traps. 28202 Devlin: Meat safes. 28242 Miller: Filters. [Date applied for under International Convention, January 22nd, 1909.] 28318 Walker: Rotary motive power engines, pumps, compressors, and blowers. 28356 Simmons, and R. Waygood and Co. Ltd.: Lifts and hoists. 28429 Wynne: Electric switch with lever motion and instantaneous make and break. 28557 Hirst and White: Electric bell pushes. 28616 Mackenzie (S. C. F. Machinery Co.): Cloth-piling machines. 28653 Tateson: Illuminating cabinets or like cases for advertising purposes. 28668 Brown: Combined agricultural engine and road wagon. 28724 Hubschmann: Inkstands. 28753 Wilkerson: Appliance for lifting sacks, milk churns, and the like. 28789 Copland and Fullarton: Fixing of tents, marquees, and the like. 28795 Notbohm and Eigemann: Controlling device for winding engines. 28862 Dales: Vulcanising presses. 28932 Kohn and Taubert: Motor ploughs and tractors. [Application for Patent of Addition to 15310, 1909.] 28955 Huntington and Maltby: Valve mechanism of internal-combustion engines. [Application for Patent of Addition to 1323, 1909.] 28976. *See* 23790, 1909. 29068 Hirst and Angold: Electric arc lamps. 29337. *See* 18931, 1909. 29340 Rogers: Type line-casting machines. [Date applied for under International Convention, January 20th, 1908.] 29473 Kershaw and Helliwell: Machinery for finishing cord, fustians, velvets, and other suitable pile fabrics. 29580 Pocock and Sibun: Loose-leaf books, files, and the like. 29732 Mutton: Wheels for vehicles. 29820 Longsdon: Bearings for the shafts of rotary washing machines. 30053 Clayton and Shuttleworth Ltd., and Poore: Means for separating light particles from corn. 30201 Westmacott: Puzzle. 30461 Schweiter: Reels or skein holders. [Date appiled for under International Convention, February 3rd, 1909.]

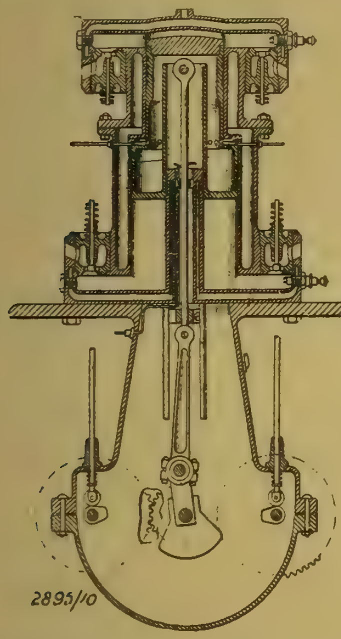
1910.

88 Leistler: Automatically locking locks for doors and the like. 107 Turnham: Tree clip. 176 Davies: Spare or auxiliary rims for wheels. 241 Alderman and Kerr: Digging cultivator. 262 Blake and Smart: Kilns for the decarbonising and revivifying of animal charcoal. 562 Lake (Deutsche Niles-Werkzeugmaschinen Fabrik): Method of and means for turning tyres for railway vehicles and the like. 678 Schar and Von Schmid: Manf. of chains. [Date applied for under International Convention, January 22nd, 1909.] 760 Goltstein: Capsules or caps for sealing receptacles. [Rights under Section 91 of the Act not granted.] 777 Senior, Burt, Pickering, and Martin: Construction of apparatus for holding and securing wearing apparel and other articles. 781 Hoskins: Cutting-out or formation of holes in tubes, and tools or appliances to be used in connection therewith. [Date applied for under Rule 13, July 12th, 1909.] 826 Benninghoff and Firm of August Klonne: Gas-fired retort oven and like furnaces. 853. *See* 18805, 1909. 880 Schwarzhaupt: Powder and puff box. [Date applied for under International Convention, January 13, 1909.] 923 Grant: Systems of laying out stair rails. 982 Asa Lees and Co., and Bardsley: Locking devices for the doors or covers of carding engine cylinders. 1115 Schmidt: Gas-fired furnaces for heating bars, rod iron, and the like. 1130 L. Dutheil R. Chalmers et Cie.: Sparking devices for internal-combustion motors. [Date applied for under International Convention, January 15th, 1909.] 1202 Lloyd: Means for keeping up the front of peak and other caps. 1415 Muggli: Cultivation of land and apparatus therefor. [Date applied for under International Convention, January 23rd, 1909.] 1429 Orlai: Aeronautical apparatus. [Date applied for under International Convention, January 21st, 1909.] 1527 Pfannkuche: Means for effecting the lateral tipping of trucks. [Date applied for under International Convention, January 22nd, 1909.] 1532 Beswick: Bedsteads. 1535 Diehl: Skiving machines. 1684 Reckless: Devices for delivering measured quantities of liquids. 1685 Lange: Machines for picking, scutching, and swingling flax, or the like. 1865 Lemetais: Mixing valve or cock for liquids. [Date applied for under International Convention, January 27th, 1909.] 2021 Stumpf: Uni-directional flow steam engines. [Date applied for under International Convention, January 27th, 1909.] 2178 Twidale: Collapsible cardboard and like boxes. 2286 Blum: Electrical vaporiser. 2324 Hartley and Brown: Means for supporting pit cages at the top and bottom of the shaft. 2372 Cotten: Billiard tables. 2409 Erith: Separation of suspended matter or impurities from gases or vapours. 2418 Nystrom: Apparatus for recording and reproducing the pedal movements in keyed musical instruments. 2431 Felix Peltzer and Co.: Tracing cloth or fabric. [Date applied for under International Convention, March 30th, 1909.] 2438 Briggs: Igniting devices for gas engines and the like. [Date applied for under International Convention, February 4th, 1909.] 2583 Plotner: Cracker boxes. 2634 Thompson (Duplex Printing Press Co.): Rotary mechanism for folding newspapers and the like. 2741 Brinkhaus: Eyeglasses. 2892 Gropper, Voge, and Lascelles: Machines for cleaning road and like surfaces.

2895 Brown: Double-acting internal-combustion engines.

This invention relates to internal-combustion engines, and consists essentially in a cylinder having at each end thereof inlet and exhaust valves, a central opening through one end of the cylinder, a tubular wall extending inwardly from the edge of the opening, the tubular wall forming an air passage and an annular explosion chamber with that end of the cylinder, a hollow piston having an opening in one end thereof, and another tubular wall extending inwardly into the piston from the edge of the piston opening and forming a telescopic continuation of the first-mentioned tubular wall for the passage of air into the annular chamber within the piston.

3147 Murray: Pumps. 3216 Troje: Cock with cut-off mechanism actuated by overflow from vessels filled from the cock. 3410 Murphy: Electric valves. [Date applied for under Rule 13, August 19th, 1909.] 3414 Kantorowicz: Manf. of dry preparations for forming liquid adhesive substances with cold water. [Date applied for under International Convention, March 10th, 1909.] 3459 Plant: Go-cars. 3460 Jenkins: Furnaces and firebars used in them. 3487 Halliwell and Maschmeier: Boring tools. 3602 Brock: Coverings for pillows. 3628 Qvist: Paving rammers. [Date applied for under International Convention, February 15th, 1909. Request under Section 19 of the Act not granted.] 3712 Dunker: Gauge for use in cutting glass. 3952 Steedman: Hook for suspending curtains or other articles. 3994 Byrom and Baker: Thatching pins for thatching roofs, ricks, and the like. [Cognate Application. 4502, 1910.] 4036 Hardy: Propulsion of fluids by rotary apparatus. 4096 Hindemann: Illuminated advertising devices. 4172 English: Talking machines. [Date applied for under International Convention, February 20th, 1909.] 4178 Van Maurik: Device for use in connection with the manf. of cigars. 4295 Lowenberg: Gloves. 4409 Brenken and Boddecker: Hand saws or rasps composed of saw blades. 4502. *See* 3994, 1910. 4514 Whitehorn: Case for holding tobacco cartridges. 4555 Cary: Metal fabric. [Application for Patent of Addition to 22522, 1908.] 4616 James C. Kay and Co., and Coffey: Machine for making indiarubber tyres and tubes. 4721. *See* 23698, 1909. 4822 Nolan: Aerial machines. 5045 Backiewiez: Sponge holder for slate wipers. 5164 Minnich: Safety flying machine. [Date applied for under Rule 13, September 29th, 1909.] 5293 Rowell and Rowell: Petrol-air gas generators or producers. 5353 Burch (Smith): Stock or sheet-feeding or transferring mechanism for printing or other paper-handling machines. 5366 Heilmann: Change-speed and reversing gearing applicable to motor vehicles. [Date applied for under International Convention, March 15th, 1909.] 5434 Printing Machinery Co. (Wood): Apparatus for trimming curved stereotype plates. 5447 De Laroquette: Portable apparatus for hot-air treatment.

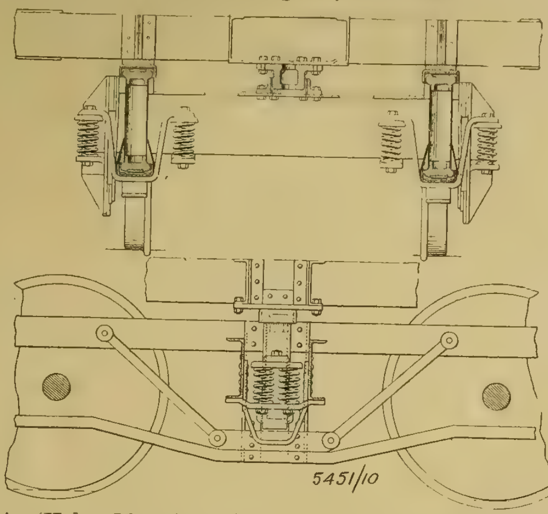


2893/10

5451 Leeds Forge Co., and Kinder: Railway and like vehicles.

This invention has reference to improvements in railway and like vehicles of the kind in which the vehicle body is supported on bogies. According to this invention the weight of the body of the vehicle is supported at two or more points on opposite sides of the centre as remote therefrom as may be found convenient by supporting means in the form of columns mounted between bearing plates or the like on the bogies and body, the ends of the columns being of partly spherical form so as to permit the columns to oscillate with a more or less true rolling motion and thus allow the bogies to swivel freely in relation to the vehicle body about a pivotal point.

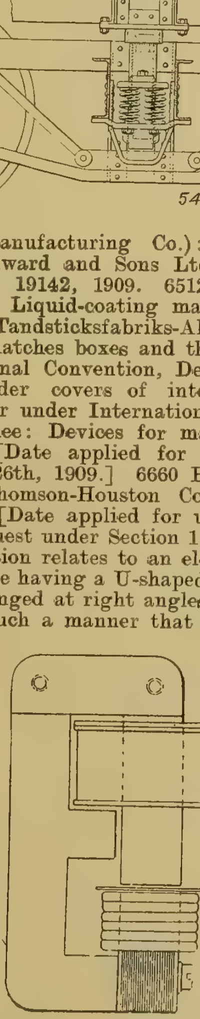
5517 Whiteman (Anderson Tool Co.): Weighing apparatus. 5549 Midland Railway Carriage and Wagon Co., and Currall: Fastenings for doors of railway and like wagons. 5692 Special-Erzeugung fur Hotel Cafehaus-und Conditorei-Kucheneinrichtungen Sowie fur Alle Arten Von Kuhlanlagen C. F. Mayerhofer: Coffee-clarifying machines. [Date applied for under International Convention, March 8th, 1909.] 5835 Neudorffer: Insulating wall boxes for electric apparatus. 5840 Clark: Cock for controlling the supply of gas from the main to the meter or other devices. 5916 Barbanson and Lepersonne: Open-hearth process of refining steel. [Date applied for under International Convention, July 3rd, 1909.] 5985 Smith, Green, and Glover: Alternating-current induction motors. 6149 Corrie: Wire fences. 6160 Adams Manufacturing Co. (Cutler Hammer Manufacturing Co.): Electric switches. 6348 Glass: Combined kitchen table and mangle. 6363 Adams Manufacturing Co. (Cutler Hammer Manufacturing Co.): Electric switches. 6448 Hunt (Holz Manufacturing Co.): Bottle-handling device. 6460 Henry Millward and Sons Ltd., and Ashford: Fishing lines. 6498. *See* 19142, 1909. 6512 McCallum: Tags. 6527 Lake (Koehler): Liquid-coating machines. 6618 Jonkopings Och Vulcans Tandsticksfabriks-Aktiebolag: Machines for manufacturing matches boxes and the like. [Date applied for under International Convention, December 11th, 1909.] 6626 Dombret: Cylinder covers of internal-combustion engines. [Date applied for under International Convention, May 11th, 1909.] 6657 Bollee: Devices for mantaining the equilibrium of aeroplanes. [Date applied for under International Convention, March 26th, 1909.] 6660 Boothroyd: Brushes.



5451/10

6667 British Thomson-Houston Co., and D'Arcy: Electric energy meters. [Date applied for under Rule 13, September 20th, 1909. Request under Section 19 of the Act not granted.]

This invention relates to an electric energy meter of the induction type having a U-shaped core carrying the current winding arranged at right angles to the core of a potential winding in such a manner that the U-shaped core carries the potential flux which passes through the driving disc, the employment of an E-shaped potential core connected to the U-shaped current core at a point below the coils carried by the U-shaped core.



6667/10

6813 Fabry: Horizontal or inclined regenerative coke ovens. 6907 Lee and Lee: Spinners for fishing. 7011 Paul and Paul: Means for opening tobacco and like boxes. 7083 Deguingand: Mouthpiece fitting for tobacco pipes and cigar and cigarette holders. 7086 Torchebeuf and De Lanneau: Incandescent burner utilising carburetted air. [Application for Patent of Addition to 15197, 1909.] 7132 Hemphill: Apparatus for controlling the change gear clutches of circular knitting machines. [Date applied for under Rule 13, September 2nd, 1909.] 7133 Hemphill: Clamping apparatus for use in connection with the yarn feed of circular knitting machines. [Date applied for under Rule 13, September 2nd, 1909.] 7134 Hemphill: Disconnectable sinker cams for use in connection with circular knitting machines. [Date applied for under Rule 13, September 2nd, 1909.] 7178 Biheller: Lamps or lanterns for incandescent gas lighting. 7256 Marendowski: Spring buttons or pressure fasteners. [Date applied for under International Convention, March 25th, 1909.] 7268 Heinze: Sound boxes for talking or sound-reproducing machines. 7370 Noblett: Hat leathers. 7449 Liers: Door or like locks. 7531 Vandercook: Rotary wire straighteners. [Date applied for under International Convention, June 23rd, 1909.] 7584 Graham: Boats' davits and the raising and lowering gear therefor. [Application for Patent of Addition to 16610, 1909.] 7624 Schneider: Clockwork advertising devices. [Date applied for under International Convention, November 19th, 1909.] 7652 Irving: Tobacco pipes. [Date applied for under International Convention, March 30th, 1909.] 7715 Parker: Press rolls. 7821 Siemens Bros. Dynamo Works (Siemens Schuckertwerke Ges.): Electric arc lamps. 8090 Buomberger: Maps for railway passengers. [Date applied for under International Convention, April 6th, 1909.] 8130 Porter and Morrow: Semaphores for railway signalling. 8141 Kajiura: Duplex systems of electric telegraphy. [Date applied for under Internatonal Convention, April 6th, 1909.] 8231 Thompson (Hoffman): Rotary engines. 8514 Brueton: Tobacco pipes. 8635 Von Engelhardt: Spark arresters. 8651 Andreas and Wolf: Speed meters. [Date applied for under International Convention, April 10th, 1909.] 8656 Bolle (Akt.-Ges. der Maschinenfabriken Escher, Wyss, et Cie.): Nozzles of axial flow turbines and turbo-compressors. 8827 Grath and Drexler: Coin-freed electric alarm bells.

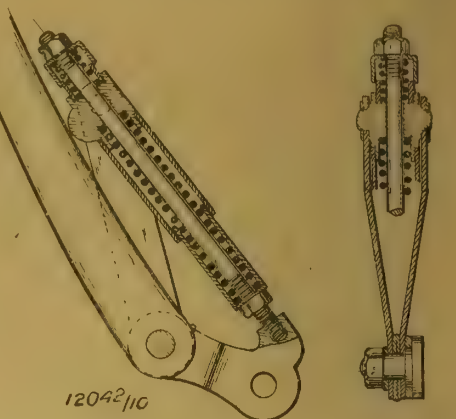
8833 Gwynnes Ltd., and Mortimer: Hydraulic ejectors.

This invention has reference to hydraulic ejectors for lifting and discharging liquids containing solids, objects being to construct such ejectors so that solid matter in comparatively large pieces can pass through them, that they can be easily cleaned without disturbing the joints of the suction, pressure, or delivery branches, and that the discharging capacity may be easily varied by adjusting the position of the nozzle. The ejector comprises a tubular body having formed in one with it inclined lateral branches for connection to the suction and pressure pipes, and a co-axial internal nozzle which is removable through the rear end of the tubular body and the rear portion of the passage way through which is curved, so as to terminate in a lateral aperture serving as a connection with the suction branch, the nozzle fitting the bore of the tubular body between the suction and pressure branches and being secured in position by external means.

8866 Hochberger: Combination under garments. 8871 Towers: Salt cellars, toilet powder receptacles, and the like. 9268 Porter: Cylinders applicable to steam winches and the like. [Date applied for under Rule 13, August 19th, 1909.] 9367 Puleston, Thomesen, and Kent: Machine for cutting the bristles of tooth and other brushes. 9590 Berg: Time switch applicable to electric or other lighting purposes or uses. 9596 Brumby and Clarke: Appliances for securing and carrying folding cardboard or other boxes. 9696 Rodriguez and Coleman: Reaming apparatus. 10068 Fruhling: Method of and arrangement for removing dredged material from ships' holds, hopper barges, and the like. 10312 Laurent: Indicating or alarm governors for motors. [Date applied for under Rule 13, 11th February, 1910. Application for Patent of Addition to 16802, 1909.] 10354 Soc. Francaise de Constructions Mecaniques (Anciens Etablissements Cail): Carburetters for internal-combustion engines. [Date applied for under International Convention, April 6th, 1910. Application for Patent of Addition to 3008, 1909.] 10475 Meeus, and Banque Centrale de Fonds Publics: Closing device for vessels for holding milk and similar liquids. 10604 Howson: Support of lavatory basins and the like. 10820 Zahringer: Device for operating magneto electric ignition machines. 10898 Tyerman: Envelopes. 11052 Graf: Sewing devices for surgical operations. [Date applied for under International Convention, October 25th, 1909.] 11126 Carroll: Thief-proof clip for inflators for pneumatic tyres. 11171 Eras: Lock. 11611 Schneider: Incendiary projectiles. 11944 Lamson Paragon Supply Co., and Pope: Card for facilitating sales and the assembling of purchases.

12042 Swan: Device for minimising the vibration of the front forks of bicycles and motor cycles.

Many devices in the way of springs and air cushions are successfully used to minimise the vibration of the rear portion of the frame and saddle of a bicycle, but the prevention of the vibration of the front forks and handle bar and consequent jar on the wrists and arms of the rider is a matter which hitherto has presented a difficulty to inventors, and it is with the object of overcoming this difficulty and obviating that vibration that this invention has been devised. A pair of the devices forming the subject of this invention are used, one attached to the tip of each member of the front forks, and each device consists essentially of a guide arm rigidly attached to the fork tip and a crank lever pivotally attached thereto concentrically with the arm. The guide arm and crank lever are attached to the tip by a bolt passing through the hole provided ordinarily for the front wheel axle which is removed and mounted in a hole in the crank lever provided for the purpose. To the forward and uppermost end of the crank lever is attached a bolt extending upwardly and passing freely through a crosshead provided on the end of the guide arm, a coil spring being threaded upon the bolt and bearing against the under side of the crosshead and a nut screwed on the lower end of the bolt. Above the crosshead a shorter and lighter coil spring is threaded on the bolt and bears under a nut screwed on the upper end thereof. Both the springs are encased in telescopic sheaths to protect them from dust and rust.



12176 Lintleman and Hanchett: Surgical operating pans. 12219 Greisenegger: Fire engines. 12260 Thorandt and Kohn: Collar support. 12399 Kleppek and Mlyneck: Top boots. 12575 Lilly: Hinged joints for wind and rain shields for motors and the like. 13089 Worley: Railway points and switches. [Date applied for under International Convention, May 29th, 1909.] 13319 Burdizzo: Castrating tool. 13389 Eeley: Smokers' tray. 13436 Hess: Ball bearings. [Date applied for under International Convention, June 25th, 1909.] 14229 McNeil: Device for discharging finished sheets from sheet-metal-punching machines. 14371 Pokorny and Wittekind Maschinenbau Akt.-Ges.: Turbo-compressors. [Date applied for under International Convention, July 1st, 1909.] 14540 Hollingworth (Crompton and Knowles Loom Works): Filling detecting mechanism combined with shuttles employed in weft-replenishing looms. [Date applied for under Rule 13, August 21st, 1909.] 14557 Edelstein: Enemas, douches, and syringes for surgical and medical purposes. 14791 Pittroff: Flexible props of iron or the like, more particularly intended for use as mine prop. [Date applied for under International Convention, June 18th, 1909.] 14907 Boozer: Coulters of seed-drilling machines. 15396 Bartha: Collapsible baths. 15538 Orr: Embossing appliances. [Date applied for under International Convention, July 26th, 1909.] 15904 Bates, Silvester, and British United Shoe Machinery Co.: Pincer-lasting or like machines. [Date applied for under Rule 13, July 12th, 1909.]

COMPLETE SPECIFICATIONS OPEN TO PUBLIC INSPECTION BEFORE ACCEPTANCE, UNDER THE PATENTS ACT, 1907.

1909.

30598 Holzwarth and Junghans: Gas turbine plant.

1910.

7747 Mead: Mufflers for personal wear. 10973 Troupenat: Safety device for circular saws. 11685 Lagoutte: Axial lubricator with reservoir. 13685 Non-Explosive Gas Co.: Apparatus for the manf. of gas. 15508 Boistel: Dredgers. 15819 Becke: Process for producing multi-coloured effects in spun and woven goods. 17051 Penke: Fireproof fabrics for theatre decorations or the like. 17190 Schlesinger: Apparatus for taking off, counting, or arranging sheets of paper, tickets, cards, and the like. 17474 Allgemeine Elektricitats-Ges.: Centrifugal compressors or pumps. 17887 Politz: Tube fastening for condensers, feed-water heaters, and other apparatus for absorbing heat. 18079 Ohmer and Bridenbaugh: Taximeters. 18135 Kovatch: Coal-mining machines. 18277 Zwing: Winding apparatus for paper, cloth, and the like. 18475 Soc. l'Air Liquide: Fixation of nitrogen and oxygen at high temperatures. 18528 Siemens-Schuckertwerke Ges.: Electrical fuses. 18548 Goodspeed: Pneumatic control devices. 18561 Felten and Guilleaume Lahmeyerwerke Akt.-Ges.: Heddles. 18604

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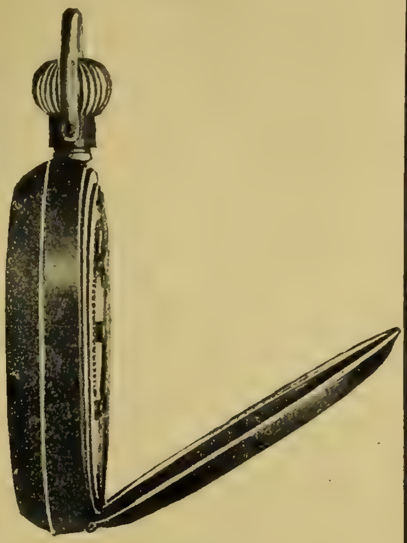

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Esnault-Pelterie: Flying machines. 18698 Soc. l'Air Liquide: Desiccation of air and other gases. 18702 Firm Wolf, Netter, and Jacobi: Device for fixing shelves which are adjustable in height. 18738 Weissmann: Holder for electric incandescent lamps. 18785 Herzog: Insertion of spindles in cops. 18847 Rheinische Metallwaaren und Maschinenfabrik: Aiming apparatus for guns. 18853 Kanzler Schreibmaschinen Akt.-Ges.: Carriage feed mechanism for typewriters. 18854 Lundbom: Devices for the distribution of the pressure fluid on piston engines, especially mechanical stokers. 18926 Gabet: Elastic bullets. 18945 Coln-Musener Bergwerks Actien Verein: Manf. of ferro-manganese and by-products from manganese ores. 18950 Loison and Beranger: Sifting apparatus. 19010 Rougeon: Non-slip plate. 19020 Dow: Tension devices for shuttles of sewing machines. 19021 Brothers: Lasting or like machines. 19033 Beige: Incandescent electric lamp or like holders. 19036 Gladman: Copyists' indicator apparatus. 19073 Skriwan: Incandescent mantles.

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THE
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ELECTRIC TRAMWAY MATTERS.

ELECTRIC tramway matters are very much to the fore just now. We have had a good Tramway Union Conference at Brussels, and a three-days' meeting of the Municipal Tramways Association at Bradford, at both of which the questions of the hour to the tramway manager and engineer have been considered. Almost at the same time an equally, if not more, interesting series of sittings of quite another kind has been in progress in London, where a Board of Trade arbitrator has been listening to arguments of counsel, expert evidence by consulting electrical engineers, and practical experience testimonies from tramway managers, concerning the working of surface-contact traction systems. This inquiry is the outcome of unsatisfactory working of the Torquay lines, and the question to be decided is whether the Town Council has unreasonably withheld its consent to the conversion of the system to overhead trolley. The collection of evidence and arguments put forward form the most entertaining reading that we think we have met in the whole course of the surface-contact controversy in this country, but comment must be withheld just now, as the arbitrator has not yet issued his award. It will be out very shortly, for the tramway company may not continue the surface-contact running after the end of October, according to the Board of Trade ruling, and something must be decided before that date as to the future working.

In regard to the rail corrugation question, which tramway officials have so often discussed, no progress towards a solution of this baffling mystery has been made, except such as is found in the collection of data by the Municipal Tramways Association, which is still proceeding. At Brussels the point received attention, and it was mentioned in the presidential address at Bradford on September 21st.

The subject of speed indicators for tramcars is under investigation by the Special Committee of the Tramways and Light Railways Association. Experiments are being made with instruments for this purpose, which have been submitted by 15 of our firms, and others who have specialised in this line.

An interesting point in connection with municipal trading has been raised at Manchester, where the legality of the Corporation Tramways Department building its own tramcars has been called in question. The manager says that he is authorised under the Corporation Acts to provide cars, but his questioners say that this does not mean that he may make them. The department purchases the electrical equipments from our manufacturers, and makes the bodies and fits the cars together, and its chief says that he is promoting local labour by so doing, inasmuch as there are not works in the city which lay themselves out to meet car-building requirements; he also says, though probably the car-building works of Preston, Loughborough, Birmingham, Motherwell, etc., would not agree with him, that he gets a better and much cheaper job by making them—better because he knows exactly the condition of the material employed, and cheaper because he does not have to pay manufacturers' profit or cost of transport, and so on. Manchester is by no means the only large city which builds its own cars—Glasgow is an important example, many new cars being constructed municipally there every year, and there are others which might also be named. Some of the tramway companies working in foreign cities, for which British firms provided the original rolling stock, have also found it good policy to do their own car-building after a time. These are some of the smaller reasons that have led to the unsatisfactory position of some of our private works that have laid themselves out for many years for this particular class of work, the larger reason being, of course, the general falling off in tramway construction work in the United Kingdom during the last few years. How much business will come to them from the running of trackless omnibuses one hardly likes to prophesy. Bradford is ordering a couple to start with, and a few others may soon follow. In a paper read at last week's Tramway Convention at Bradford, Mr. Baker, the Birmingham tramway manager, very definitely ranged himself on the side of those who do not believe that the possibilities of this new movement are likely to yield any particularly good result.

Mr. Spencer, the president of the meeting, wants our tramway authorities to cultivate goods traffic more than they have already done. Increased attention is certainly being paid to this class of traffic, but without an organisation to serve for distribution in roads apart from the tramway routes there is not likely to be effective competition with private carriers, who, it will be remembered, offered a successful resistance to the attempts of one city in this connection a year or two ago.

PETROL MOTOR TRAINS ON RAILWAYS.—The Great Western, London and North-Western, North-Eastern, South-Eastern, Midland, and several other railway companies, are reported to be displacing steam on some of their branch lines by petrol. The substitution of oil and petrol for steam generated by coal fuel is said to have been found to work well on branch lines, and signs point to a still wider application of the new motive power. The Pennsylvania Railway, who have opened "the largest station in America," is now also said to be making experiments with a "gasoline car." It is about 70 ft. with "wedge front," and has seating accommodation for 75 persons. There is a fuel tank holding 110 gallons of gasoline; there are twelve cylinders; and it attained on its trial trip an average of 42 miles per hour. According to the *Pittsburg Dispatch*, this type of car will admit of an increased service at a less cost on branch lines. The competition in modes of propulsion will probably give to railways further ability of service when experiments have been reduced to working practice.

THE AUSTRALIAN NAVY.—Two Australian destroyers, Parramatta and Yarra, left Portsmouth for Sydney. The cruiser Gibraltar, with relief crews for ships on the Australian station, will act as escort on the outward journey. The Parramatta and Yarra are manned with officers and men belonging to the Australian Naval Reserve, but for the past six months the men have been at Portsmouth receiving instruction at the gunnery and torpedo schools, while the engine-room ratings have been instructed in the working of water-tube boilers and oil fuel. For the present voyage the Admiralty have lent the Commonwealth Government some stokers who are skilled in the use of oil fuel. The Parramatta and Yarra are two of six destroyers which the Commonwealth Government intends having built as part of the local Navy it has undertaken to provide. They are of the improved River class. The engines, on the turbine principle, are of about 9,000 H.P., and give a speed of 27 knots. Steam is supplied by water-tube boilers, the furnaces being fitted to consume oil and coal fuel.

SHIPYARD EXTENSIONS ON THE TYNE.—In addition to the 70 acres already secured by Messrs. Armstrong, Whitworth and Co. at Walker for shipyard purposes, another great scheme is said to be on hand, according to the chairman of the Newcastle Education Authority, before whom the matter was referred at a recent meeting. The latest scheme requires only sanction, after which there will be the development of another 60 or 70 acres. The matter was mentioned as a result of a suggestion by Mr. Dawson at the Education meeting that they should approach Messrs. Armstrong, Whitworth and Co. and ask them to buy the Walker School, as adjoining houses would be pulled down so as to make room for the new shipyard, and that in consequence the school would be in a too noisy centre. It was pointed out, however, that the new yard would add to the population of the district, and that as the school, after the excavations for the shipyard, would stand 100 ft. above the works, it would not be affected by the noise. The development of Walker, continued the chairman, within the next few years would be phenomenal.

CONSTRUCTION OF RAILWAYS IN CHINA.—Mr. W. P. Ker, Commercial Attaché to His Majesty's Legation at Pekin, in a Consular report on the foreign trade of China in 1909, states that many of the projected railways are likely to be delayed for want of funds. The chief obstacle to railway development in China, he adds, is the antagonism between the Central Government and the inhabitants of the provinces. The former desires to get all the railways under the supreme control of the Board of Communications, and recognises the necessity for foreign loans; the latter are jealous of Government interference, and insist with varying degrees of failure and success on providing their own capital and their own engineers. In spite, however, of all obstacles, the construction of railways is bound to go on, and ample opportunities for British enterprise will be afforded for many years to come. Competition for supplying material is exceedingly keen, and the only firms that have a chance of success are those which are directly or

It is not fully recognised at home, adds Mr. Ker, that indirectly represented by technical experts on the spot. Chinese railway engineers are not as a rule qualified to draw up detailed specifications of locomotives and other requirements, and are largely dependent on the assistance of the manufacturers' agents. Thus it is that even in the case where tenders are publicly invited in time for firms at home to compete, the result is often necessarily a foregone conclusion.

Railway Material.—The *Reichsgesetzblatt*, of 10th September, publishes a notice granting a 90 years' concession for the construction and working of a standard gauge light railway from Drohobycz to Truskawiec, Austria-Hungary. Two years are allowed for the completion of the line. According to the *Bollettino Finanze, Ferrovie*" (Rome), of 11th September, the Ministry of Public Works have approved the plans for the construction and working of a railway from Busca to Dronero. Operations will be commenced as soon as possible by Messrs. Boggio, sub-contractors for the construction of the line. The *Australian Mining Standard*, of 17th August, states that the Western Australian Government propose to construct a line of railway from the Leonora goldfield to the Lawlers goldfield. A proposal is also being brought forward for the construction of a line from Norseman to Esperance on the Kalgoorlie goldfield, a distance of about 120 miles. The *Argentina Boletin*, of 6th August, contains a decree approving the plans, and the estimate of 2,222,700 pesos gold (about £445,000), submitted by the "Dirección General de Ferrocarriles" for the second section, between 120·5 and 240 kilos., of the railway from Puerto Deseado to a point on the San Antonio—Lake Nahuel-Huapi line. H.M. Consul at Savona reports the formation of a company under the name of the "Società Anonima Funivie Savona—San Giuseppe," with a capital of 4,000,000 lire (£160,000) for the purpose of construction and working a funicular railway for the transport of coal from the port of Savona to San Giuseppe, Italy. Work is to be begun shortly, and it is hoped that by the end of next year the first line will be ready for use.—*Board of Trade Journal.*

A contract has been entered into between the Southampton Harbour Board and the Tilbury Dredging Company for dredging a part of the harbour to a depth of 35 ft.; the cost being £20,500.

New lifts are to be fitted at the tube railways, to work at a speed of 300 ft. per minute.

Cheaper Light, Dearer Electricity.—Owing to the reduced consumption of electricity, due to the adoption of metallic filament lamps, one of the London Supply Companies has raised the price to private consumers from 5½d. to 6d. per unit.

The battleship, Conqueror, now being built by Messrs. Beardmore and Company, Dalmino, is to be fitted with new-pattern guns, built by themselves; these comprising 13½ in., 6 in., and 4 in. sizes.

It is expected that the Loetschberg Tunnel, now in course of boring, will be completed next spring. Its length is about eight and a half miles, and the cost £2,000,000.

Engineering and Machinery Exhibition.—The arrangements for the opening of the Engineering and Machinery Exhibition at the Manchester Exhibition Hall on October 14th were completed on the 20th September at a meeting of the Advisory Committee composed of representatives of firms whose products will be on view.

VENTILATION AND DUST REMOVAL IN COTTON MILLS.—VII.

(Concluded from page 298.)

The dust-removing apparatus invented and manufactured by Herbert Smethurst, of Bankside Street, Oldham, is of the portable type, and comprises a truck or trolley within which is a dust separator, and a fan or exhauster connected with a casing surrounding the stripping brush. The fan is driven by a rope from the stripping-brush shaft.

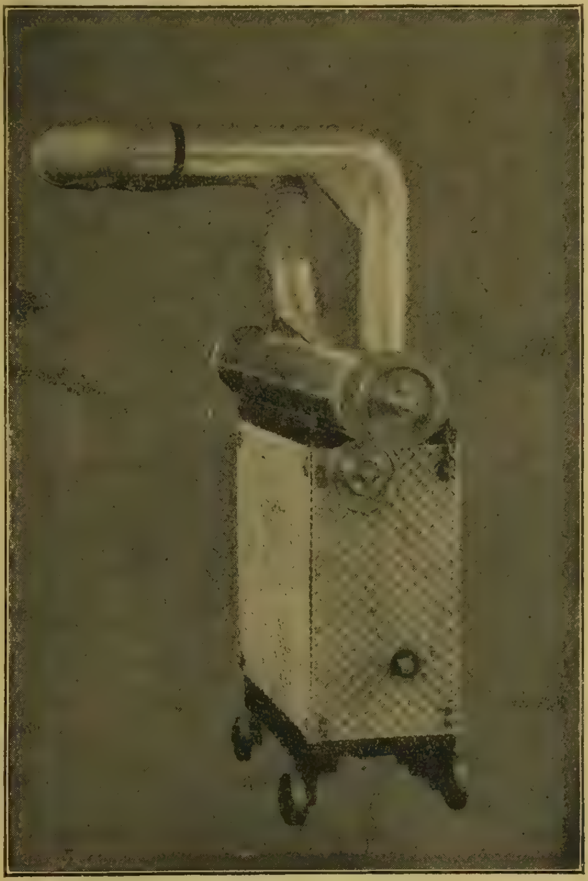
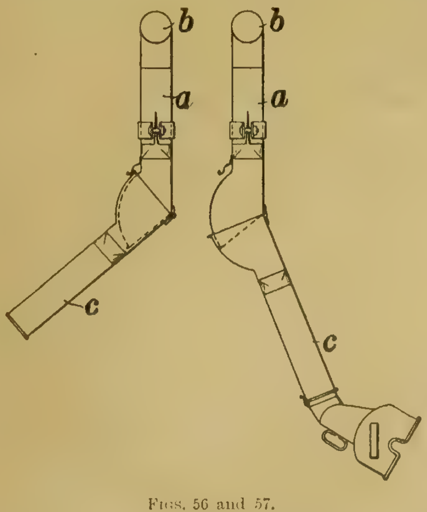


Fig. 54.

The stripping brush, with its enclosing hood, is carried upon the trolley, as shown at fig. 54, when the apparatus is being moved from one carding engine to another. Fig. 55 shows the apparatus collecting the dust from the stripping brush on the doffer. It will be seen that no fixed exhaustion pipes are required with this system, which can



Figs. 56 and 57.

therefore be very readily adopted in a mill with but small capital outlay, and without affecting the heating and lighting arrangements of the card rooms, as no air is extracted from the card room and no overhead exhaust conduits are employed.

In Walton's apparatus described in specification No. 20,866, of 1909, the lower end of each branch *a* to the exhaustion conduit *b* is adapted to slide within the upper end of the uptake tube *c* from the hood *d*. The arrangement, which is illustrated at figs. 56 and 57, is such that when the lower end of the tube *c* is turned downwards for connection to the hood (as shown in fig. 57), there is a through-way connection between *a* and *c*, but when the latter is turned upwards or into its out-of-service position (as shown at fig. 56) such connection is closed.

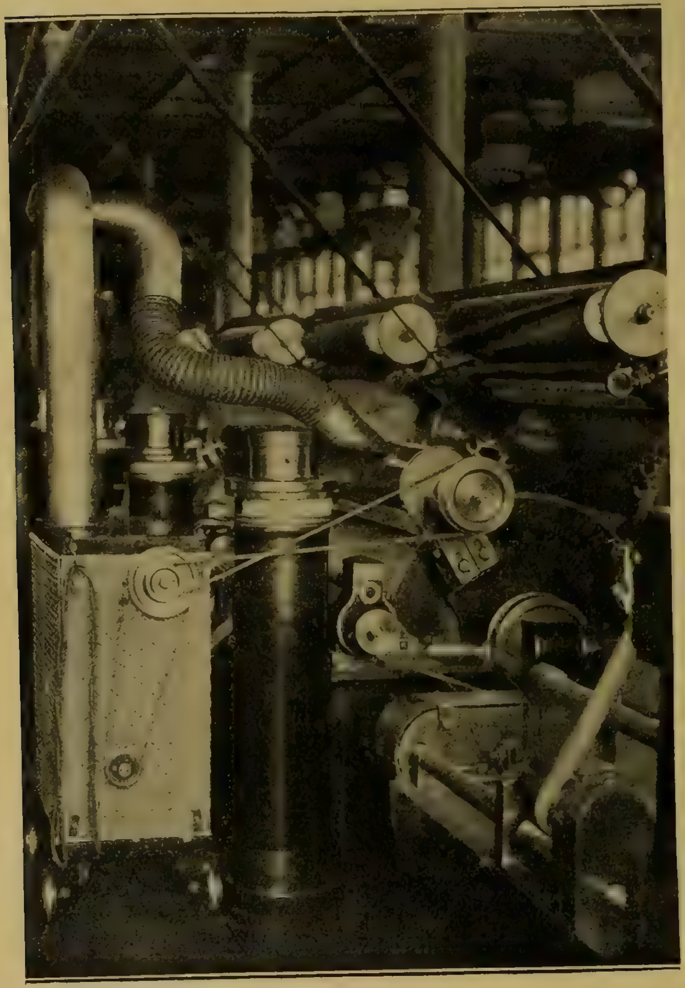


Fig. 55.

In all the systems of dust and fluff removal for carding engines heretofore described and illustrated, a stripping brush is employed for detaching the fibre from the card wires. Proposals have, however, been made for removing the dust and fluff without the use of a stripping brush.

In 1898, Messrs. Wilson and Kestner obtained a patent, No. 21,672, in the specification of which they proposed to "effect the stripping or cleaning of loose fibres and neps from card surfaces of carding machines by a sucking or exhausting action through a narrow orifice applied near to the card surface in a position transversely to the motion thereof."

One form of the apparatus is illustrated at fig. 58, where *a* indicates the cylinder, *b* the doffer, and *c* the revolving flats. A tube *d* having a longitudinal slit *e* extending through the grating *f* is employed for stripping the cylinder. For stripping the doffer a split tube *g* is employed, and a similar tube *h* is used for the flats.

The patentees state: "It is found that owing to the very firm hold which the card surface of the large cylinder has upon the fibres and neps, only a partial stripping thereof can be effected by the suction alone, and we therefore in this case prefer to employ a metallic or other brush in combination with the exhaust, such brush being employed either intermittently during the working of the machine, or at the time of grinding the cylinder." The

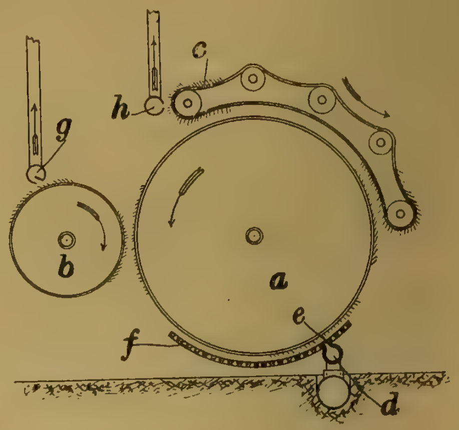


Fig. 58.

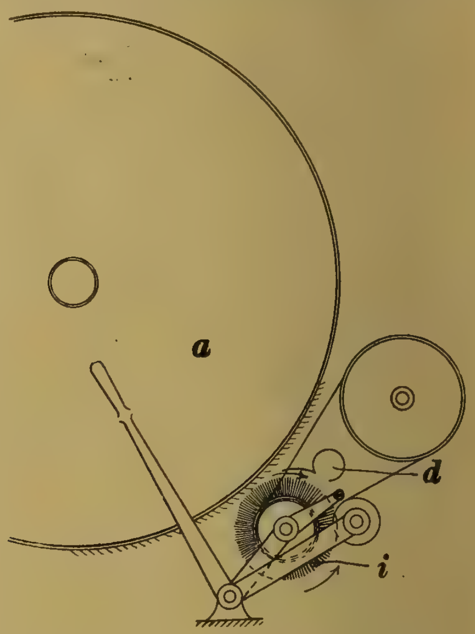


Fig. 59.

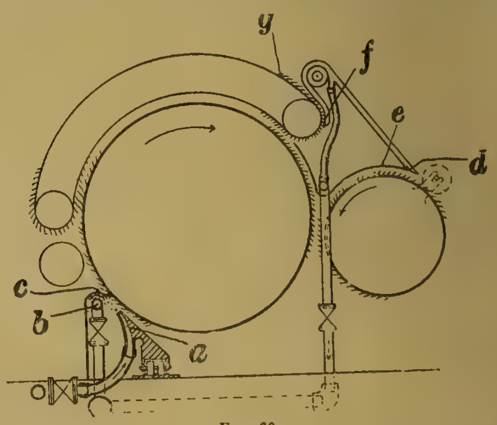
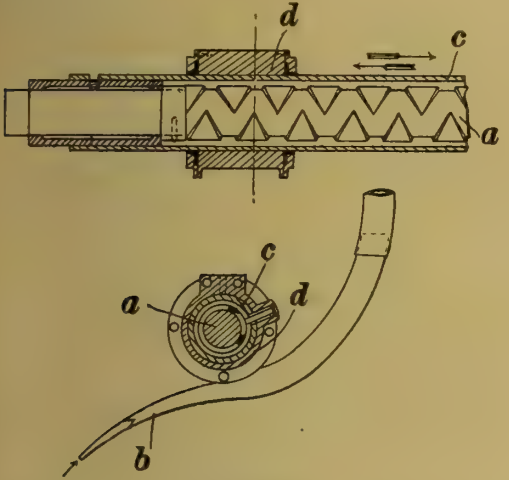


Fig. 60.

latter arrangement is illustrated at fig. 59, where *d* indicates the exhaust pipe and *i* the stripping brush.

Wilson obtained a further patent in 1901, No. 3,180, for several improvements on the apparatus described in the prior patent, No. 21,672, of 1898. The chief improvement consists in obviating altogether the use of the stripping brush for the cylinder, and employing in place thereof an air blast for loosening the fibres and so facilitating their removal by the suction nozzle.



Figs. 61 and 62.

One form of the improved apparatus is illustrated at fig. 60, in which the air blast is caused to issue through a nozzle *a*, which is traversed back and forth across the cylinder by any convenient means. The suction or exhaust pipe is at *b*, the fibre and dust being directed thereto by the curved plate *c*. For removing the fluff from the doffer, a nozzle *d* is employed, which is traversed by a double screw arrangement, and is guided at the required distance from the doffer by the cover *e*. A nozzle *f* clears the revolving cards *g*. In some cases both the suction nozzle *b* and the blast nozzle *a* are traversed across the cylinder in a similar manner to the nozzles over the doffer and flat cards.

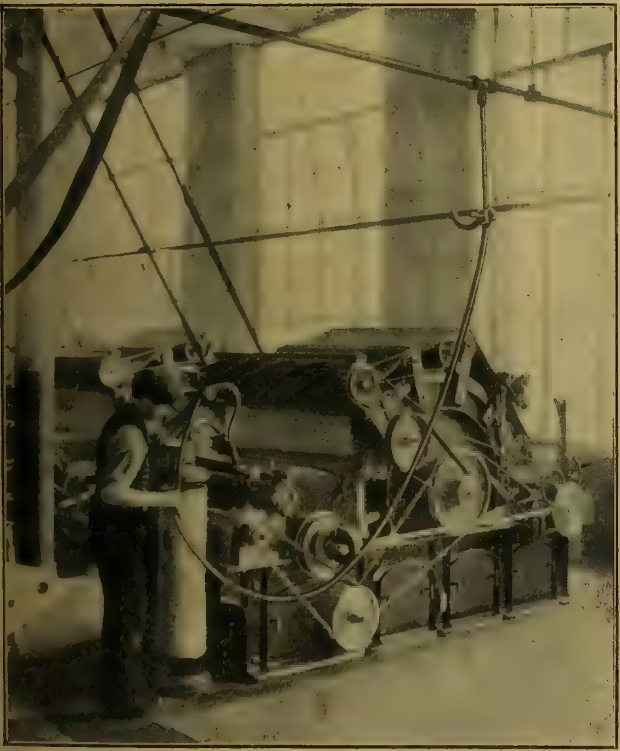


Fig. 63.

In Vöster and Jungbauer's patent specification No. 23,822, of 1909, from which figs. 61 and 62 are taken, a dust-removing apparatus is described of the type in which the use of the stripping brush is dispensed with. A double-threaded screw *a* is employed for traversing the nozzle *b*, the latter being supported on the casing or tube *c* surrounding *a*. A pin on the nozzle carrying sleeve *d* projects through the tube *c* into the double screw.

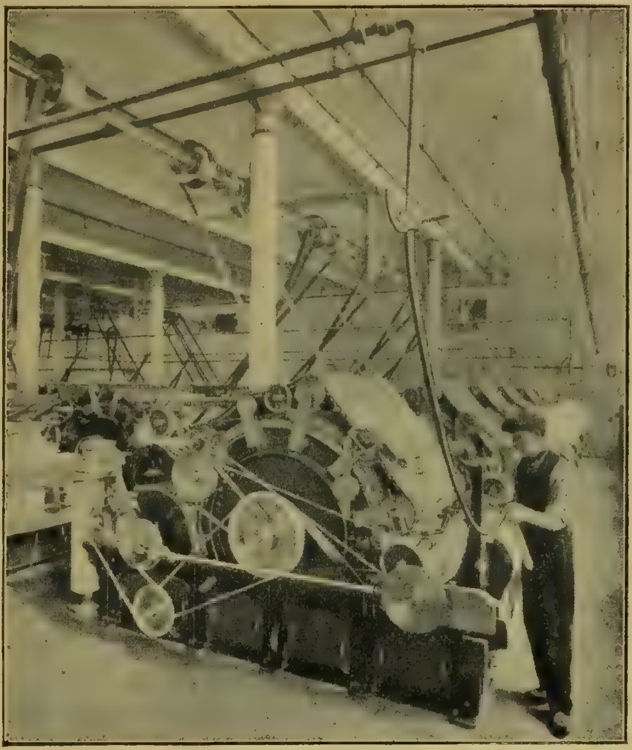


Fig. 64.

Figs. 63 and 64 illustrate a carding engine fitted with card-stripping apparatus by Messrs. Cook and Company, of 18, Exchange Street, Manchester, who are owners of Vöster and Jungbauer's patent before referred to, and also sole licensees for textile factories of the British Vacuum Cleaner Company Limited, of London.

In their apparatus Messrs. Cook and Company employ a vacuum of about 24 in. (mercury) and exhaust pipes of about $1\frac{1}{2}$ in. to 2 in. diameter. It will be noticed that the stripping of the cylinder is effected just above the taker-in, and not adjacent to the doffer, as is usual with stripping brush systems.

The advantages claimed for the system, in which no brush is employed, are that: (1) It does away with (*a*) the interruption of the working of the machine for stripping purposes and so increases production, (*b*) the necessity for skilled strippers (one boy alone can attend to the stripping), (*c*) the necessity for cylinder door-locking motions; (2) less time is occupied in stripping cylinders, consequently more frequent strippings can be made and the best carding conditions obtained; (3) the card clothing has a longer life.

The advocates of the stripping brush assert that owing to the firm hold which the hard neps take upon the card clothing, due to the waxy nature of cotton, it is impossible to detach them by mere suction.

In deciding upon the system to adopt, the following points should be borne in mind by the prospective buyer:

(1) The number of moving parts in the system which

may require skilled attention, and which are subject to wear and tear.

(2) The effect of the piping (if any) upon the lighting arrangements of the card room.

(3) The effect of removing large volumes of air from the card room upon the heating arrangements of the latter in the winter months.

(4) The relative cost of the different systems.

(5) The relative length of efficient life of pumps and fans when used for dust-extracting purposes.

(6) Cost of upkeep.

(7) Power required for driving purposes.

(8) Amount of time employed in stripping, and nature of services required of strippers.

(9) The relative efficiency of the stripping brush and non-stripping brush systems for the particular service.

(10) Value and quantity of strips.

THE FRICTION OF BALL BEARINGS.

(Continued from page 399.)

We now come to the ball bearing, fig. 7, the advantage of which is that it admits of the balls being most efficiently loaded, *i.e.*, in the direct line of pressure. The defect in this type of ball bearing is that the balls are free endways, but this is easily obviated. Such a bearing, when run, heats very slightly, provided that the load does not exceed a certain limit. Very little replenishment of lubricating material is required, and signs of wear do not appear.

We have said that the bearing is efficient as long as the load does not exceed a certain limit. This limit would be very low for a bearing of the design of fig. 7, and if exceeded the balls would be liable to chip and break.

As regards the design of the bearing with regard to load capacity if a ball be placed between two hardened steel plates in contact with it at the points A and B. If a load be now applied to the upper plate, the ball will be compressed; when the load is removed it will resume its original shape, provided the limit of elasticity of the ball has not been exceeded. It is important with ball bearings that this be not exceeded, otherwise the balls and races suffer accordingly. We will now assume that the limit of elasticity has not been exceeded. The maximum load on the balls may be so that flats are formed at the points of contact to the extent of C D and E F. The load on the ball, up to this limit, is proportionate to the square of the diameter of the sphere. Taking the diameter of the ball as *d*, then—

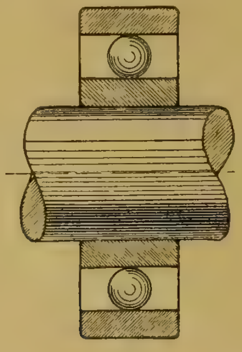


Fig. 7.

$$Q = Kd^2 \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

K is a coefficient which we have to find.

If the ball is flattened to the extent of C D and E F, the points A and B have travelled the longest distance, and C, D, E, F the shortest. The former correspondingly stand the greatest load, and the latter the least. The ball must not be loaded beyond a certain limit at A and B, as above explained, though further pressure could be put upon it at all the other points. If it were possible for all the points on the surface under load to travel the same distance, then the load would be distributed fairly evenly, and the maximum capacity of the ball would be reached. From this point of view a race would be of the most efficient type where the section of the groove corresponds with the half diameter of the ball, but in view of the friction that would arise, such a type is not serviceable. While the points A and B roll, the points C, D, E and F of the balls will slip. The only thing that can be done now is to test all designs of races from the curve section

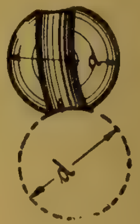


Fig. 8.

$$r = \infty \text{ to } r = \frac{d}{2},$$

and to test the load capacity and the increase of friction as the shape of the race approaches to that of half the diameter of the ball. As the flat surface commences to curve, it becomes evident that the load capacity increases, but not the friction; this, as a matter of fact, decreases in proportion to the load capacity, because this increases at a rapid rate. As the curve of the surface is increased, the load capacity also correspondingly increases up to a certain limit, without increase of friction. The most efficient form of curve section for the outer race is—

$$r_a = \frac{9}{16} d \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

and of the curve section for the inner race—

$$r_i = \frac{25}{48} d \quad . \quad . \quad . \quad . \quad . \quad . \quad (7)$$

The curve section for the inner race is smaller than that for the outer race, for the reason that if both these are viewed from the side, the outer race is concave to the ball and the inner race is convex; thus the outer ring seen from the side assumes the shape of the ball more than the inner race. The coefficient K of the equation (5) for $r = \infty$, and thus for the surface in fig. 13 = 4, whereas for two curve surfaces it increases to 15; such dimensions being usual for balls, ⅛ in. is adopted as a convenient standard for the diameter of the ball. For instance, for 1 in. balls $d=8$, and for ½ in. $d=4$, and so on. Consequently, the load capacity of a ball where the inner and outer rings have straight races is $Q=4d^2$, and for a ball where the inner and outer rings have the most efficient form of curved races $Q=d^2$. The best type of ball bearing is therefore as shown in fig. 7, but with ball races as above. Here

$$V_a \text{ the curve section of the outer race} = \frac{9}{16} d$$

$$V_i \text{ the curve section of the inner race} = \frac{25}{48} d$$

and the load capacity of a ball is $Q=15d^2$.

It is easy to see that the balls in a bearing are not all evenly loaded when the load on the shaft is vertical. The lower balls will be loaded, but not the upper ones. The balls at the apex of the load receive the greatest weight, and those near it rather less, and those opposite to the direction of the load carry no weight. Consequently the balls at the apex of the load must not receive more than

$15d^2$. Taking z as the number of balls in a bearing and P as the load on the whole bearing, then the weight on the balls at the apex of the load would be—

$$Q = \frac{5}{z} P \quad . \quad . \quad . \quad . \quad . \quad (10)$$

From this and from formula (9) there results—

$$d^2 = \frac{P}{3z} \quad . \quad . \quad . \quad . \quad . \quad . \quad (11)$$

or

$$P = 3zd^2 \quad . \quad . \quad . \quad . \quad . \quad . \quad (12)$$

A bearing with 15 1 in. balls will, therefore, stand a minimum load of 3 × 15 × 64 = 2,880 kilogrammes.

In this way the most efficient type of bearing has been evolved, and it has become clear as to how the bearing has to be proportioned.

Ball bearings have a high load capacity, and work with a minimum of friction and wear, requiring very little replenishment of lubricating material. The various types of standard ball bearings differ chiefly merely in the means adopted to insert the balls between the races. These have been covered by patents.

At the outset ball bearings were made in which the balls were in contact with one another. This method was satisfactory for many purposes, but trouble arose often, the bearings emitting considerable noise, heating now and again, and extraordinary phenomena became apparent.

The consideration of these points leads us to discuss the containing cage for the balls. With regard to the noise, the following remarks may be made. The greater the speed and the larger the balls, the greater it became. When large bearings were run at several thousand revolutions per minute the balls made a rattling sound, audible at a considerable distance. The reason was found to be as follows:—

It is not possible to design the dimensions of the rings and balls so that these completely fill up the circumference. A clearance must be provided for one practical reason, to allow for inaccuracy in manufacture. Another important reason will be given later. The amount of play generally is 2 mm. to 3 mm., with small bearings rather less, with large ones rather more.

If the inner ring be revolved to the right, the topmost arriving ball will also move in this direction, and when it has passed the apex of the inner ring, it runs downhill, and gaining momentum, falls on the ball in front of it. On account of the smallness of the clearance, the speed at which this takes place would be relatively low, but it must be remembered that in consequence of the load P on the balls, causing them to contract to the extent of some hundredths of a millimetre, corresponding play develops between the balls on the upper side of the bearings and the rings. If, for example, we now take the diameter of the inner ring D = 250 mm., the ball diameter d = about 25 mm., the speed of the shaft about 3,000 revolutions per minute, and that of the balls A and B about 15,000, the balls make about 250 revolutions per second in the direction of the arrow, shown on ball A. If, now, the ball A strikes B, the points of contact of both balls have a relative speed equivalent to about 500 revolutions per second. Coming in contact at such a speed, the ball A is projected in the direction of the arrow F at the moment it touches B. But owing to centrifugal force it was lying against the outer ring, so that the play was on the inner side. The ball striking sharply against the inner ring springs back again, strikes the outer ring, and bounces in this way backwards and forwards between the two rings. Before it stops the next ball follows on, the noise of this being added to that of the previous and the following one. If the load P, instead of from above, was from any other direction, similar action would result.

The second objectionable phenomenon, as already mentioned, was the heating, generally taking place simultaneously with a third evil, scratching of the balls and races. Short scratches would appear, and also some describing complete circles round the largest circumference of the ball. Scratches also would develop on the inner and outer races, sometimes short, or often going right round the ring. Some of these scratches would develop into deep grooves, the radius of these being exactly that of the diameter of the balls, fig. 8. On holding an undamaged ball against one showing grooves, it was found that they fitted each other exactly. From this the conclusion was arrived at that these grooves, which in extreme cases actually caused breakage of the balls, only arose on account of one ball, for some reason, being driven into another. In extreme cases, owing to the impossibility of making one ball exactly as hard as another, one had necessarily to give way.

There were also cases where some balls showed deeper grooves than others, but then at the points where grooves were to be found both balls fitted each other exactly.

The question then arose as to how it happened that the balls were driven into each other, in the case of large balls to the extent of several millimetres. The reason for this was as follows:—

If a gear wheel is fitted on a shaft between two ball bearings, the shaft will sag when a load is applied to the gear wheel, and especially if the machine in question is started suddenly, or is subject to loads coming on with a jerk. Then the inner race is forced out of parallel with the outer race, and in consequence the balls are driven into each other, as will now be shown.

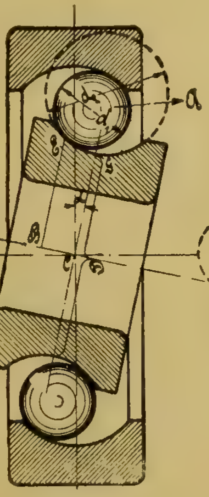


FIG. 9

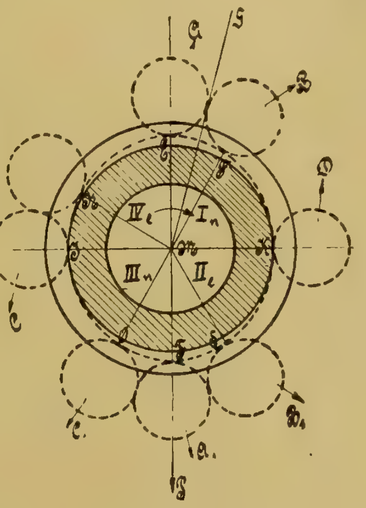


FIG. 10.

Some years ago the following test was made: A heavy load was applied to a large ball bearing, and an arrangement made whereby, when under load, the inner ring could, by means of a lever, be suddenly forced out of parallel with the outer ring. At the moment when this took place, the balls were jammed. The driving belt fell off, and the bearings ceased to revolve. Exactly the same sort of scratches appeared on the balls as previously referred to, and even, in many cases, deep grooves. The position taken up by the inner ring to the outer ring is shown in fig. 9, though, of course, exaggerated. It will now be proved that when this happens the balls are bound to be driven into each other, and it will also be shown to what extent this takes place.

The ball A, fig. 9, is in contact with the inner ring at the point F. It is, therefore, at the distance E B from the axis of the inner ring. The balls lying at right angles to the diameter of the bearing, as drawn, *i.e.*, the balls C and D (fig. 10), are at a less distance from the axis of revolution, viz., J M and K M, respectively. The points of contact of the balls C and D (fig. 10) are therefore nearer to the centre point M than those of the ball A, while the centres of the balls are at about an equal distance. The ball A has a speed corresponding to the distance E M, the balls C and D have a speed corresponding to the distances K M and J M; H thus runs faster than D and C. The ball B is only at the distance F M from the centre point M, which is already smaller than E M; thus B runs slower than A, *i.e.*, ball A catches up ball B, this the one in advance of it, and so on. As long as the tangent M G lies within the segment I*n*, the balls approach each other, that is to say, are driven into each other. When it reaches the segment I I *e*, the balls fall away from each other. It is well to point out that this takes place only now and again, that is to say, only when the rings are out of parallel. At the moment they are driven into each other, the balls also slip along the races, whence arise the scratches on these referred to above.

If the balls are forced against each other and then separate to meet again, they will, in the end, slip so far that a small amount of clearance between them develops, so that at the moment of nearest approach they just touch each other. This is the other reason why, as mentioned above, it is advisable to leave the balls play, *l*, as in fig. 7. An occasional case of a ball bearing being out of truth does not cause so much trouble as the sagging of the shaft, which, constantly re-occurring, results in the rings being repeatedly driven out of parallel. Sagging of the shaft to the extent of a quarter or half a millimetre, which may often happen, is likely to cause an appreciable amount of scratching of the balls, these being fitted between the races with but little play. If in consequence of faulty fitting of the housing, the inner ring is forced out of parallel with the outer, the play will develop as explained, through the balls being driven into each other.

From the above it is seen that the bearing, fig. 10, may, under certain circumstances, heat, although the conditions as regards friction may leave nothing to be desired, and are in theory perfect. The slipping of the balls along the races, as well as the fact of their being driven into each other, must cause heating.

Recognising these faults, the question arises how they may be removed. This can be done by the provision of a device by which the balls are forced to leave a certain clearance between each other—this device is called a "cage."

(*To be continued.*)

THE STABILITY AND PERMANENCE OF REINFORCED CONCRETE.[*]

There are two matters affecting the stability and permanence of reinforced concrete which appear to me to be of special importance.

The first is the risk of destruction of the cement in the concrete and of corrosion of the steel constituting the reinforcement; the second, the stresses due to expansion of the concrete and the steel, and to the difference in the value of the co-efficient for the two materials.

The likelihood of attack of the cement itself depends on the same conditions as determine whether ordinary concrete—unreinforced—is attacked, but as the thickness of the concrete over the reinforcement is usually small, it is evident that even more care must be bestowed on the avoidance of those conditions than in the case of concrete in large masses, where the surface of attack is relatively smaller. With regard to the steel, the risk of corrosion is primarily dependent on the continued access of water to the steel. Mere moisture left in the concrete after its preparation or any stationary water is of small consequence, because that water soon becomes saturated with lime and forms an alkaline medium excellently adapted for the preservation of steel. But continued access of water involving anything approaching a flow of water will remove this preservative lime and cause the customary rusting of steel exposed to water. It follows that the concrete of armoured concrete must be practically impervious. This need for imperviousness has been recognised in practice by making the concrete rich in cement, but as far as I know no measurements of the permeability of the mixtures ordinarily employed have been published. Such experiments as I have carried out have been directed to a different end, and have been made with mixtures of cement and standard sand, and go to show that though at first pervious such mixtures soon become moderately water-tight. Similar experiments with concrete composed of cement, sand and small stones, such as is ordinarily used for reinforced concrete would be useful. Impermeability of reinforced concrete, whilst desirable in all cases, becomes of great importance in structures immersed in fresh water, and imperative for those in sea water.

The co-efficient of expansion by heat of mild steel is well known, the figures generally accepted being 0·0000069 per degree Fah. That of concrete varies somewhat with the composition, but for a 1 : 2 : 4 mixture is usually taken at 0·0000055 per degree Fah. For a mixture of one of Portland cement to one of sand I have found 0·0000053 per degree Fah. wet and 0·0000073 per degree Fah. dry. These values are so similar that the stresses resulting from their difference is small. But the stresses due to the two materials regarded as a whole in a structure hindered from expansion may be considerable, and should certainly be computed in cases where the structure is exposed to a large range of temperature. Further, there are no data (so far as I have been able to ascertain) concerning the alteration of length of concrete which takes place by alternation of wetness and dryness. If this, as seems probable, is considerable, serious stresses may arise both in a structure not free to expand and between the concrete and its reinforcement. Experimental investigation of this question appears to me to be desirable.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 22nd September, 1910.

Barrow.—*First class :* V. Nash.

Cardiff.—*First class :* T. I. Hunt. *Second class :* P. A. Byrne, W. Gibson, J. F. Murphy, S. Stickland, G. L. Timms.

Glasgow.—*First class :* P. McF. Marshall, J. Gray, J. F. Bisset, W. Dickson, D. H. K. Jones, H. Gemmill, G. Black. *Second class :* C. MacFarlane, W. D. Hewitt, W. McNaught, D. Reith, J. Rolland.

Leith.—*First class :* J. McGruther, A. Dykes, R. A. Mowatt, J. London. *Second class :* A. T. Bower, G. Stark.

Liverpool.—*First class :* L. E. Owens, T. J. Roberts, H. Smith, B. May, J. H. Pritchard, W. M. Turner. *Second class :* E. Bell, R. F. Hallwood, W. Hill, W. W. Jones, S. C. Kelly, T. E. Lunt, J. Parker, E. Smith, H. E. Wood.

London.—*First class :* S. C. Smith, F. C. Bastar. *Second class :* T. Evans, A. H. Rose.

North Shields.—*First class :* H. Metcalf, R. D. Phillipson, J. R. Little. *Second class :* T. S. Appleby, S. Baguley, J. L. Currie, W. Manson.

Plymouth.—*First class :* H. P. Rowe.

Southampton.—*First class :* H. A. Laws, G. McK. Roberts. *Second class :* R. E. Le Bas.

West Hartlepool.—*First class :* T. C. Gaunt, J. F. Wild, W. S. Gibson, W. S. Hull, V. Oldham. *Second class :* E. S. Harrison, T. Marston.

Obituary.—We regret to announce the death of Mr. F. H. Harrison, J.P., which took place on the 22nd September at Lincoln. Mr. Harrison was head of the Lincoln Malleable Iron and Steel Alloy Works.

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[*] Statement by Mr. Bertram Blount, Assoc. Inst. C.E. Preliminary and Interim Report of the Committee on Reinforced Concrete, Institution of Civil Engineers.

AN IMPROVED SEAMING MACHINE.

The improved rotary seaming machine we are about to describe is of that class having a movable work-supporting table, movable seaming tools, and means for revolving the work, and adapted for seaming together, and similarly operating upon parts, such as the body and an end of a cylindrical or analogously shaped sheet of metal, or thin metal boxes or canisters, etc.

The present improvements render a machine of the above class generally more serviceable and more readily worked and manipulated; enable a greater output to be accomplished, and render the quality of the work performed by it uniformly high; while at the same time providing a machine which is durable, and not liable to be put easily out of order.

The construction of the improved machine, which is the invention of The F. E. Adams Pressure Tool Company Limited, of Cleveland Street, Birkenhead, in conjunction with Mr. F. E. Adams, is clearly shown in our illustrations.

The seaming machine shown is one in which the levers for operating the seaming tools are adapted to be put in and out of action by a swinging frame, which is actuated by a manually-operated part, which also serves—through the medium of a spring—to actuate the work-supporting table; and the levers which actuate the tools are mounted on adjustable fulcra.

Referring to the drawings, 1 designates generally the frame of the machine; 2 is the holding up or supporting table; 3 the revolved block or part against which the box is pressed during the action of seaming; 4 are the seaming roller tools, of which there are two, carried in slides 5; and 6 is the main driving shaft of the machine. The holding-up plate 2 is mounted on a spindle 7, supported and adapted to slide vertically in an adjustable bracket 8, carried from and adapted to slide vertically on the main frame 1. The spindle 7 of the table or plate 2 is adapted to be raised and lowered through a rod or bar 14, the lower end of which is mounted and adapted to slide in a rotatable pin 15, supported in a jaw forming the upper part of a crank 16, which is carried on the spindle 17 mounted in brackets 18 on the lower part of the bracket 8. The lower part 19 of the crank lever 16 is operated through a rod 20 as hereinafter described

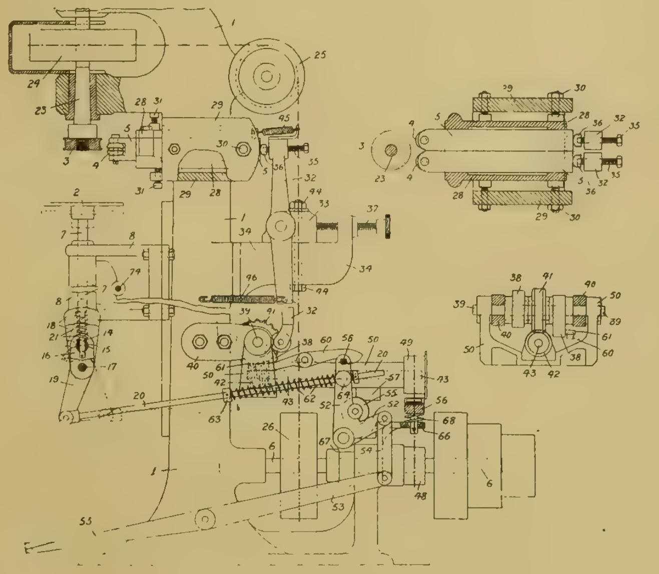
The position of the jaw of the lever 16, when the table 2 is down, and the machine in operation, is shown in dotted lines in fig. 1, and in full lines in fig. 4; while the position it takes when the table is up and the machine active is that shown in full lines in fig. 1 and in dotted lines in fig. 4. Figs. 4, 5, and 6 show in elevation and sectional plan the can-supporting, holding, and discharging mechanism.

The rod 14 has an enlarged head, which moves in the splayed-out lower part of the hole in the bracket 8, in which the spindle 7 operates; and it is normally pressed upwards to this spindle by a spring 21 disposed between the enlarged head and the pin 15. The upper rotatable or revolved block or part 3 is mounted on a spindle 23, carried in the upper part of the frame 1; and this spindle is revolved by a belt wheel 24 upon it, from a belt wheel 26 on the main driving shaft 6, the belt passing from 26 to 24 over guide pulleys 25.

The tool carriers 5 are in the form of rectangular slides, and are mounted and adapted to slide or reciprocate in a box 28, disposed and mounted within a tubular portion 29 of the frame 1. This box is pivoted in the horizontal plane at each side by screw studs 30, the ends of which fit in recesses in the sides of the box; and the box 28, and with it the tool slides 5 and tools 4, are adjusted horizontally in relation to the level of the parts of the box to be operated upon by the screw studs 31, above and below the box 28. By this means, the exact horizontal position and adjustment of the grooves or operative parts of the roller tools 4 upon the flanges of the can to be acted upon and seamed is accomplished accurately or exactly.

The tool carrier slides 5 are operated by rocking levers 32, carried in a sliding crosshead or bearing block 33, mounted and adapted to slide and be adjusted on a bracket 34. The upper ends of these levers have threaded pins 35, with thimbles 36 fitting loosely over their ends, which act directly on the back ends of the slides 5; and the adjustment of the screws and thimbles—which are the parts which actually operate on the slides—is effected by turning the pin 35. The levers 32 are vibrated by cams 38 mounted on a shaft 39 carried by outwardly projecting brackets 40 on the frame 1, the shaft 39 being revolved by a worm wheel 41 upon it, meshing with and rotated by a worm 42 fixed on a shaft 43 driven from the main driving shaft 6, as hereinafter described.

The cams 38 are of such a form, and so disposed in relation to each other, as to impart to the tool slides 5 the amount of motion, and the sequence of actions or motions desired, in operating upon, and effecting the seaming of, the parts of the box to be joined; that is to say, the folding of the flange of the box end over the flange of the body, and the closing of the seam against the body, in the well-understood way. The bearing block or crosshead 33 is adjusted on the bracket 34 by a screw 37, and it is held in position after being set by a clamping bolt 44. The thimbles on the ends of the threaded bolts 35 are kept in contact with the slides 5 by a spring 45, connecting the upper end of the levers 32 and the slides 5; while the lower ends of the rocking levers 32, or the rollers on them, are kept in contact with the cams 38, by springs 46.



Figs. 1, 2, and 3.

Motion is transmitted to the shaft 43 and worm 42 for operating the cams 38 and the levers 32 from a pulley 48 on the shaft 6, and a pulley 49 on the shaft 43, over which a belt passes; and this motion is intermittently transmitted to the moving parts in the manner and by the means as follows: So that the parts will be set in action by the attendant when a box or can is in position on the table 2 to be operated upon, and after being operated upon is automatically thrown out of action. This is effected by so arranging the shaft 43 and pulley 49 that they can be moved further from, or nearer to, the shaft 6, so that in the one case the belt will be tight and the shaft 43 revolved, whilst in the other case it will be slack and the shaft 43 will remain stationary.

To provide for this movement, the frame 50 which carries the shaft 43 and worm 42 is hinged or movably carried on the shaft 39, the vertical members of this frame which are supported from the shaft 39 being outside the brackets 43 (see fig. 2) and the frame 50 is raised, so as to make the belt passing from the pulley 48 to the pulley 49 taut, through the bell crank lever 52, which is operated through the treadle 53 and link 54. That is to say, this lever 52 has a roller 55 upon it, which, when the operative end of the foot treadle lever 53 is up, will be away from the frame 50, so that it—the frame—will be in its lower position, and the pulley 49 resting on a block 56, which serves as a brake to stop and hold it and its shaft when the parts are in this position; but when the treadle 53 is depressed, the wheel 54 will come in contact with the block 57 of the frame 50, and will lift it until it reaches the position in which the belt would be taut, and the pulley 49 and shaft 43 will be revolved.

When this position is reached, a pin 58 on the upright member of the lever 52 will become engaged with a catch lever 60, so that the parts will be held in this position when the frame 50 is raised, and the operative mechanisms are in action, and the canister or box being seamed; and the attendant's foot can be removed from the lever 53. When the parts are thus set in motion, the cam shaft 39 will receive one revolution, and so through the gear described the tools 4 and their slides 5 will be moved up to the work in the proper sequence, and returned from it; and on the termination of this action, that is to say the termination of the revolution of the cam shaft and the cams 38, a pin 61 on one of the cams will come in contact with the tail of the catch lever 60, and will depress this end, and so trip the catch end up and relieve the pin 58; whereupon a spring 62—one end of which rests on a collar 63 on the rod 20, and the other against a pivoted boss 64 on the lever 52—will press the bell-crank lever 52 backwards, so that the roller 55 leaves the block 57, and the frame 50 and shaft 43 moves down, and the pulley 49 will rest on the brake block 56, whereupon, the belt being now slack, the moving parts will be thrown out of action and stopped. The brake block 56 is supported from a bracket 66 on the bearing 67 through a spring 68.

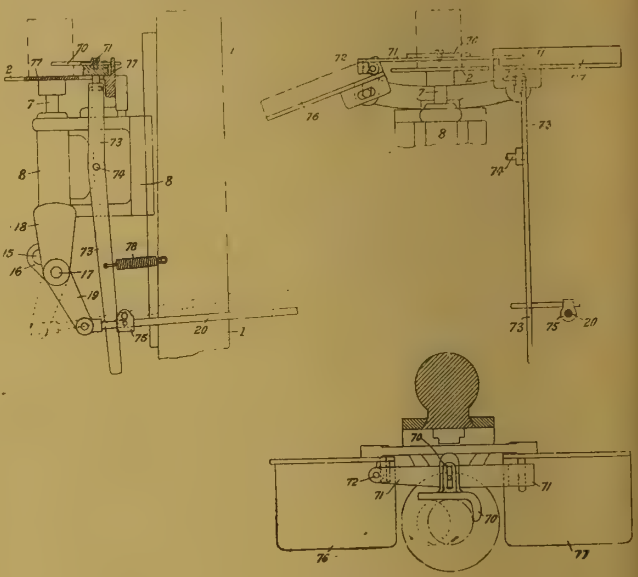
With regard to the movement of the plate 2, that is, its lifting, this is obtained through the treadle 53 and lever 52, and in precedence of the movement and rotation of the spindle 43, so as to bring the box or canister end to be seamed to it into contact with the rotative block 3, prior to the rotation of it—the block—and the movement of the tools 4; namely, at the first portion of the stroke of the treadle 53, the rod 20 will be moved forward by the boss 64 pressing on the spring 62 on the rod 20, which thereby moves the crank arm 16 up, and with it, through the pin 14, presses the spindle 7 upwards, and so presses the work—*i.e.*, the box—against the block 3; whilst the further movement of the bell-crank lever 52 upwards merely compresses the spring 62, the crank 16 being prevented from moving further than to bring the pin 14 to its vertical position, after which only the belt between the pulleys 48 and 49 is made taut, and the other parts of the machinery set in motion.

With regard to the handling of the tins, there is employed in connection with them for the purpose of expediting or facilitating their manipulation a mechanism operated from a suitable part of the machine, such as the rod 20. This mechanism consists of an adjustable gauge 70, preferably of right-angle form, which is carried upon a horizontal lever 71, hinged at 72; the lever 71 being moved towards and away from the axis of the shaft 7 by a lever 73 hinged at 74 to the bracket 8, and the lower end of which is actuated by a tappet 75 on the rod 20.

In the stationary position, the lever 71 and the gauge 70 will be in their forward position, and the can is placed so as to rest against the inner edge and angle of the gauge; and this position will be such that the axis of the tin and its end will be coincident with the axis of the revolving block 3, so that when the treadle 53 is put down, and the table 2 and the tin raised, the dished or recessed end of the tin will pass over the lower edge of the block 3. During the lifting of this table 2 and the tin, a pin on the block 75 will have come in contact with the lever 73 and moved the lever 71 back, and so the gauge 70 away from the tin. Thus the lifting of the tin and the moving of the gauge 70 out of contact with it are simultaneous.

Then when the tin is lowered after being seamed on the table 2, a spring 78 pulls the lever 73 back, and presses the gauge 70 forward, so that it will come in contact with the rotating tin, which is now free and spinning, and the body of the tin, thus brought in contact with the gauge 70, will run along its edge, and move off the table 2 on to the inclined table 76 down which it falls. The tins to be operated upon are placed upon a table 77 (figs. 4, 5, and 6) on the opposite side of the plate 2 to the table 76.

It should be observed that it has been before proposed, in connection with rotary seaming machines for metal canisters or boxes, to connect a clutch mechanism for actuating the seaming tool slides through the medium of a cam, and the supporting table, to the treadle or manually-operated part; and to provide means for rendering the seaming tools adjustable in the machine; and to so arrange the connection to the treadle or manually-operated part of the supporting table, the clutch mechanism, and the means by which the tool actuating mechanism is operated as to cause them to be brought into operation in succession. But the machine we have just described comprises the following features of novelty, viz.:—



Figs. 4, 5, and 6.

Seaming tools, adapted to be moved up to or away from the canister or box; operating mechanism for actuating the supporting table; means for revolving the canister or box; and actuating mechanism for operating the several parts or mechanisms. This actuating mechanism comprising means for transmitting motion to the operating means for moving the seaming tool carriers, carried by a swinging or movable frame, and motion transmission means being adapted to be driven from a primary motion shaft or part, when moved away from or in one direction in relation to same, and stopped when moved in the opposite direction, the movement of frame being effected through the manually-operated part of the machine.

The triple-screw steamer now being constructed by Messrs. John Brown and Co., Clydebank, for the Orient Line is to be named Orama.

NEW WESTINGHOUSE SILICA LAMP FOR DIRECT CURRENT.

The history of the most recent developments in electrical lighting is not a lengthy one, indeed it may be summed up in a very few sentences: The metallic filament lamp succeeded the carbon filament lamp in the matter of individual lighting, thus effecting a considerable saving, or, say, an economy in consumption of about 75 per cent.

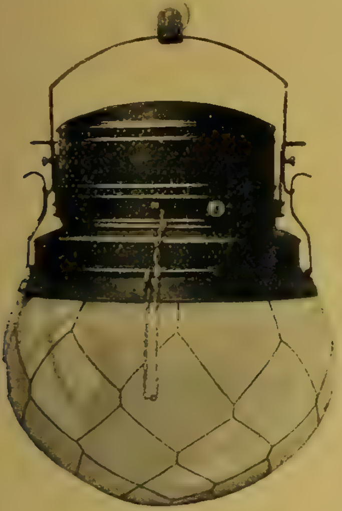


Fig. 1.

At the same time, in the direction of general lighting, the flame arc lamp has supplanted the ordinary carbon arc lamp, with a similar percentage of economy. This apparent economy is, however, in the ordinary type of flame arc lamp practically annulled by the large consumption of carbons and the general high cost of maintenance. The frequent changing of the carbons, indeed, and the necessity for cleaning and replacing the dirty globes, and more especially the disagreeable and noxious gases given off by the combustion of the mineralised carbons, not to speak of the blinding glare of the arc, often render it difficult—sometimes even impossible—to make use of flame arc lamps in large industrial establishments.

In order to overcome these above serious objections, a new type of flame arc lamp has lately been brought out by Messrs. The Westinghouse Cooper-Hewitt Company Limited, of 151-152, Great Saffron Hill, Holborn Circus, London, E.C. This lamp, which is intended for direct current, is known as the Westinghouse silica lamp, and the makers guarantee a minimum life of burner of 1,000 hours. It is constructed on an entirely different principle from the ordinary type of flame arc lamp, and is designed to give the high candle power of the latter without having any of the numerous and costly drawbacks largely consequent upon the use of carbons. In the Westinghouse silica lamp the light is obtained from the incandescence of vapour in a tube of special construction, the life of which is claimed to be theoretically unlimited since there is no consumption of matter. Fig. 1 of our illustrations shows one of the above lamps, fig. 2 being a diagram showing the connections.

The lamp itself consists essentially of a quartz mercury-vacuum tube. The luminous part of this tube is, in a 3,000 candle-power lamp, about 4 in. long, and the tube is supported in a tilting cradle provided with balance weights. A link projecting through the base operates this cradle, the upper end of the link being connected to the magnet of a large solenoid, which is mounted upon the upper side of the base, and is coupled to a dashpot arrangement, which is not shown in the diagram. The large solenoid effects, in conjunction with a cut-out arrangement, the automatic tilting operation necessary to produce the mercury arc, a smaller coil being embodied in the cut-out arrangement for this purpose. In operation, on switching on, the current will flow through the cut-out and through the coils shown to the negative main. The energising of the coils of the solenoid causes the magnet to lift, thereby effecting the tilting of the cradle and lamp-tube, which action causes the mercury contained in the right-hand end of the tube to flow down towards the other end and complete the tube circuit. The cut-out coil is in series with the tube, and now comes into operation, breaking the solenoid circuit and de-energising the latter. The magnet then falls away through the action of the balance weights fixed to the cradle, and the tube remains in the above-mentioned position whilst burning and when switched off, being again tilted automatically at starting. The light is produced by vaporised mercury, and a continuous cycle of vaporisation and condensation is maintained whilst the lamp is burning. The light given off is of a bluish-white character, the quartz tube being raised to such a temperature that it glows and provides rays which, to a certain extent, correct the very pronounced colour given off by ordinary mercury-vapour light. It is absolutely essential that the correct polarity should be maintained, otherwise the tube may become damaged, and in order to ensure this an automatic device, consisting of a small permanent magnet suspended from the arm carrying the dashpot cylinder, is provided. This is a simple arrangement that is found to work very satisfactorily; if the polarity be correct, the lower end of this permanent magnet will be repelled from the locking piece on the magnet arm below, and the lamp will be tilted; on the contrary, should the polarity be incorrect, the permanent magnet will be attracted to and will foul the locking piece, and the lamp cradle will be prevented from being drawn up. Clear or opal globes are fitted to the lamps, which outwardly resemble very nearly arc lamps. Chains are fitted to the globes, so that they can be lowered from the base the length of these chains for inspection purposes. All the mechanism is enclosed and well protected from dust and dirt.

The most expensive items connected with the lamps are the quartz tubes. These, as already mentioned, are guaranteed by the makers for a life of 1,000 hours, but the average duration is much longer, and is given at 2,000 hours. Tubes that have given out through loss of vacuum can, moreover, be repaired. The lamps are intended for direct-current circuits for working in parallel, and they have a low consumption, viz., 0·25 watt per candle power.

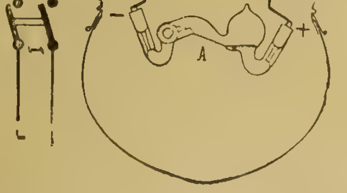


Fig. 2.

For a lamp taking 3·5 amperes at 250 volts, the light distributing curve shows a mean hemispherical candle-power of over 3,000, and a maximum illumination of

4,500 candle power at 65 deg. to 70 deg. to the horizontal. A 1,200 candle-power lamp, taking four amperes at 100 volts, is stated to work out at 1·27d. per hour, with a supply costing 3d. per kilowatt, making an allowance for replacement of tubes calculated on a 2,000-hour life basis. On cutting down the life to 1,000 hours, the life the tubes are guaranteed for, the cost works out at 1·54d. These figures compare favourably with 2·565d. for the flame arc and 2·88d. for the enclosed arc, using ordinary carbons of similar candle power on line voltages of 65 and 110 respectively. The cost of current for the lamp under consideration is stated to be 1·20d. and 0·17d. for replacement of tube on 2,000-hour basis. Comparing the figures for the flame arc, 0·975d. for current and 0·29d. for the cost of carbons, with 1·2d. for the cost of maintenance, cleaning, labour, etc.; in the case of the enclosed arc the cost of current is placed at 2·64d., of the carbons at 0·04d., and of the maintenance, cleaning, etc., at 0·2d. per hour.

In addition to the smaller consumption, the makers claim for this silica lamp the following further advantages:—All re-carboning and consequent labour charges are done away with. The light being created in the interior of a tube exhausted of all air, no fumes are given off which might be liable to corrode the globes. These two valuable qualities of the Westinghouse silica lamp render it particularly suitable for large installations which hitherto have been obliged to keep an extensive staff for the maintenance of their arc lamps. All lamps are independent of one another, which allows of maximum economy in installation and operation. The lamp operates without mechanical regulation, and will stand fluctuations of voltage 10 per cent above or below the normal without any variation in operation, this being a very important advantage in the majority of private plants. The source of light is of very large area compared with the electric arc. No shadow is thrown on to the globe, all the mechanism being situate above the luminous element. The light is of an agreeable bluish-white colour. This allows of globes of clear or very slightly opal glass being used. There is consequently an appreciable gain in the output of light. The source of light is not in contact with outside air. The installation is very simple, and the replacement of the tube can be effected by any intelligent workman, being much less delicate than the replacement of carbons.

Although the purchase price of a complete lamp may appear at first sight higher than that of an arc lamp, this difference is due to the tube, which in itself represents more than half the price. It must be taken into consideration that once this outlay is made, maintenance becomes practically nil, the average life of the tube being 2,000 hours, whilst a minimum of 1,000 hours is guaranteed. Tubes which have passed the guaranteed life, and have given out through loss of vacuum, can be sent to the factory and be repaired at a low rate of cost.

The following table gives the comparative working costs of Westinghouse silica lamps and arc lamps:—

Type of lamp.	Hemispherical c.p.	Number of lighting units.	Line voltage.	Amperes per circuit.	Consumption in watts per cricuit, includin gresistance.	Approximate consumption in watts per c.p.	Burning hours.	Cost of carbons or replacement of tubes per hour.	Maintenance and cleaning, labour per hour.	Current cost per hour. Price per kw.				Total running cost per hour Price per k.w.			
										1d.	2d.	3d.	5d.	1d.	2d.	3d.	5d.
								d.	d.	d.	d.	d.	d.	d.	d.	d.	d.
Ordinary open arc, ordinary carbons. White light ...	1200	2	110	7·35	810	0·67	10½	·45	1·5	·81	1·62	2·43	4·05	2·76	3·57	4·38	6·00
Enclosed arc, ordinary carbons. Violet light	1200	1	110	8	880	0·73	125	·04	·2	·88	1·76	2·64	4·40	1·12	2·00	2·88	4·64
Flame arc, mineralised carbons. Yellow light	1200	1	65	5	325	0·27	10	·29	1·2	·325	·65	·975	1·63	1·82	2·14	2·565	3·12
Westinghouse silica lamp, no carbons. Bluish-white light	1200	1	100	4	400	0·33	2000	·17	0	·4	·80	1·20	2·00	·57	·97	1·10	2·17
Westinghouse silica lamp, no carbons. Bluish-white light	Assuming that the life of the silica lamp tube only reaches guaranteed life of 1,000 hours.							·34	0	·4	·80	1·20	2·00	·74	1·14	1·54	2·34

N.B.—The above table shows the economy effected by the use of the Westinghouse silica lamp: an installation of 10 lamps burning 1,000 hours per annum at a current cost of 5d. per k.w. would effect an economy compared with flame arc lamps of 10 × 1000 × (3·12 – 2·17) = £39 11s. 8d.

IMPROVED SALT-BATH FURNACE FOR HARDENING STEEL.

For some considerable time past Mr. S. N. Brayshaw, of Manchester, has been carrying on experiments with a view to simplify the working of his salt-bath furnace, and at the same time to make a more efficient use of the gas consumed. These experiments have resulted in the furnaces being re-designed, and the following are the principal improvements which have been made:—

The pot containing the melt is carried almost to the top of the furnace and is fitted with a lid, while the opening in front has a lip all round, this lip being luted to the brickwork so that the gas does not come into contact with the melt at all. It is now impossible to splash the salt on to the outside of the pot, and thus the chief cause of the pots scaling and the emission of salt fumes has been removed.

The burners also are made on an entirely new principle whereby the flame comes up under the centre of the pot, passing between numerous feet cast on the bottom, and thence up the sides, by which means the contents of the pot are heated much more rapidly than before. Air blast has been entirely done away with, yet the new type of burner is found to be so efficient that the furnace can be heated up ready for use in a shorter time than was the case with the old type, and with a very much smaller gas consumption; the ordinary working of the furnace also requires much less gas than heretofore.

In the case of the oil-fired furnace, the arrangement has been very much simplified, so that this style of furnace can now be operated almost as easily as the gas-fired type.

This type of furnace is principally used for the hardening of ordinary carbon tool steel articles, but is also largely used for the reheating of carburised work for case hardening and also for quenching tools, etc., of high-speed steel which have been heated in the twin-chambered furnace specially constructed for this work.

Salt-bath furnaces of this type are now in constant use by many of the principal railway companies, shipbuilders, motor car manufacturers, textile machinists, tap and die makers, and general engineering works.

The Greenock-owned steel ship Hyderabad, 2,110 tons register and 3,700 tons dead weight, has been sold to foreigners for £4,500. The vessel was built in 1892 by Messrs. William Hamilton and Co., Port Glasgow.

PILE FOUNDATIONS FOR THE WORKS OF THE VIENNA-DANUBE SAND DREDGING CO.*

General Description.—The works in question constitute the foundation for an erection of iron columns and a platform supporting a dredging apparatus and sand-sifting plant. The structure, which is carried on reinforced-concrete piles, has thus to support great and concentrated loads. The reason for the employment of piling was that the erection occupied made ground, which was filled in at the time of the carrying out of the Danube Regulation Works at Vienna. In spite of the fact that this filling took place some considerable time ago, it was deemed expedient by the contractors to go down to the solid gravel bed, at a depth of about 16 ft., and under these circumstances the use of piling appeared to be indicated. No details of cost are given.

1. *Age of the Work.*—Completed early in 1909.

2. *External Influences.*—Piling wholly embedded in loose soil.

3. *General Condition of the Work at the Present Time.*—Although the work was executed during frosty weather, and with frozen materials, no defects have shown themselves.

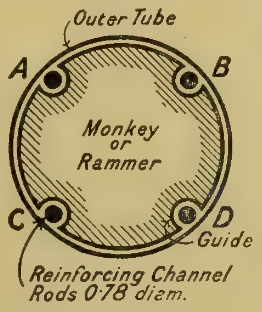
4. *General Features of the Design.*—The carrying out of the design involves two entirely distinct operations, namely, first, a drilling or perforating process, followed by the second, consisting of a ramming or stamping process.

In the first place an iron tube, whose diameter is determined in accordance with the requisite strength to support the necessary load, is driven down by the ordinary boring process to the depth needed, with the simultaneous removal of the core. When this part of the work is finished, concrete is passed down the tube and is energetically rammed, while at the same time the tube is raised gradually. By this means the concrete is driven out of the bottom of the tube and is caused to pass over the outer edge of the tube into the surrounding soil, and this latter, owing to the continual stamping and ramming, is compressed in the best possible way. As soon as one layer of concrete has been forced down to the utmost extent the tube is slightly raised and more concrete is added and again rammed, and this is repeated until the whole perforation made by the tube is occupied by a concrete pile, when the iron tube, wholly withdrawn, reaches the surface.

It is evident from this description that the pile will vary greatly in thickness at different parts, in accordance with the yield of the subsoil at the various depths, but this fact is of marked advantage, because in this way the utmost possible amount of pressure of earth against the entire length of the pile is assured, while the roughness of the exterior secures the greatest skin friction, and the piles are endued with considerable power of maintaining their position without shifting or alteration of level under heavy loads.

It is claimed, moreover, that as the hole for the pile is formed by drilling, all undue disturbance of the subsoil is avoided, and it is possible to carry out the work on this system, even where the ground is filled with fragments of rock or where the subsoil is in a frozen condition.

This last fact proved an additional argument in favour of the selection of the process in question on this occasion, because the company only decided on the execution of the work in December, 1908, and it was necessary to have it completed in the spring of 1909. The foundations had, therefore, to be carried out in mid-winter, during a severe frost, with the thermometer ranging from −6 deg. to −7 deg. Cen. (19·4 deg. to 21·2 deg. Fah.). The position of the work, in close proximity to the right bank of the Danube, exposed the piling to the most unfavourable influences, as the water had penetrated the loose and porous soil of the site, and the whole mass had frozen hard. This created a tendency of the material to swell out in the direction of the river bank and to move bodily in a horizontal direction, exerting thereby very considerable pressures. These forces could not be estimated, but could only be counteracted by great care in the execution of the concrete work. It was also thought advisable to reinforce the piling in these parts of the site with four iron rods, each 0·78 in. diameter, to every pile, throughout their entire length, and to tie these rods together by hoops or stirrups formed of iron rods, 0·27 in. diameter, fixed every 7·8 in., as is usual in the construction of columns. The reinforcement was inserted by a process which will be understood by means of the accompanying diagram. The upright bars, A B C D, are placed in their proper positions inside the outer tube, before the concreting begins, and the concrete is then inserted, and is stamped down by a monkey or rammer made to fit the tube loosely, but having four grooves or guides cut out to admit of the passage of the iron rods. By lifting out the rammer from time to time, or when more concrete is introduced, it becomes possible to affix the cross-straps or stirrups at the requisite distances apart. This mode of reinforcing the piles gave excellent results and enabled them to resist successfully the outward thrust of the frozen soil already alluded to. It is explained by reference to detailed drawings that the seventeen piles were driven in four groups. These groups, counting from the water-side outwards, contained respectively four, seven, four, and two piles each. After completion the heads of the various groups of piles were united together by means of massive slabs of reinforced concrete, so as to ensure, as far as possible, an equal distribution of the load over the whole of the piling.



In the determination of the dimensions of the piles or the diameter of the tube (11·8 in.) it was assumed, in accordance with previous experiments, that for each square inch of surface the frictional resistance would be 14·19 lbs., and no allowance was made for the fact that these piles rested on firm ground or for the advantage likely to be derived from the varying diameters. If, therefore, each pile is loaded to the extent of about 24½ tons, and only the skin friction due to the average diameter is taken into account, it would seem that there is a double factor of safety to guard against eventual settlements. Reference is made to the composition of certain concrete binders and inter-ties between the various groups of piles and to the calculations used in determining the strength of these members.

5. *Materials*: (*a*) *Composition of Concrete.*—The concrete consisted of sharp, clean, river sand and ballast, with fragments as large as one's fist, mixed with Portland cement.

(*b*) *Character and Quality of Cement.*—The Portland cement is one of the best native brands, which complies with all the requirements of the Austrian standard specification. No proportions are given.

(*c*) *Quality of Reinforcing Bars.*—The iron used for the reinforcement was selected from ordinary commercial bars, made for the most part by the Thomas process which is not usually submitted to tests. As a rule iron of this quality possesses an elastic limit varying between 14 tons and 15¼ tons per square inch, and a tensile strength of about 25¼ tons per square inch. No concrete tests were made.

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* Report by Mr. Karl Naehr, Civil Engineer. Preliminary and Interim Report of the Committee on Reinforced Concrete, Institution of Civil Engineers.

6. *Methods of Construction: Mixing the Concrete.*—The amount of water used in making up the concrete varied in different cases. For the piles of pure concrete, *i.e.*, those not reinforced (six in number), about 10 per cent of water was employed, so that when it was vigorously rammed, it was compressed closely into the earth surfaces as the tube was withdrawn. For the eleven armoured piles the concrete was mixed with rather more water (from 2 to 3 per cent) so as to work well round the bars, and a still more plastic material, with as much as 16 to 18 per cent of water, was employed for the binders. The massive blocks for the heads of the piles were composed of concrete of the consistency of damp earth (*erdfeucht*), with about 8 or 10 per cent of water.

8. *Failures or Deterioration.*—As the whole of the work was executed during the prevalence of a sharp frost, not only the water but also the sand had to be heated, and at times about 1½ per cent of table salt was added to the mixture. Notwithstanding these adverse conditions the work has stood well, and after use for nine months showed no sign of injury.

TESTING OF ALTERNATORS, WITH RESULTS OF TESTS ON A THREE-PHASE MACHINE.

By J. W. Rogers.

The shop tests it is the custom to carry out on single and polyphase alternators may be classified under two distinct heads, viz., (*a*) experimental and (*b*) commercial. Experimental tests are made on all machines of a new type, chiefly for the benefit of the designer, and consist of (1) resistance, (2) open and short circuit characteristics, (3) iron loss, saturation, and friction, (4) regulation and efficiency, and the information derived from these tests enables the design of a machine to be checked, and also serves as a guide to its operating characteristics when running under working conditions. The methods of making the various tests mentioned above may be considered as follows:—

Resistance.—In shop testing the ohmic resistance of machines is always found by the drop of potential method, the value of the resistance of a one-phase alternator being given by dividing the voltage drop between terminals by the current flowing through the windings. With a two-phase generator there are two separate circuits to be considered; the total armature resistance Ra will therefore be half the resistance as measured between the two terminals of either phase, *i.e.*,

$$Ra = \frac{\text{voltage drop between terminals of one phase}}{\text{current} \times 2}.$$

Strictly speaking, the use of direct currents for measuring the resistance of alternating-current machines is not quite correct, owing to the skin effect of alternating currents, but, as the difference between the apparent and true resistance in the case of small conductors is very small, the drop of potential method may be considered sufficiently accurate at ordinary frequencies.

In the case of a three-phase generator its armature may be connected up in either star or mesh fashion. With a mesh winding the resistance between any two terminals is the resultant of one phase in parallel with the other two phases in series. Suppose r represents the resistance per phase, then

$$r = \frac{r \times 2r}{r + 2r} = \frac{2r^2}{3r} = \frac{2r}{3};$$

that is to say, the resistance per phase

$$= \frac{\text{resistance between terminals} \times 3}{2},$$

or, in other words, the resistance between terminals is only two-thirds of the resistance per phase with a mesh winding. When the windings are star-connected, the resistance, as measured between any two terminals, is that due to two phases in series; therefore resistance per phase

$$= \frac{\text{resistance between terminals}}{2}.$$

The total resistance

$$Ra = \frac{R_1 + R_2 + R_3}{3 \times 2},$$

where R_1, R_2, and R_3 represent the values of resistance between terminals. Therefore

$$Ra = \frac{\text{mean resistance between terminals}}{2},$$

which is true for either a two or three phase armature. Having found the total resistance of an armature, its copper loss may be easily calculated.

For a single-phase alternator the copper loss in watts $= C^2\ Ra$ where C = armature current and Ra its resistance.

The copper loss in a two-phase armature is given by the following formula, where C = total current, and Ra the resistance per phase.

Watts lost per phase

$$= \left(\frac{C}{2}\right)^2 \times Ra = \frac{C^2}{4} \times Ra;$$

therefore watts lost in both phases

$$= 2\left(\frac{C^2\ Ra}{4}\right) = \frac{C^2\ R}{2}.$$

With a three-phase alternator, having either a star or mesh winding, the copper loss is found as follows:—

Let C = line current,

then $\frac{C}{\sqrt{3}}$ = current per phase.

If R = mean primary resistance between terminals, the resistance per phase

$$= \frac{R}{2};$$

then watts lost in each phase

$$\left(\frac{C}{\sqrt{3}}\right)^2 \times \frac{R}{2} = \frac{C^2\ R}{6};$$

therefore watts lost in three phases

$$= \frac{C^2\ R}{6} \times 3 = \frac{C^2\ R}{2};$$

that is to say, the copper loss in either a two or three phase winding is given by

$$\frac{C^2 \times R}{2},$$

where R = mean resistance between terminals, and C = total amperes. The total amperes

= amperes per ϕ × 2 for two-phase machines

= " " × $\sqrt{3}$ for three-phase machines.

The armature resistance drop between terminals in a three-phase machine

$$= \frac{R}{2} \times \text{amperes per } \phi \times \sqrt{3}.$$

Open and Short-circuit Characteristics.—An open-circuit characteristic curve is obtained by running the machine at normal speed on open circuit with different values of exciting current, and taking readings of field amperes and their corresponding values of terminal voltage. This saturation test determines the amount of energy required to excite the alternator field to give any particular value of terminal voltage, and at the same time indicates the degree of saturation attained by the iron. As the same readings are necessary, this test is always made in conjunction with the iron loss test.

The short-circuit characteristic is obtained by short-circuiting each phase of the armature (in the case of a polyphase machine) through ammeters of negligible inductance, and driving the machine at its normal speed with different exciting currents up to a value sufficient to give about twice the full load armature current. The input to the driving motor is measured before the armature is short-circuited, and also for different values of short-circuit armature current, the difference between the two values of motor input so obtained representing the iron loss for various values of short-circuit current. A series of readings connecting the motor input in kilowatts and the armature short-circuit current, with the exciting current, is then taken, and the results of this test, when plotted with field amperes as abscissæ and armature amperes and kilowatts as ordinates, will represent the short-circuit characteristics of the alternator, the current curve being generally a straight line.

(*To be continued.*)

LITERATURE.

All books received or noticed in this column can be had through " The Practical Engineer " Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

" Workshop Wrinkles and Recipes." Edited by P. Marshall. Marshall's Practical Manuals, No. 10. London: Percival Marshall and Co. Price 1s. net.

All amateur mechanics and model makers have met, at some time or other during the course of their work, difficulties which are easily overcome if one only knows how. These little troubles are generally in the nature of special operations, such as how to drill a hole through glass. A handy companion giving well-tried wrinkles of this sort and recipes for workshop use acts as a lubricant and makes the work run smooth. The collection of nearly 130 hints, compiled and made readily accessible, to be found in this little handbook needs no further commendation. An ample index adds considerably to the value of the book as a ready reference.

" Coal Mining." By D. Burns and G. L. Kerr. Part IV., Drills and Drilling and Coal-cutting Machinery. London: Whittaker and Co. Price 2s.

We are pleased to see the continuation of this serial publication, the previous numbers of which have proved themselves of a high order. The present part is confined to descriptions of drills used in coal getting, the methods employed at the seams, and a comprehensive discourse on the principal makes of coal-cutting machines. These include both hand and mechanically-operated drills of the percussive and rotary classes, and calculations are given showing how to determine the energy of the blow and work done, with tables of the comparative cost of operating by hand and machine cutting.

The descriptions include beside the hand drills, machines of the disc, bar, chain, and punching types, all of which are driven by electricity or compressed air.

The advantages of the various makes of machines are carefully considered and their merits for working on the different qualities of the coal that are met with.

There are over one hundred illustrations throughout the pages, and altogether this number constitutes a valuable section in the series

" Our Home Railways." There is now in the press of Messrs. F. Warne and Co., publishers, a serial on British Railways. There will be 12 parts when complete, with 36 accurately-coloured plates, and upwards of 300 illustrations from the most interesting photographs. The first three parts, which are now issued, are descriptive of the Great Western Railway, the Midland Railway, and the London and South-Western Railway. The information is chatty, descriptive of the early days, and contains many interesting incidents concerning the progress of the railways, which are instructive to both old and young. The price is 9d. per part.

Books Received.

" The Steam Engine Indicator." By F. R. Low. Third Edition, revised and enlarged. London: McGraw-Hill Book Co. Price 6s. 6d. net.

" Coal Mining." By D. Burns and G. L. Kerr. Part IV. Drills and Drilling and Coal-cutting Machinery. London: Whittaker and Co. Price 2s. net.

" Practical Mathematics and Geometry." A Text Book for Elementary Students." By E. L. Bates and F. Charlesworth. London: B. T. Batsford. Price 3s. net.

" Official Gazette of the United States Patent Office." Vol. CLVIII., No. 1. Published by Authority of Congress, Washington.

" Aerial Navigation." By F. Walker, C.E. Second Edition. London: Crosby Lockwood and Son. Price 5s. net.

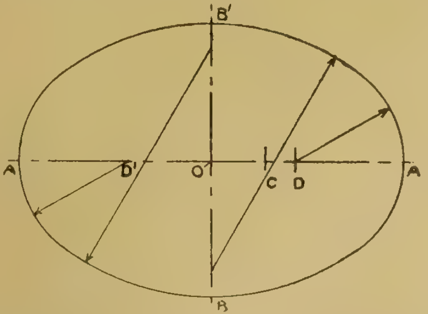
" Ganot's Elementary Treatise on Physics, Experimental and Applied." By Atkinson. Eighteenth Edition. Edited by A. W. Reinold. London: Longmans, Green and Co. Price 15s. net.

"Elementary Manual on Applied Mechanics." By A. Jamieson. Ninth edition; thoroughly revised. London: Charles Griffin and Co. Price, 3s. 6d. net.

TO DRAW AN ELLIPSE WITH COMPASSES.

The following method of drawing an ellipse with compasses given by a correspondent of the *American Machinist* may prove useful to some of our readers.

The accompanying is a sketch of an ellipse drawn with circular arcs, the method of locating the centres of which, while not new, is, the writer thinks, not generally known to draftsmen. He has, he says, used the method with entire satisfaction, and after becoming familiar it comes as natural as saying two and two are four.

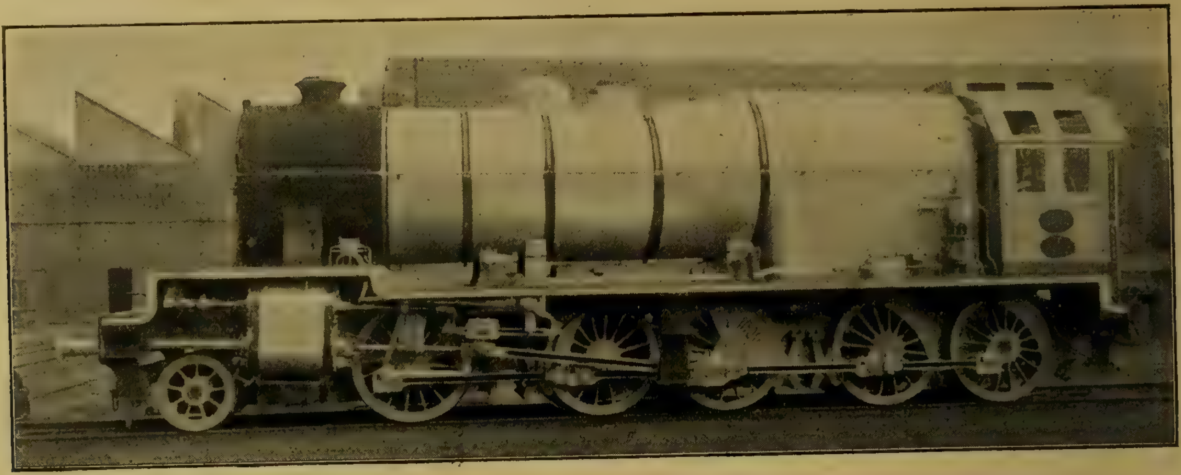


After laying off the points A', A and B', B, through which the arcs are to be drawn, lay off on line A', A the distance A', C equal to O, B or half the minor axis. Then with C, A' as radius, draw arcs through B and B', using line B, B' for centres. Next lay off C, D equal to half of O, C, and with D and D' as centres and D, A' as radius, scribe arcs through A' and A. These latter arcs will, if reasonable care is taken, come tangent to the arcs drawn through B' and B.

" This method can be used only where the ellipse is not extremely flat, but I have used it for a number of years in general drafting work, and find it convenient, fairly swift, and it makes a good-looking ellipse, such as is used to represent an oblique view of a hole or stud, etc."

NEW 2-10-0 TYPE LOCOMOTIVES FOR THE BELGIAN STATE RAILWAYS.

There have recently been constructed at the Haine St. Pierre Forges Usines et Vonderies, of Haine St. Pierre, Belgium, several powerful 2—10—0 locomotives of an entirely new type, to the designs of Mons. J. B. Flamme, the chief mechanical engineer of the Belgian State Railway system. As will be seen from the illustration, this locomotive type is of outstanding interest, and reaches dimensions hitherto unattained on the Belgian State Railways. The 10 coupled wheels have a diameter of 4 ft. 9 in., and a total wheelbase of 33 ft. 2¼ in. A four-wheeled bogie is constituted by a leading pair of small wheels, and by the first pair of driving wheels, in accordance with the Krauss-Helmholtz system, by means of which the weight of the main frame is carried on a central cradle swung from four oblique links on the bogie frame, the pivot being hemispherical in form and traversed horizontally by a safety-pin. The side frames of the bogie are connected at their back end by a transverse spring sandwiched in a cross frame, which is suspended by swing links to the underside of the leading driving axle boxes. The centres are 19¾ in. diameter, and the piston stroke 26 in. The two inside cylinders are connected to the second driving axle, and the outside cylinders to the third axle, balancing being effected through the coupling rods. The boiler is fitted with a Schmidt superheater arrangement, and has a total heating surface of 2,563 square feet, the grate area being 53·82 square feet, and the working pressure 199 lbs. per square inch. Exclusive of the tender, each of these 2—10—0 locomotives have a weight of 98 tons, 8 cwt., 3 qrs., and a tractive effort of about 45,635 lbs.



NEW 2—10—0 TYPE LOCOMOTIVE.

Table of Principal Dimensions, Weights, etc.

Weight, empty, about		90,000 kg.
Weight, fully loaded, about		100,000 kg.
Diameter of the cylinders, 4 cylinders		500 mm.
Stroke of pistons		660 mm.
Diameter of the coupled wheels		1,450 mm.
Diameter of the bogie wheels		900 mm.
Effective traction, 65 per cent		20,700 kg.
Distance between the coupled axles		7,615 mm.
Total length over cross pieces		12,375 mm.
Maximum width		3,150 mm.
Distance between the further axles		10,115 mm.
Maximum height		4,280 mm.
Heating surface of grate		18·11 mm.
Heating surface of tubes (interior)		220·00 mm.
Total heating surface		238·11 mm.
Heating surface (exterior)		60·85 mm.
Grate surface		5·00 mm.
Mean diameter of boiler		1,780 mm.
Length between tube plates		5,000 mm.
Exterior diameter of tubes	smoke	50 mm.
	water	127 mm.
Number of tubes	smoke	230
	water	31
Capacity of the water space in boiler		8,500 lit.
Capacity of the steam space in boiler		4,500 lit.

SIMPLE JIG FOR THE ACCURATE DRILLING OF SPLIT-PIN HOLES.

[CONTRIBUTED.]

The illustrations show a simple and useful jig for the accurate drilling of small split-pin holes in machined pins, such as are used in considerable quantities in engineering concerns.

The object of the jig is to be able to locate the pin hole to be drilled in its correct position relative to the diameter, and also its correct and specified distance from the head of each pin, and in the design illustrated all has been done to render the jig a useful accessory to the drilling section of any machine shop.

Obviously the sizes may be extended *ad libitum*, if sufficient numbers of pins of the larger sizes are required to be done.

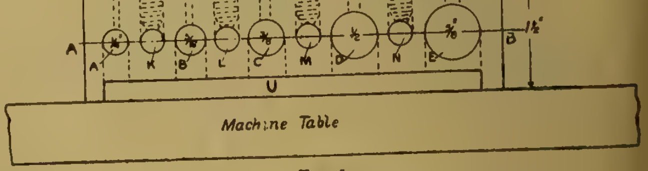


Fig. 1.

Referring to the sketches, fig. 1 is an elevation of the tool, fig. 2 is a sectional plan through A, B of fig. 1, fig. 3 is a plan of the jig. The jig is arranged for the drilling of pin holes in pins varying from ¼ in. diameter to ⅝ in. diameter, and of any length, the pin holes varying from $^1/_{16}$ in. diameter to $^3/_{16}$ in. diameter. The body of the jig is of cast-steel stock, $1\frac{1}{2}$ in. by $1\frac{1}{4}$ in. by $4\frac{7}{8}$ in. long, and tempered throughout.

In fig. 1 may be seen the holes A, B, C, D, E, in which the pins from $\frac{1}{4}$ in. to $\frac{5}{8}$ in. diameter may be inserted;

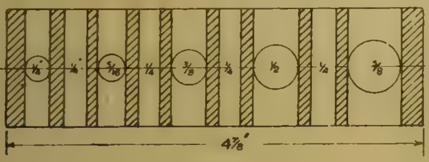


FIG. 2.

while F, G, H, I, J represent the drill holes, and are located in the precise diametral centre of the pins to be drilled; K, L, M, N are $\frac{1}{4}$ in. holes drilled quite through the cast-steel stock, and are provided for the purpose of holding the register pins O, P, as shown in fig. 3; Q, R, S, T are $\frac{1}{4}$ in. screws, provided for the purpose of fixing the register pins O, P, etc., in any desired position, so as to be able to drill the pin holes the required distance from the head of the pin.

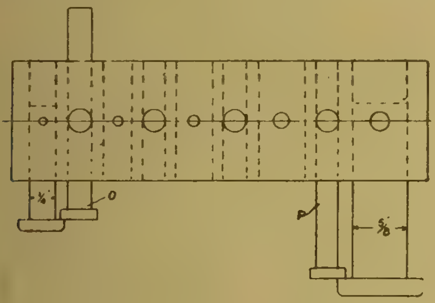


FIG. 3.

The holes shown in dotted lines in fig. 1, and in full lines in fig. 2, and also the gap U, are for the purpose of getting rid of the drillings. In fig. 3 may be seen a $\frac{1}{4}$ in. pin and a $\frac{5}{8}$ in. pin in position ready for being drilled, the pins O and P locating them in the jig block.

For the purpose of setting the register, the distance (*i.e.*, $\frac{3}{8}$ in.) from the centre of the drill hole to the face of the block being known, the register pin may be set by gauge piece (say $\frac{3}{8}$ in. thick) between the head of the pin and the side of the block, as shown in fig. 3. Having this once set, any number of pins may be correctly drilled by simply pushing up the pin to be drilled against the head of the register pins as shown.

A FLOATING DOCK FOR SOUTH AMERICA.

THE floating dock which we illustrate below has been built by Messrs. Wm. Hamilton and Co. Ltd., of Port Glasgow, to the order of Messrs. Empreza Navegacao Bahiana, of Bahia. It is of the self-docking pontoon floating type, and has a length over all of 220 ft., a breadth over all of 60 ft., and a maximum lifting power of 1,300 tons. The structure is composed of five separate pontoons, connected together by two continuous side walls. The pumping machinery comprises two large horizontal centrifugal pumps, manufactured by Messrs. Drysdale and Company, of Clydebank. These pumps are placed direct on the main drain, and are actuated through vertical shafting by steam engines located in the house on the top of the side wall, and supplied with steam from two Cochrane donkey boilers, which work at a pressure of 150 lbs. The compartments into which the dock is divided are connected to the main drain, and the arrangements are such that either pump may pump out any compartment in any of the pontoons. The valves controlling the pumping are regulated from the top of the engine house placed at the top of the pontoon wall by means of levers, bell cranks, etc. The pumping operations are directly under the control of one man. In each compartment self-indicating floats which show the water level are provided, and all of these are readable from the central position. Mechanical shores, capstans, keel blocks, and portable bilge blocks are fitted for handling the vessel when being docked, and at one end of the structure there is a bridge enabling easy access to be obtained between the side walls. Either of the two parts of this bridge, which may be used as a crane, is capable of taking loads from the centre line of the dock weighing six to eight tons. The dock is capable of accommodating vessels up to a maximum length of 250 ft., and of 11 ft. draught. During construction, the work was superintended on behalf of the owners by Mr. Crookston, of London, while the material and workmanship were carried out under Lloyds' survey. The dock left the Clyde for Bahia on August 30th in charge of the tug Ocean, belonging to the towage fleet of Messrs. L. Smit and Co.'s Sleepdienst Ltd., of Rotterdam, and it has recently arrived at Madeira.

NEW FLOATING DOCK FOR SOUTH AMERICA.

A NEW PROCESS FOR WELDING CAST IRON.

A CHEMICAL compound for welding cast iron has been invented by Messrs. Wassermann and Co., Lausanne, Switzerland.

This compound, which has been christened "Castolin," is said to be unaffected by acids, water, oil, steam, and heat.

Castolin is a concentrated chemical compound, forming a granulated brass spelter of special composition, which is ready for use and unaffected by time. A thin layer of it is applied to the broken surfaces after they have been thoroughly cleaned.

The broken pieces being tightly clamped together, the castolin welds them when red hot, and the melted castolin brazes them, filling up all small pores.

Castolin is always ready for use, and the welding of small castings requires only 20 to 30 minutes and for heavy castings a few hours only.

No special plant or implements are required for the operation; an ordinary smith's hearth or a portable forge will deal with castings up to 7 cwt., large hearths being required for heavy castings.

It is necessary to screw the parts to be united with a clamp as firmly as possible. One or two ordinary wrought-iron clamps with screws and pins will do even for complicated castings.

Any kind of cast iron can be welded by castolin in a reliable way and without being depreciated. With castolin it is also possible to weld and braze cast iron on wrought iron, steel, and on any other metal, such as bronze, copper, silver, etc.

The shape and size of the castings are not altered by this process, and where the edges have not been damaged it is difficult to detect the joints even on polished surfaces. Castolin joints can be easily machined.

The auto-chemical effect of castolin consists in welding and brazing simultaneously the metal; therefore castolin joints resist heat, acids, water, oil, and steam. The solidity of the joints being superior to the metal itself, castings welded in this manner will not break again through the same joint. Joints have given tensile breaking strains of more than 10½ tons per square inch. These results were obtained by official testing works in different countries and affords a striking testimony as to its merits.

The autogenous welding of cast iron is effected by making an application of castolin on the surfaces and then heating and allowing the casting to cool slowly. The autogenous welding becomes then more easy and sure; besides, the quality of the metal, cast iron, etc., remains unaltered and easy to work. At the same time the strength of resistance against impact, pulling, and bending stress is increased.

Kept in its original receptacle, even after having been opened, castolin is unaffected by time, and can be used to the very end. As regards cost, this, of course, depends on the broken surface. The cost of each square inch is only from 1d. to 2d.

CARE OF MACHINERY.

THE majority of machine tool users, including even the large shops, fail to realise how absolutely essential are all details in the care of their machinery if their work calls for any degree of accuracy.

The foundation is a very important adjunct to any machine Money spent to secure a firm and unyielding base is tru economy. A machine should always be levelled up when first installed, and care should be taken that the wedging material used to bring it level will not warp or shrink. A carpenter's level will not do for setting machinery; this work requires a sensitive level of known accuracy.

Occasionally we receive a complaint: "Lathe just received will not turn true; send operator." In such cases we almost invariably find the difficulty results from a shaky foundation from the lathe being out of level. As soon as the machine is levelled up so that the bed lies perfectly horizontal, the alignment is just as perfect as when the machine was shipped. Many managers don't see how a heavy casting can spring out of true by being a bit out of level. But it is an established fact that no matter how massive the bed, or what the style of the machine, it must be level to do its best work. A planer has an extremely massive bed; in fact, the bed constitutes the bulk of the machine, and it is truly surprising how "warped" planer work will be if the bed is out of level

No matter how good the foundation, a machine cannot be levelled "once for all." Our product requires the most accurate machine work. Therefore, we have a shop rule that on the first Saturday afternoon of each month every foreman must stay (the plant closes at noon on Saturday) and personally see that each machine in his department is absolutely level.

Cleanliness is another essential; manufacturers more generally recognise that this is so, as applied to the other man's factory. The accuracy of the work turned out by any machine tool depends upon the alignment of the different parts and the regularity of their relative movements. If chips cover the ways of a lathe and work in under the carriage bearings, the quality of the work will rapidly depreciate and the machine itself will soon need to be overhauled. A little grit will play havoc with the spindle bearings. A dirty chuck plate will soon spoil the threads of the spindle nose. Yet in many plants expensive machines, capable of accurate work when properly cared for, are subjected to these abuses.

We expect each operator to care for his own machine to the extent of keeping all bearing surfaces free from dirt and chips. Labourers empty the chip pans beneath the machines as frequently as necessary. In addition to this, there is a general clean-up once a week. Each department has one or two men who thoroughly clean all machines every Saturday afternoon and wipe up the bearing surfaces with oily rags.

With the heavy duty put upon machines by present-day high-speed cutting tools, ample lubrication is more necessary now than it ever was. Not only are the speeds higher to-day, but there are also greatly increased pressures on the bearings, due to deeper cuts. The oiling of the line shafting and counter shafts can well be left in charge of one man in every department, but each operator must be largely depended upon to oil his own machine as frequently as necessary.

We find that sight feed oil cups, each holding a day's supply of oil, are a great advantage on the main bearings. In the first place, they insure positive lubrication of the journals and allow the supply of oil to be exactly regulated to suit individual conditions. Another valuable feature of the sight feed oil cup is that the glass shows at a glance whether the cup is full or empty. The superintendent in passing through his shop can instantly tell whether or not the oiling has been attended to. A full oil cup proves that that particular bearing has been recently oiled, and is also a pretty good indication that the operator did not forget to oil the other bearings when he had his oil can in hand.

Careful attention to the levelling, cleaning, and oiling will increase the life of the machine and a better grade of work will be turned out. Many costly delays will also be prevented, because the machine is not out of commission for repairs.—By H. M. WOOD, in *Machinery*, New York.

INTERCHANGEABLE INVOLUTE GEARING.*

By WILFRED LEWIS.

(Concluded from page 340.)

FIG. 2 illustrates three types of gearing to be tested, and with these other types may be included.

Figs. 3, 4, and 5 illustrate a group of involute gears designed by Mr. Bilgram to engage a rack of 15 deg. obliquity and to demonstrate the possibility of using pinions of ten or even nine teeth with such a rack, provided the addendum can be varied. Without wishing to advocate the use of a variable addendum in interchangeable gearing, it is interesting to note the possibility of making a tentative solution of the problem in this way. Mr. Bilgram has also made a set of models from which the figures have been photographed, and referring to them, he gives the following explanation:—

While the involute system of gearing has decided advantages over any other, it has the one disadvantage that the faces of the teeth of wheels come into interference with the flanks of pinions, if the latter have a comparatively small number of teeth. Unless the flanks of the latter are undercut the teeth will interlock, or at least mesh improperly.

In making a single pair of wheels, a remedy can readily be applied. There are two ways in which interference can be avoided, namely, either by increasing the angle of pressure or by shortening the addendum of the wheel. If the latter method is chosen and it is desired not to reduce the working depth of the teeth, it is necessary to add to the addendum of the pinion the amount taken from the addendum of the wheel.

This latter method is out of the question when the problem is given to make an interchangeable set of spur wheels from a rack down to a 12-toothed pinion. This problem may be solved by a combination of both remedies alluded to.

The method consists of making racks and larger wheels with normal addendum, but increasing the addendum of pinions just enough to prevent the rack tooth from interfering with the flank. The samples presented (figs. 4 to 6) consist of a rack R and a 36-toothed wheel W, with angle of pressure of 15 deg. and addendum equal to the modulus. The 12-toothed pinion A, generated by a rack, corresponding to rack R, shows the undercutting thereby produced. Obviously this pinion will not work, as so much of the involute is cut away that the path of contact is materially less than one pitch. But there are also shown pinions of 12, 10, and nine teeth made with increased addenda. These were generated by a rack like R, but with a somewhat greater addendum than that used in generating the wheel W and a somewhat greater cutting depth. If these pinions are then mated with wheels of a large number of teeth, they will not enter as far as with pinions of equal number of teeth and have therefore a slightly less working depth.

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* Abstract of paper read by W. Lewis at the joint meeting of the American Society of Mechanical Engineers and Institution of Mechanical Engineers, July 1910.

On this plan may be based a system of involute gearing with a working depth of twice the modulus, and with a moderate pressure angle 15 deg. in the samples submitted. Pinions of a small number of teeth will have an increased addendum, but a theoretically correct action is maintained. The pinion teeth have a wide base and are strong. One disadvantage in those cases in which pinions with less than about 24 teeth are embraced is that the centre distance is greater than that computed by the usual rule from the modulus and the number of teeth of the meshing wheels. Moreover, pinions will not have the full working depth when meshing with large wheels or with racks, but even in the case of a 10-toothed pinion meshing with a rack the path of contact exceeds one pitch, so that at least for a portion of the action two teeth will be in contact simultaneously.

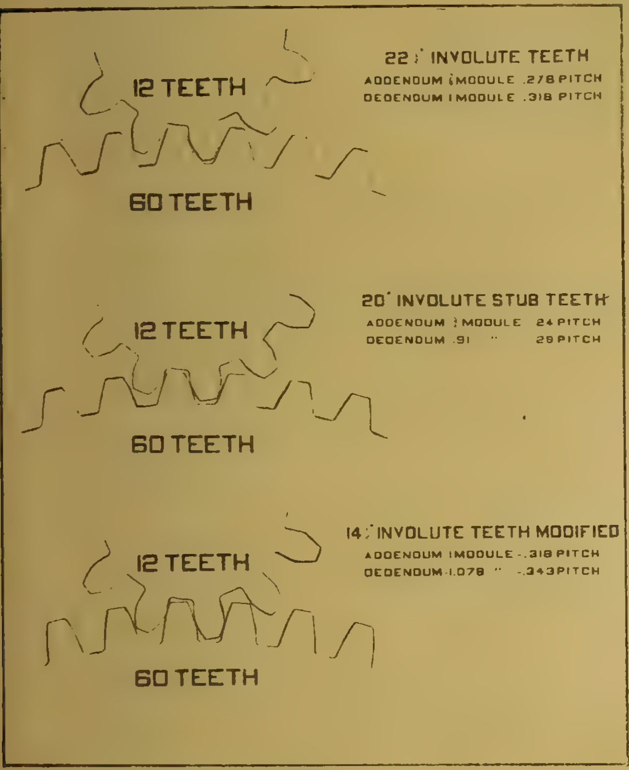
12 TEETH
60 TEETH
22½° INVOLUTE TEETH
ADDENDUM ⅞ MODULE .278 PITCH
DEDENDUM 1 MODULE .318 PITCH
12 TEETH
60 TEETH
20° INVOLUTE STUB TEETH
ADDENDUM ¾ MODULE .24 PITCH
DEDENDUM .91 " .29 PITCH
12 TEETH
60 TEETH
14½° INVOLUTE TEETH MODIFIED
ADDENDUM 1 MODULE -.318 PITCH
DEDENDUM 1.078 " -.343 PITCH

Fig. 2.

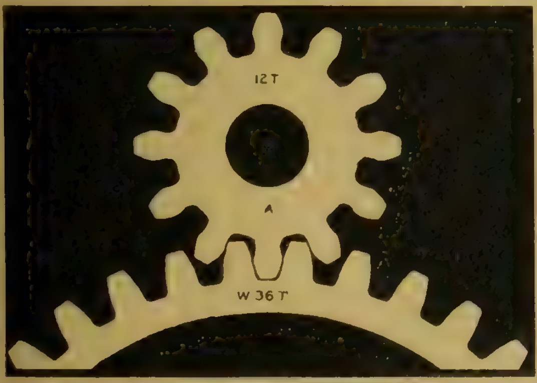

Fig. 3.

The plan proposed by Mr. Fellows is to use an involute with an angle of pressure of 20 deg. and to reduce the addendum to three-quarters of the modulus. Such teeth are known as "stub teeth." By this method interference in case of a rack gearing with a 12-toothed pinion is just avoided and in the case of two 12-toothed pinions meshing with each other the path of contact is equal to about 1⅓ of the pitch.

Mr. Gabriel prefers the 14½ deg. standard of the Brown and Sharpe Manufacturing Co., and he has prepared a contribution to the discussion expressing his views on the subject.

The system which I propose is that of a pressure angle of 22½ deg. and an addendum of seven-eighths of the modulus.

I believe that an interchangeable system of involute gearing, to be of the greatest value, should extend from a 12-toothed pinion to a rack, and in the selection of gears to be tested we have chosen a 12-toothed pinion engaging a 60-toothed wheel. The maximum reduction with the maximum strength in a limited space is the problem in gearing that generally confronts the engineer and a ratio of five to one is very often as much as he can realise without sacrificing too much strength. He recognises, of course, that the adoption of a larger number of teeth in the smallest allowable pinion overcomes some difficulties, and that this may be a debatable point, but does not think any system of interchangeable gearing will be satisfactory which does not include pinions of 12 teeth. The cycloidal system formerly employed was based upon a 12-toothed pinion, and the author believes this number can be retained for the smallest number in an interchangeable involute system without serious objection. That is, there is better ground for the retention of this minimum number than for a higher number, and when the pros and cons have all been summed up there will be no change in this well-established minimum for interchangeable pinions.

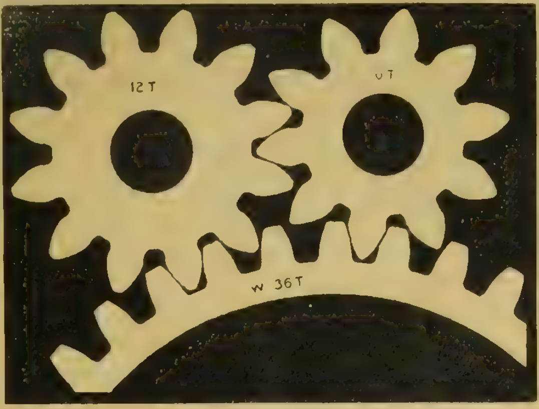

Fig. 4.

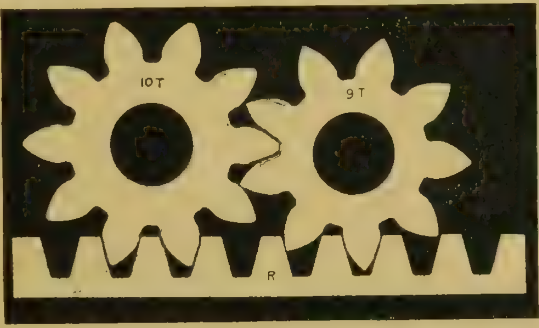

Fig. 5.

Although the experiments made under the direction of Professor Lanza are not by any means conclusive, enough has been done to indicate that the friction loss in gear teeth is influenced to a greater extent by the length of the addendum than by the obliquity of the system. Theoretically, the friction loss in involute teeth is independent of the obliquity and increases with the addendum. The loss in journal friction should vary as the secant of the pressure angle, but the latter is also affected by the dead weight on journals which even with plain bearings is a small matter, while with ball or roller bearings it is a very trifling consideration indeed.

The author believes therefore that a pressure angle of 22½ deg. can be adopted without fear of reduced efficiency in the transmission of power; that an addendum of seven-eighths module will give an ample arc of action for all combinations of gears between a 12-toothed pinion and a rack, and that true involute forms made to these constants will avoid the necessity for any empirical modifications and give results comparable with the best now obtained by such means.

An Electrical Exhibition in 1911.—It is reported that the International Trades Exhibitions Ltd. are organising an electrical exhibition at Olympia for next year, and that definite arrangements have now been made. The show will be held from September 23rd to October 21st, and will be promoted by the National Electrical Manufacturers' Association.

HIGH-SPEED TOOLS AND MACHINES TO FIT THEM.*

(Continued from page 371.)

Although considerable use is made of high-speed steel in engineering workshops, generally full advantage is not taken of its cutting powers. Certainly speeds have been greatly increased, but they have not been increased in the proportion warranted.

The author thinks that, although the rapidity of production with high-speed tools has been well emphasised during the last few years, insufficient attention has been given to the accompanying savings. Where full use is made of modern machinery, the production, in so far as roughing-out goes, is three times what it was under the old conditions. This means that only one-third the number of machines, one-third the amount of space, one-third the number of operators, one-third the amount of shafting, and about one-half the amount of supervision, are required to produce the same amount of work. Further, although the power required to drive machines capable of making full use of high-speed steel is very large, the power absorbed for each pound of metal removed is less for high-speed than for low-speed machines.

There is, in the author's opinion, only one way in which the full saving may be made, and that is by setting aside certain machines for roughing and roughing only. It is quite unnecessary to replace all or even many of the old machines, which have quite enough power to carry the finishing cuts at good speeds, nor is it desirable to use either the same class of machinery or labour for roughing out as for finishing.

There are a number of workshops where there is not the inclination or, owing to trade depression, the capital to buy many new machines. In such cases much may be done by making a judicious selection of the heaviest of the existing machines and increasing their belt speed, so that high speeds may be run with the back gear in. In some instances, the cones have been removed and replaced by wide pulleys, speed changes being provided for by means of sliding gears. Fortunately, the English machine builders of the past did not hesitate to put plenty of weight into their machines, so that, by increasing the driving power, excellent results may be obtained, but it is generally necessary to fit new gears.

An idea what saving in cutting time has been made by the use of high-speed steel can be gathered by a comparison of the power allowed for machines designed before and after its introduction. Engineers have also grasped the fact that the power which may be usefully employed depends upon the stiffness of the work and not on the height of centres in the case of lathes, or the length of stroke, etc., in the case of other machines. Thus we find instances of 12 in. centre lathes designed to use 50 H.P., which is about 10 times as much power as was allowed for in any of the pre-high-speed lathes. This increase in power must be accounted for by a desire for increased depths of cut and feeds as well as increased speeds. There is no doubt that the interest awakened by the introduction of high-speed tool steel has called so much attention to the subject of roughing out work that many improvements have lately been made which might have been made in earlier times. The author remembers cases where recourse was had to putting three belts, one on the top of the other, to increase the very limited belt power of some lathes. The following are some examples of increases in horse-power provided: Turret lathe for 2¼ in. bars, 2 H.P. to 10 H.P.; lathe 6-in. centre, 1 H.P. to 4 H.P.; lathe 10-in. centre, 2½ H.P. to 10 H.P.; lathe 14-in. centre, 5 H.P. to 20 H.P.; lathe 36-in. centre, 20 H.P. to 60 H.P.; lathe 60-in. centre, 30 H.P. to 100 H.P.; slotting machine, 12 in. stroke, 9 H.P. to 15 H.P.

An 18-in. centre lathe took a test cut on steel 1½ in. deep with a ¼-in. feed, at a cutting speed of 28 ft. per minute, the consumption of power being upwards of 80 H.P.

There seems to be no finality as to the amount of power which can be applied to a machine. We find a milling machine described as capable of removing 1,400 lbs. of steel per hour which would entail a consumption of not less than 92 H.P. Such a machine may be economical when it can be employed on a continual run of work requiring such cuts, but would be a serious charge when employed on lighter cuts. In the desire for rapid production from machines we must be careful not to overlook the consideration of the cost of power and value of material cut to waste in cases where the work could be made nearer to the size in a more economical way. The fact that by the use of high-speed machines a ton of cuttings can be made at a labour cost of 8d., must not make us forget that someone has to pay for a ton of material and 7s. or 8s. for power.

It is impossible to lay down any law regarding the limiting point of the weight and power of machines, as the number of variables which enter into consideration is so numerous. There are, however, three principal governing factors, namely: (1) The length of time the machine will be used for heavy cutting; (2) the length of time the machine will be used for light cutting; (3) the length of time the machine will be at rest. During (1) the machine is used efficiently; during (2) more is being paid for power and capital charges than if a lighter machine were used; during (3) more is paid for charges than in the case of a lighter machine. These considerations evidently point to the importance of using heavy machines for roughing only, but there are many cases where this cannot be done. Take for instance the case of a drilling machine which is generally employed to drill and ream holes of an inch in diameter, but occasionally has to drill holes 3 in. in diameter. In such a case it would be a mistake to install a machine capable of drilling the 3 in. holes at a quick rate, as the proportion of standing time to working time is very large for a drilling machine, and the time during which the machine would be employed at its full power would be very small.

(To be continued.)

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* Abstract of a paper by Mr. H. I. Brackenbury, read at the Birmingham Meeting of the Institution of Mechanical Engineers in July last.

LAUNCHES AND TRIAL TRIPS.

Star of India.—On September 22nd Messrs. Workman, Clark, and Co. Ltd., Belfast, launched from their south yard a handsomely-modelled twin-screw steamer, built by them for the well-known Star Line of steamers owned by Messrs. J. P. Corry and Co. Ltd., of London. The Star of India is a three-decked vessel 486 ft. in length, with a gross tonnage of about 7,300, and has been built under Lloyd's special survey for the highest class in their Registry, besides complying with the Board of Trade requirements for a first-class cargo steamer. She is the tenth vessel built by this firm for the Star Line fleet, and has been specially designed for the conveyance of frozen meat and other products from the Australian and New Zealand colonies. The cargo space is divided into five large holds, three of which have been insulated and otherwise prepared for carrying chilled and frozen meat. For the preservation of this cargo during transit a large plant of refrigerating machinery has been arranged. Each of the five holds is furnished with a large hatchway equipped with steam winches and derricks capable of dealing with heavy cargo. The propelling machinery consists of two sets of triple-expansion engines, complete with all necessary auxiliaries, supplied with steam from four large steel boilers working under forced draught.

Estrella.—Ramage and Ferguson Ltd. launched on September 22nd a steel screw steamer named Estrella for the London and Portuguese trade of the Ellerman Line Ltd., Liverpool. The principal dimensions of the vessel are: Length, 230 ft.; breadth, 34 ft. 8 in.; and depth, 18 ft. 7 in. The construction of the vessel is in advance of the most modern practice, having been built on the longitudinal girdered pillared system without side stringers or hold beams. A cellular double bottom is provided throughout the full length of the vessel. An electric light installation is fitted complete. The deck machinery and general arrangements are specially adapted for expeditious handling of special cargoes. The vessel has been constructed to the highest class in the British Corporation, with scantlings in excess of their requirements, as usual in vessels built for the Ellerman Lines. Triple-expansion engines are fitted, having cylinders 16½ in., 28¼ in., and 48 in. diameter, by 33 in. stroke, and steam at 205 lbs. pressure will be supplied by two large boilers fitted with Howden's forced draught.

Lisbon.—Messrs. W. Harkess and Son Ltd., of Middlesbrough, launched on the 20th September the steamship Lisbon for Messrs. The Ellerman Lines Ltd. Her dimensions are: 231 ft. 6 in. by 35 ft. 6 in. by 18 ft. 6 in. She will acrry 2,000 tons on light draught, and is fitted with 'tween decks throughout. Her engines are by Messrs. Richardson, Westgarth, and Co. Ltd., of Middlesbrough, and are capable of driving her a speed of 10½ knots, loaded.

Princess Mary.—Messrs Bow, M'Lachlan, and Co. Ltd., Paisley, launched on September 21st the Princess Mary, which they have built for the Canadian Pacific Railway Co. The vessel is a twin-screw passenger steamer of the following dimensions: Length, 210 ft.; breadth, 40 ft.; and depth, 16 ft. The upper deck extends the full length of the vessel. Two sets of triple-expansion engines, designed to give a speed of about 15 knots, are to be fitted by the builders. The vessel will have accommodation for about 200 passengers. Electric light is fitted throughout.

Weeroona.—The official trials of the new paddle steamer Weeroona took place recently, the results obtained being satisfactory. The vessel, which was built and engined by Messrs. A. and J. Inglis, Pointhouse, for the Huddart, Parker, and Co.

Proprietary Ltd., Melbourne, is intended for pleasure sailing on Port Philip Bay. She measures 310 ft. in length by 36 ft. in breadth, and 71 ft. in breadth overall. After a series of runs over the measured mile the trial was extended as far as Lamlash, having lasted altogether about eight hours. A speed of 18 knots was attained.

Themistocles.—Messrs. Harland and Wolff Ltd., of Belfast, launched on the 22nd inst. the new steamer Themistocles, built for Messrs. Geo. Thompson and Co. Ltd., of the Aberdeen Line, for their Australian passenger and cargo service. The new vessel is 516 ft. long, 62 ft. in beam, of 11,400 tons register, and has a displacement of 20,000 tons.

Messrs. Alexander Hall and Co. Ltd., Footdee, launched from their yard on September 21st a steel screw trawler, built to the order of Mr. William H. Dodds, Aberdeen. The vessel, which is built on the most modern lines, is of the following dimensions: Length, 125 ft.; breadth, 22 ft. 6 in.; moulded depth, 12 ft. 9 in. She will be fitted with triple-expansion engines of 500 H.P.

NAVAL NOTES.

H.M.S. Falmouth.—The second-class protected cruiser Falmouth, which Messrs. William Beardmore and Co. Ltd., Dalmuir, are building for the British Government, was launched on the 20th September. The new vessel is the first of four second-class cruisers of the Bristol type, and she was ordered by the Admiralty in October last. She is very similar to the Gloucester, being 450 ft. in length, 49 ft. in beam, and of about 5,500 tons displacement and a normal draught of 16½ ft. The armament of the Falmouth is rather more powerful than that of the Gloucester, her primary battery being composed entirely of 6-in. guns, whereas the guns of the Gloucester are principally 4 in., only two of them being 6 in., one at the bow and another at the stern. The Falmouth's torpedo tubes are also somewhat larger—21 in. as compared with 18 in. Her protective deck is made of 2 in. nickel steel, and it is carried forward and aft so as to completely cover all her machinery, boilers, magazines, and all the vital parts of the ship. Her propelling machinery is composed of four Parsons turbines, driving four shafts, and the steam for these turbines is supplied by 12 Yarrow small tube boilers. The designed speed of the Falmouth is 25 knots, but if she does anything like as well as the Gloucester, she will have no difficulty in obtaining about a knot and a half more than her contract speed. Her keel was laid on February 21st of this year, and she has been built in 170 working days.

H.M.S. Harrier.—The gunboat Harrier has been fitted with new water-tube boilers and undergone an extensive refit at a cost of about £18,000, and left Sheerness Dockyard on September 29th for Portsmouth to resume duties as tender to the navigational school ship Dryad.

H.M.S. Newcastle.—H.M.S. Newcastle arrived at Sheerness on the 17th September from the Elswick Works of Messrs. W. G. Armstrong, Whitworth, and Co. The Newcastle was designed to run 25 knots, but on her full-power trials she developed 26·262 knots per hour. This fleet scout, which was laid down under the 1908-9 programme, has been chosen to replace the lost cruiser Bedford on the China station. She goes to Chatham, where she will be commissioned.

NOTICES OF MEETINGS, &c.

October 3rd.—Institute of Marine Engineers, 58, Romford Road, Stamford, London, E. Fuel Test.

October 7th.—The Junior Institution of Engineers. The Friday Evening Re-unions at the Rooms of the Institution will be resumed.

The Aberdeen Mechanical Society. Annual General Meeting. Paper by Mr. James Laing, M.I.N.A.

Messrs. Brown, Boveri, and Co., of Baden, Switzerland, the large electrical engineering firm, announce that arrangements have been practically concluded with both the Electrical Co., Alioth, and the Isaria Co., Munich, for an exchange of shares, a deal which will necessitate an increase in the capital of the Baden undertaking. The Isaria Co. are makers of technical instruments and small motors, and the capital is 1·6 million marks. The profits last year amounted to 272,071 marks, and a dividend of 10 per cent was paid. The Swiss concern already has a branch at Mannheim, and it is thought that the acquisition of the Isaria Co. will be of considerable assistance in dealing with the South German trade, and especially that of Bavaria, which is likely to be an important market in the near future. The present capital of Messrs. Brown, Boveri, and Co. is 20 million francs, and for the purpose of carrying out these absorptions it will be raised to 28 million francs.

TRADE CATALOGUES.

We have received from the **Newall Engineering Co.** (proprietors, Peter Hooker Ltd.), of Walthamstow, London, E., a copy of their catalogue giving particulars of gauges, micrometers, and measuring machines, etc.

Messrs. Arthur Cort and Co., of Camberwell, London, S.E., have sent us their wholesale price list of belting, and their insulating hard or flexible vulcanised fibre which is made in the form of sheets, tubes, rods, washers, valves, etc.

We have received from **Messrs. Mansfield and Sons Ltd.,** engineers, Derby Square, James Street, Liverpool, a copy of their small catalogue of their petrol plants. The firm are putting on the market a plant which can be depended upon to give the very best effects, and at the same time it eliminates the very great difficulty of selective evaporation of petrol. Petrol is a body which nobody knows very much about except that it will give off a vapour below or above a certain temperature because of this point of selective evaporation. If you have a definite quantity of air and a definite quantity of petrol which will vaporise without the troubles of selective evaporation, you can depend upon very good results. This is what Mansfield's petrol gas plant does, and what they are prepared to guarantee to any of their customers.

We have received from **Mr. S. N. Brayshaw,** of 2, Mulberry Street, Hulme, Manchester, a short supplementary list of his patent improved salt-bath furnaces for hardening steel.

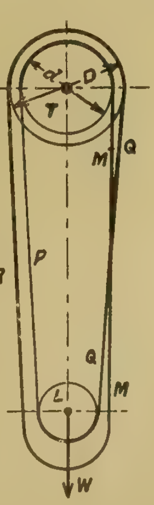
QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2274. Pulley Blocks.—Please explain the principle of the Weston pulley block. State power of same and why this is different up and down. Give an expression for the efficiency of the blocks, state usual value, and compare with other blocks.—K. T.

Answer.—The figure shows the essential features of the Weston pulley block system. An endless chain passes over pulleys with toothed grooves as shown. The lower sheave to which the weight or load hook is attached contains a single pulley L round which passes the loop of chain P Q. The upper sheave T consists of two pulleys cast together or otherwise mechanically constrained to move as one. The diameter of the two pulleys of T are very slightly different, and the smaller this difference the greater the mechanical advantage of the system (see below). The loop of



chain R M hangs freely, and by pulling on R or M the operator raises or lowers the load respectively. Thus :—

CASE 1, LOAD REVISED.—Pull applied to R: While the top sheave makes one revolution (π D) inches of rope are wound in along Q and (π d) inches paid out along P; hence, as a net result, π (D – d) inches of rope are wound up. This results in the block L rising $\frac{\pi (D-d)}{2}$ inches, while the "power" (at R) moves down (π D) inches.

The velocity ratio of the system (= mechanical advantage if there be no friction) $= \frac{2D}{(D-d)}$ . . . . (1)

CASE 2, LOAD LOWERED.—Pull applied to M: In this case, while (π D) inches of rope are wound in along P, (π D) inches are paid out along Q. So that the load is lowered $\frac{\pi (D-d)}{2}$ inches, while the "power" is moved through (π d) inches. Hence the velocity ratio, or theoretical mechanical advantage, now

$$= \frac{2d}{D-d} \quad . . . . (2)$$

From the above two results it will be seen (1) that the mechanical advantage is greater the smaller the difference (D – d), and (2) that the mechanical advantage $\propto$ D during raising and with d during lowering. The velocity ratio in actual blocks is thus some 2 to 5 per cent greater during the raising than during the lowering of a load.

Using Goodman's efficiency formula :—

The mechanical efficiency of a Weston block $= \eta = \frac{1}{\left(\frac{K}{W} + x\right)v_r}$

where K = 3 lbs. (average value), W = load raised (pounds),

$x = \frac{1 + 0{\cdot}1\, v_r}{v_r}$ (average), v_r = velocity ratio (see above).

This formula is very handy and reliable. It will be found in general that the efficiency of a Weston block is some 25 to 30 per cent. This value is low compared to that obtainable with certain other tackles, but it yields the compensating advantage that very heavy loads are self-supporting (or rather "friction-supported") if handled by Weston blocks. The latter are very compact, and it is easy to obtain a very high mechanical advantage without in the least increasing the complexity of the tackle.

In a certain case D = 9·71 in.; d = 8 in. Therefore, on raising the load, $v_r = \frac{19{\cdot}42}{1{\cdot}71} = 11{\cdot}364$ (negative).

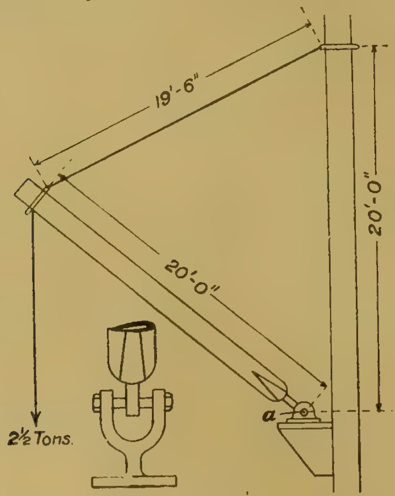
Therefore $\quad x = \frac{1 - 1{\cdot}1364}{-11{\cdot}364} = 0{\cdot}012.$

By trial it was found that K = 3·2 lbs. (= constant resistance of the blocks), hence the law of the tackle was

Effort = [3·2 + (0·012 × load)] lbs

and the efficiency, when raising a load of 100 lbs. = $25\frac{1}{4}$ per cent, approximately.—W. M.

2278. Diameter of Jib.—Will any reader answer the following? The illustration represents a derrick on the mast of a ship, and



it is required to know the diameter of the jib if made of steel plate, and also the diameter of the steel pin a.—S.

2279. Composition for Filling Floats.—Can any reader of *The Practical Engineer* give the writer particulars of the composition used for filling floats?—W. M.

MISCELLANEA.

THE HEMATITE IRON TRADE.—The demand for Cumberland hematite iron, and particularly for the special brands, has been well maintained, and another furnace has been lighted at the Whitehaven Hematite Iron Co.'s works at Cleator Moor. This increases the number of furnaces in blast in Cumberland to 18.

ANDES TO BE CROSSED BY ANOTHER RAILWAY.—The Argentine Senate have, according to Reuter's correspondent at Buenos Ayres, passed a bill authorising the construction of another Transandine railway connecting the northern part of Argentina with Chili. The sum of 8,122,000 pesos gold is appropriated for the purpose.

LONDON MATRICULATION.—"The London University Guide and Calendar for 1911," the organ of the University Correspondence College, has just been issued. This is an exceedingly useful publication for those intending to sit for the London matriculation and the higher examinations. Full particulars are given of the regulations for the various examinations to be held in 1911 and 1912; also lists of the subjects, with descriptive articles on special subjects and other matter of interest to intending candidates.

AMERICAN SHIPS.—There were built and officially numbered in the United States in August about 14,020 tons of sailing and steam vessels. Two of these were large steamers aggregating 8,000 tons, and the remainder of the vessels numbered 125, so that the average tonnage is seen to be very small. The total tonnage built in that great country is far below that of one of our shipbuilding ports, and apart from the vessels built for the work of the great lakes the great bulk of the ships are of very small size, and often for river and similar service.

NEW STEEL WORKS.—At the forthcoming meeting of shareholders of Messrs. Pearson Knowles Coal and Iron Co. it is reported that a proposal will be made to call up the balance of the company's unissued capital with a view to the erection, in conjunction with others, of works for the production of semi-manufactured steel. According to the statement of the directors great changes have been effected in the process of the manufacture of iron and steel, and for many years malleable iron has been superseded by the cheaper classes of Bessemer and Siemens steel.

THE TEES TRANSPORTER BRIDGE.—At a recent meeting of the Ferry Committee of the Middlesbrough Corporation the borough engineer reported that excellent progress was being made with the construction of the Tees Transporter Bridge between Middlesbrough and Port Clarence. The total amount of work executed to date was £46,028. The foundations had been completed at both sides of the river, and on the Middlesbrough side towers had been erected to a height of 80 ft. On the Port Clarence side the towers were 160 ft. high, and were ready to receive the main cantilevers.

WIRELESS INSTALLATION ON A TRAMP STEAMER.—Whilst on her present voyage from Bombay to Hull and Middlesbrough, the tramp steamer Nonsuch, which reached Hull on the 24th September, was heard by the wireless station at the North Foreland, calling her name at a time when she was 15 miles south of Cape de Gata, at the south-east corner of Spain, a position distant 940 nautical miles. This distance, across the obstacle of the whole of France and Spain and the Pyrenees, is a remarkable range for wireless signals from a ship. The owners, Messrs. Bowles Brothers, received a message, through the station at Ushant, sent from the ship off Cape Roca, near Lisbon, no less than 610 nautical miles from Ushant. The Nonsuch is the first tramp steamer to be fitted with wireless telegraph, and the system is that of the British Radio Telegraph Co.

AT the first ordinary general meeting of the Workington Iron and Steel Co. on the 20th September Sir John S. Randles, M.P., chairman, said that, having in view the difficulties incident to an amalgamation of so many interests, the result of the first year's trading was not unsatisfactory. It was true that there was not sufficient margin to pay a dividend to the ordinary shareholder, but they had carried forward the fair balance of £91,498. The unremunerative departments of the works had been stopped. The colliery at Lowca was really the big new feature of the concern. They had proved there the existence of a very large area of coal which had justified a considerable capital expenditure. They had under the land 2,550 acres of coal, and under the sea 7,200 acres, a total of 9,750 acres. When they took over the colliery the production was about 60,000 tons of coal per annum. Under the existing conditions the yield had been doubled. When the new shaft at present being sunk was completed, the experts told them that they should win 300,000 tons of coal per annum, and by working two shifts, after they had opened out sufficient workings at the face, it would be possible to make the yield 600,000 tons per annum.

PATENTEES' CHRONICLE

OF

Applications for British Patents.

The following is a Complete List** of Applications for Patents made during the past week. Where a Complete **Specification accompanies an Application an asterisk** is suffixed, thus.

SEPTEMBER 19th, 1910.

21670 Piano player. Staley.
21671 Gyrostates. Barbour.
21672 Hair curling device. Glover.
21673 Easy chairs. Fletcher.
21674 Tipping wagons. Bradley.
21675 Fire alarm. Johnson.
21676 Game, etc. Pye.
21677 Non-skid studding machine. Laughton.
21678 Box corners. Beale.
21679 Looms. The British Northrop Loom Co. Ltd.
21680 Tyres. McKelvie.
21681 Firearms. Dickson.
21682 Treatment of flax, etc. Hamilton.
21683 Potter's clay press. Johnson.
21684 Lace manf. Simpson.
21685 Advertising signs. Sadgrove.
21686 Heating. Muirhead.
21687 Kilns. Jones.
21688 Infusers for tea. Mills.
21689 Fans, etc. McLean.
21690 Piano player. Bryan.
21691 Collar stud. Leigh.
21692 Sponge box. Hollingsworth.
21693 *Door, etc., locking device. Fossati.
21694 Tar spraying machine. Ames.
21695 *Shaving cup. Arnone.
21696 *Propeller. Wilcke.
21697 *Steam laundry boiler. Ahlgrinin.
21698 Match box. Gould.
21699 *Converting fluid energy into work. Patitz.
21700 Telephony. Nemeth.
21701 Loose-leaf binders. Wynne.
21702 Cycle free wheels. Williams.
21703 *Rail joints. Russell.
21704 *Adding machine. Austin.
21705 Boot drying device. Farrington.
21706 *Mine ventilation. Philibert.
21707 Roller skates. Stevens.
21708 Letter box. Freeman.
21709 Steam turbines. Armand.
21710 Extracting pigments. McDougall.
21711 *Internal-combustion engine. Pieper.
21712 Window cleaning. Wilson.
21713 Gas burner. Heath.
21714 Carburetter. Lee.
21715 Fire escapes. Smith.
21716 Flying machine. Phillips.
21717 Power transmission. Kneen.
21718 Sterilising milk, etc. Beeton.
21719 Glass sheet manf. Borzykowski.
21720 Picture frames. Roberts.
21721 *Endothermic chemical reaction production.
21722 *Advertising device. Rainbow.
21723 Bed canopies. Willis.
21724 *Fireplaces. Burger.
21725 Drawing apparatus. Binko.
21726 Ordnance loading apparatus. Dawson.
21727 Gas stoves, etc. Harris.
21728 *Gas igniter. Gerald.
21729 *Presses. Perkins.
21730 Preventing cheque, etc., frauds. Redshaw.
21731 *Carburetters. Lehmbeck.
21732 Wagons. Mitchell.
21733 Non-refillable bottle. Humphrey.
21734 Paint mixing device. Gainsborough.
21735 *Radiator. Elkington.
21736 Knife, etc., container. Richards.
21737 Gas producer. Stewart.
21738 Stoker furnace. Bennis.
21739 *Musical instrument. Lake.
21740 *Electric lamp. Carangels.
21741 *Internal-combustion engine. Johnson.
21742 *Power transmission device. Dill.
21743 *Wood-working machine. Puggel.
21744 *Mills. Morel.
21745 *Propeller. Dantec.
21746 *Compressed air apparatus. Hesling.
21747 *Warm water supply. Muchka.
21748 *Window sashes. Johnston.
21749 Storm windows. Johnston.
21750 *Horn substitute manf. Bartels.
21751 Heating plants. Dieysens.
21752 Carburetters. Watchorn.
21753 *Machine tool. Gifford.
21754 Art of treating air. Miles.

SEPTEMBER 20th, 1910.

21755 Portable urinals. Sears.
21756 Cylinder, etc., design. Ruckstuhl.
21757 Sketching, etc., slabs. Peers.
21758 Tobacco cartridge manf. Bowie.
21759 Pick socket. Corbett.
21760 Motor car fittings. Camelimat.
21761 Engine starting. Coath.
21759 Door knobs. Mackinnon.
21763 Recording device. Pennefather.
21764 Friction clutch. Whitaker.
21765 Pneumatic tyres. Sankey.
21766 Boot lacing device. Ashoy.
21767 Bracelet, etc., fastenings. Harvey.
21768 Variable gear. Sturmey.
21769 Castors. Coles.
21770 Gramophone, etc., governing device. Gowlland.
21771 Speed controlling device. Benz.
21772 Speed controlling device. Benz.
21773 Speed controlling device. Benz.
21774 Flour, etc., sifting. Bamford.
21775 Telephone instrument. Birkett.
21776 Bicycle propelling device. Porritt.
21777 Bedstead construction, etc. Holden.
21778 Lamps. Craig.
21779 Tramway gearing. Dickinson.
21780 Non-refillable bottle. Horbordt.
21781 Vaporiser. Melliss.
21782 Cigarette, etc., holder. Thiemann.
21783 Bottle, etc., stoppers. Latham.
21784 Electrical device. Taylor.
21785 Wheel. Bromley.
21786 Tobacco cartridge case. Salomon.
21787 *Wheel manf. Ransmayer.
21788 Crochet cotton. Willmore.
21789 *Furnaces. Strettiner, Chamotte-Fabrik Akt-Ges.
21790 Pneumatic tyres. Gulliver.
21791 *Stone presses. Nieland.
21792 *Padlock. Grendyszynski.
21793 *Fuse casing for projectiles. Krupp.
21794 *Ball, etc., bearing. Krupp.
21795 *Ordnance sighting device. Krupp.
21796 *Breech mechanism for ordnance. Krupp.
21797 *Boiler. Johanson.
21798 Envelopes. Bull.
21799 *Ink wells. Bull.
21800 Aeration of liquids. Fletcher.
21801 *Window frames. Tentschert.
21802 *Dye manf. Imrie.
21803 *Necktie fastening. Schopf.
21804 Electric motors, etc. Barbour.
21805 Electric controllers. Barbour.
21806 Mechanism. Meacock.
21807 Mechanism control. Meacock.
21808 *Hook for swingletrees. Mander.
21809 Spring tyres. Vidal.
21810 Centrifugal pumps. Scheurmann.
21811 Tipping carts. Auty.
21812 Disc root cutters. Nicholson.
21813 Engine. Selous.
21814 Plug. Booth.
21815 Tramcar axle bearings. Thompson.
21816 Treatment of peat. Zohrab.
21817 Gramophone and cinematograph control. Madaler.
21818 *Fluid pressure tool. Lake.
21819 *Furnace. Rosenthal.
21820 *Centrifugal liquid separator. Forsberg.
21821 *Valve. Thompson.
21822 Cameras. Kamm.
21823 *Pipe wrenches. Tiner.
21824 Locking waster. Wakfer.
21825 Motor car signals. Carpenter.
21826 Pneumatic tyres. Tarry.
21827 Wheel construction. Smith.
21828 *Toy. Dull.
21829 Weighing apparatus. Kilcoyne.
21830 *Mattresses. Ryan.
21831 *Internal-combustion engine. Forest.
21832 *Pneumatic tyre. Purvis.
21833 *Winches. Felton.
21834 *Motor wheels. Johnson.
21835 *Flue gas analysis. Ward.
21836 *Fabric spreading device. Ratignier.
21837 Liquid fuel apparatus. Holden.
21838 *Weft spools. Graf.
21839 *Looms. Graf.
21840 *Coin sorter. Schultes.
21841 *Ship. Loesner.
21842 Calculating machine. Keighley.
21843 W.C. seat. Dietel.
21844 *Bag fastenings. Markwick.
21845 *Milling device. Martin.
21846 Registering the issue of check discs. March.
21847 *Horse collar. Brown.
21848*Electric heating radiators. Cunnington.
21849 Liquid raising device. Humphreys.
21850 Electric lamp. Gover.
21851 *Oiler. Lake.
21852 Goloshes. Townsend.
21853 Valve seatings. Borner.
21854 *Light signals. Jensen.
21855 Lavatory basins. Barron.
21856 *Concentration of ores. Greenway.
21857 *Concentration of ores. Greenway.
21858 Insoles for boots, etc. Rice.
21859 Cultivation device. Epstein.

SEPTEMBER 21st, 1910.

21860 Flushing cisterns. Woodhouse.
21861 Internal-combustion engines. Jones.
21862 Internal-combustion engines. Jones.
21863 Internal-combustion engines. Southall.
21864 Spectacle glasses. Zeiss.
21865 Gasificators. Cayla.
21866 Motor. Patterson.
21867 Tobacco pouches. Barratt.
21868 Surveying tapes. Rees.
21869 Pipe cleaner. Adamson.
21870 Coupling. Adamson.
21871 Skates. Parker.
21872 Motor cars. Binns.
21873 Surface condenser. Wansbrough.
21874 Card game marker. Foley.
21875 Golf club. Fleming.
21876 Biscuit machine rollers. Clarkson.
21877 Musical instrument. Muirhead.
21878 *Driving belt. Pickering.
21879 Production of aluminous compounds. Spence.
21880 Production of aluminous compounds. Spence.
21881 Card game marker. Foley.
21882 Metallic pen manf. Hughes.
21883 Guide rod for brakes. Rodnall.
21884 Tobacco pipes. Hogg.
21885 Pressure gauge. Turner.
21886 Mechanical hammer. Jeffreys.
21887 Link. Miller.
21888 Motor cars. Bennett.
21889 Lock nut. Townley.
21890 Spinning of cops. Smith.
21891 *Footstep bearing. Etrich.
21892 Bodkin needles. Mortimer.
21893 Hand inlaid decoration. Wildblood.
21894 Gas producer. Lane.
21895 Ladies' hat pin. Byard.
21896 Paper manf. Hargreaves.
21897 Pit cages. Payling.
21898 *Typographical casting machine.
21899 Sprays. Hilder.
21900 Carburetter. Veulle.
21901 Apparatus for illuminating objects. Mackinney.
21902 Door checks. Tayleur.
21903 *Paper hanging device. Kappler.
21904 Pump. Bouen.
21905 *Boot, etc., stretcher. Dresing.
21906 *Non-skid tyre. Schmidt.
21907 Tobacco pipe. Hinton.
21908 Collapsible box. Bradstreet.
21909 Paint brushes. Evans.
21910 Perambulator attachment. Shewan.
21911 *Cameras. Livesey.
21912 Button. Gaunt.
21913 Motor car tyres. Pryor.
21914 Electric lamp. Mundy.
21915 Self-propelled vehicle brake. Renouf.
21916 Harness saddles. Liggins.

21917 Building blocks. Acceltola.
21918 Bracket manf. Johnson.
21919 Pneumatic tyres. Bowley.
21920 Furniture castors. Gibbons.
21921 *Boiler construction. Stirling.
21922 Secondary batteries. Dunne.
21923 *Inking device. Custer.
21924 Gramophones. Clifford.
21925 *Automobile vehicles. Mallet.
21926 Windows. Jacklin.
21927 Nail manf. Boult.
21928 Lace manf. Fowel.
21929 *Castors, etc. Horn
21930 Boot heeling machine. Jerram.
21931 *Repairing fish plates. Wegner.
21932 Boiler setting. Poulton.
21933 *Submarine mines. Vickers, Sons, and Maxim.
21934 *Bundling machine. Lake.
21935 Wire winding device. Bowyer.
21936 Engine. Fox.
21937 Roller blinds. Harrison.
21938 *Water, etc., main connections. Verduraz.
21939 Carburetter. Lupton.
21940 Rock drill. Tippett.
21941 *Controlling lifting power. Höltring.
21942 *Coupling. Tattersall.
21943 Switch. Berrey.
21944 Boot soles. Jones.
21945 Spare tyre holder. Davensport.
21946 Oxygen production. Hyatt.
21947 *Erasers. Yelf.
21948 Submarine mines. Vickers, Sons, and Maxim.
21949 *Explosion motor. Reno.
21950 Flying machine. Edwards.
21951 Internal-combustion engine. Patterson.
21952 *Addressing machine. Jones.
21953 Toy. Shear.
21954 Waterproof varnish for lathes. Peters.
21955 Relating to guns. Kilroy.

SEPTEMBER 22nd, 1910.

21956 Flushing apparatus. Clist.
21957 Motor car signals. Ryley.
21958 Flushing cistern. Harvey.
21959 Aeroplane. Mawson.
21960 Photo film washer. Denham.
21961 Cigars, etc. Chambers.
21962 Carburetter Lindblom.
21963 Gas producer. Hawley.
21964 Rubber stamps. Scovell.
21965 Fire escape. Durham.
21966 *Turbine blades. Howden.
21967 Shock absorber. Layfield.
21968 Castors. McTaggart.
21969 Hatpin protector. Dingwell.
21970 Spare wheel attachment. Brown.
21971 *Type casting machine.
21972 *Emptying measuring tanks. Leigh.
21973 Indicating apparatus. Halliwell.
21974 Safety device in mines. Griffiths.
21975 Waterproof garments. Weinberg.
21976 Ventilating device. Wilkinson.
21977 Internal-combustion motors. Griffin.
21978 Tyre pumps. Shorter.
21979 Winding machine. Stott.
21980 Looms. Stott.
21981 Ice manf. Heeman.
21982 Electric tramcars. Gleaves.
21983 Roofing tiles. Akerman.
21984 Bouquet box. Robertson.
21985 Advertising device. Drummond.
21986 Duplicators. Townsin.
21987 Golf ball manf. Chambers.
21988 Syringes. Mayer.
21989 Engraving copper rolls. Ker.
21990 *Printing paper. Turnbull.
21991 Gas meter diaphragms. Cox.
21992 Wheels. Ireland.
21993 Cycle brakes. Austin.
21994 Free engine hub. Smith.
21995 Photo printing device. Weston.
21996 Loose leaf binder. Brassard.
21997 Music holder. Booth.
21998 *Game. Mason.
21999 Acetylene gas lighting. Lucas.
22000 Studs. Owen.
22001 *Aeroplane control. Murphey.
22002 *Internal-combustion engine. Bett.
22003 Files. Jones.
22004 Walking sticks. Bekuhrs.
22005 Railway barriers. Christoph.
22006 Wall paper. Bauch.
22007 Axle cap. Reingpach.
22008 Envelope. Cohen.
22009 Aeroplanes. Arnott.
22010 Fluxes. Gutenshon.
22011 *Washing crockery. Staines.
22012 Calcium carbide treatment.
22013 *Telephone circuit. Siemens.
22014 *Dye manf. Lucius.
22015 *Boiler flues. Crozier.
22016 *Purification of magnesium, etc. Johnson.
22017 Purifying middlings. Turner.
22018 *Roofing tiles. Prestage.
22019 Building bricks. Blythe.
22020 Relating to chess, etc. Moriarty.
22021 *Engine governor. Holdsworth.
22022 *Ore roasting furnace. Herreshoff.
22023 Nails. Williams.
22024 Door locks. Nobes.
22025 Syphons. Marshall.
22026 Syphons. Marshall.
22027 *Fibrous resilient material. Lovell.
22028 *Mattress. Loss.
22029 *Producing calcium phosphide. Doerbecker.
22030 *Safety explosives. Himalaya.
22031 *Safety razor. Markworth.
22032 *Charge delivering apparatus. Frederick.
22033 *Manf. of pigments. Moffatt.
22034 Match box. Noha.
22035 *Concentric circular wings. Beurrier.
22036 Fire alarm. Contland.
22037 Rail planing machine. Day.
22038 Revolving planes. Bouffler.
22039 *Crane ships. Bode.
22040 *Magneto.
22041 Device for sheeting dough. Callow.
22042 *Leather dressing machine. Thompson.
22043 Heavy guns. Dawson.
22044 Lifting jacks. Jackson.
22045 *Speed meter. Becker.
22046 Vacuum drier. Rorke.
22047 *Ventilating shaft. Schofer.
22048 Submarines. Jeyes.

SEPTEMBER 23rd, 1910.

22049 Gear wheels. Wirtz.
22050 *Corsets. Cox.
22051 Music leaf turner. Harris.
22052 Cooking stoves. Scott.
22053 Siphon cistern. Laing.
22054 Kite. Ellis.
22055 Glazing. Wallis.
22056 Sparking plug. Slater.
22057 Automatic stopper. Laughton.
22058 Fluid pressure engine. Chorlton.
22059 Printing device. Coates.
22060 Marine feed pump. Groves.
22061 Cash register. Harvey.
22062 Toy car. Richardson.
22063 Sheep shearing machine.
22064 Non-splash motor device. Calautarients.
22065 Spades. Hatton.
22066 Rifle range. Toombs.
22067 *Mortice lock. Bainbridge.
22068 Spindle moulding machine. Johnston.
22069 *Fluid compressor. Carter.
22070 Indiarubber pads. Livermore.
22071 Road manf. Baxter.
22072 Shoe horn. Kirke.
22073 Carding engine. Pearson.
22074 *Mould frames. Lentzsch.
22075 Motor car. Culverwell.
22076 Hydro-aeroplane. Morin.
22077 *Fountain pens. Read.
22078 *Crochet ball holder. Archer.
22079 Road scraper. Whitrow.
22080 *Belt shifting device. Urwick.
22081 Light metal ornaments. Parr.
22082 Clutch. Stanley.
22083 Bandage winder. Hatton.
22084 Furnace burner. Gale.
22085 Signalling system. Cortland.
22086 Aerial life-saving apparatus. Cowley.
22087 Rocking and swinging motion. Round.
22088 Animal traps. Fildes.
22089 *Washing machine. Eisenan.
22090 Skirting bars. Strasser.
22091 *Bath tubs. Gödicke.
22092 Rubber gloves. Linke.
22093 Capstans. Scott.
22094 *Collar support. Kraft.
22095 Transparent soap. Gray.
22096 Non-refillable bottle. Wallis.
22097 Acid manf. Newton.
22098 Tobacco pipes. Newton.
22099 Concrete sea walls, etc. Lynde.
22100 Counting device. Wigg.
22101 Woollen materials. Crowther.
22102 Roofing sheets. Ferguson.
22103 Electric lamps. Shirley.
22104 *Breaking apparatus. Segboth.
22105 *Spinning machine. Borzykowski.
22106 Platform lowering device. Atkinson.
22107 *Classifying index. David.
22108 Pistons. Borner.
22109 *Steam engine cylinders, etc. Mennig.
22110 *Electric motors. Siemens.
22111 Fabrics. Reynolds.
22112 Stapling machines. Timson.
22113 Lasts. Adkins.
22114 *Type casting machine. Palmedo.
22115 Telephone receivers, etc. Rozycki.
22116 Artificial flower manf. Czarnowska.
22117 Clothes washing. Stanton.
22118 Carburetters. Hamilton.
22119 Vapour burning lamp. Kitson.
22120 Conduit tramways. Jack.
22121 Carpet fasteners. Coake.
22122 Clamping device. Remmier.
22123 Ammunition lifting. Dawson.
22124 Indiarubber manf. Lake.
22125 *Railways. Porri.
22126 *Hydrogen purification. Jaubert.
22127 *Gas manf. Tessier.
22128 *Advertising device. Hetzer.
22129 *Floors, etc. Róth.
22130 *Paint enamel manf. Munro.
22131 *Double-beat valve. Jorgensen.
22132 Boot holding device. Brindley.
22133 Boot cleaning pedestals. Brindley.
22134 Trousers stretcher. Browning.
22135 Desk clip. Cooper.
22136 *Boiler. Rhea.
22137 *Cash register.
22138 Dye manf. Ransford.
22139 Electric fuse box. Burchett.
22140 Gun firing control. Dreyer.
22141 *Composition. Radmore.
22142 Toy, etc. Hipauf.
22143 Telephonic device. Brown.
22144 Typewriters. Yelf.
22145 Knitting machine. Toon.
22146 Tin openers. Russell.
22147 Pneumatic tyres. Hill.
22148 Artillery training. Newitt.
22149 Motor cycles. Seechman.
22150 Speed syren for aeroplanes Noblet.

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22151 Furnace air supply. Neil.
22152 Electric clock. Woolley.
22153 *Measuring tank. Leigh.
22154 Bleaching textile fabrics. Young.
22155 Roller skates. Waddington.
22156 Wireless telephone system. Kramer.
22157 Photo lenses. Beck.
22158 Game. Birch.
22159 Governing flow of water. Claxton
22160 Golf balls. Child.
22161 Fire door construction. Malley.
22162 Refuse destructors. Leask.
22163 Electric switch. Tucker.
22164 Wireless telegraphy. Smith.
22165 Tape reels. Dixon.
22166 Printing machine. Hamilton.
22167 Ovens. Adams.
22168 Coin freed gas meter. Shakeshaft.
22169 Bandage reels. MacDonald.
22170 Gas fires. Harrison.
22171 Cycle saddle. Brooks.
22172 Internal-combustion engine. Tagg.
22173 Baking tins. Hateley.
22174 Electric lamps. Edwards.
22175 Combustible vapour production. Pace.
22176 Combustible vapour production. Pace.
22177 *Gas stoves. Wilson.
22178 Steam engine. France.
22179 Well pump. France.
22180 Display stand. Nicholson.
22181 Gas lamps. Keith.
22182 Wheel tyres. Shanks.
21283 Measuring orifices. Kent.
22184 Measuring flow of liquids. Kent.
22185 Tennis racquets. Shelley.
22186 *Annealing box. Bossingham.
22187 *Furnace fronts. Hume.
22188 *Bamboo cutting machine. Richmond.
22189 Airship balancing. Adolphe.
22190 Fence. Purser.
22191 *Bottle cap securing device. Lumley.
22192 Food. Freeman.
22193 Connecting device. Leechman.
22194 Liquid fuel gasification. Evans.
22195 Clamping instruments. Moore.
22196 Curtain hanging device. Peach.
22197 *Women's garments. Béchoff.
22198 *Electric circuit. Presser.
22199 *Card shuffling device. Phabe.
22200 *Calculating machine. Geertz.
22201 Indiarubber cleaning. Norzagaray.
22202 Cement. Hall.
22203 Boot stand. Atkins.
22204 *Sheet, etc., iron manf.
22205 Photos. Hippins.
22206 Milling, etc., tool. Smith.
22207 Automatic recording device. Partridge.
22208 Railway vehicle buffer, etc. Woodhouse.
22209 Firing gear for ordnance. Bacon.
22210 *Safety razors. Cullen.
22211 Accessories for smokers. Snell.
22212 *Aeroplane safety device. Farman.
22213 *Soap manf. Grant.
22214 Apparatus for administering anæsthetics. Bloss.
22215 Horse collar fastening. Loveday.
22216 Window fastening. Mack.
22217 Cycles. Lavery.
22218 Lifting appliances. Fajans.
22219 Gloves. Landgraf.
22220 *Aeroplanes. Farman.
22221 Smoke abating device. Spicer.
22222 Sawing apparatus. Asribekoff.
22223 *Sliver cans. Archer.
22224 *Alternating current apparatus. Siemens.
22225 *Coke ovens. Wagener.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to October 31st, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

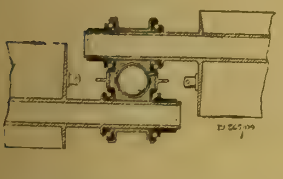
Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

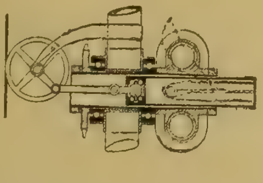
1909.

12055 Vickers, Sons, and Maxim Ltd., Vickers and Benthall: Manf. of armour plates and other steel articles. 12106 Carrick and Pattison: Preparation of iron compounds. 12180 Dennis: Construction of kiln for the firing of pottery, enamel ware, glass ware, enamelling, and the like. [Post-dated August 24th, 1909.] 124312 Grosvenor: Looms for weaving tufted carpets and other tufted fabrics. 12983 Wille: Support for the back of ladies' dress skirts. [Post-dated March 8th, 1910.] 13728 Schuer: Electric arc lamps. [Post-dated December 13th, 1909.] 16526 Martin: Belts for personal wear. [Post-dated December 22nd, 1909.] 16761 Coats and Cameron: Valves for controlling the inlet and exhaust of internal-combustion engines. 16764 Curran: Combined horizontal furnaces for heating steel or iron plates, angle irons, and the like. 16839 Mang: Frames or supports for lamp and other shades. 16885 Brackensieck: Device for automatically switching on and off flash signs or other electric apparatus at any desired intervals. [Post-dated January 17th, 1910.] 16940 Heskett: Manf. of steel. 16947 Machlet: Regulating apparatus. [Request under Section 19 of the Act not granted.] 16962 Flanagan: Two-reel sewing machines. 17224 Nall: Method of producing serrations upon sharpening steels. 17954 Goss: Acetylene gas generator. [Post-dated August 31st, 1909.] 18974 Garthorn: Reciprocating direct-acting steam or other fluid motors without rotary crank or flywheel. 18998 King: Healds for use in the production of leno fabrics. 19039 Bhisey: New process for producing imitation oil paintings and the like. 19066 Waddington and Kendal: Steam superheater. 19093 Bartholomaus and Brandt: Die stocks with sets of screw dies adapted to be alternately shifted. 19150 Smith: Process for the production of commercially useful products, from the Cyperus Papyrus, commonly known as Papyrus, and other tropical aquatic plants. 19155 Sandilands: Apparatus for impregnating air with vapour from volatile spirit or the like. 19157 Denner-Meier: Process for treating mineral oils and their distillates. 19171 Pouey: Construction of wire and other fences. 19196 Johnston and Clark: Gas manf. 19207 Boult (Automatic Press feeder Co.): Printing presses. 19211 Drews and Bennett: Extraction of fibre from fibrous vegetable matter. 19236 Hollingworth (Crompton and Knowles Loom Works): Weft-replenishing mechanism of automatic weft-replenishing looms.

19265 Lorenzen: Screw propellers for aerial machines. [Request under Section 19 of the Act not granted.]

The object of this invention is to construct a screw propeller for working in air of great lightness with an easily variable pitch. The aerial propeller under consideration has a pitch which can be altered during its employment to suit the relative speed of the movement; its constructional parts being few, of hollow section, and chiefly of magnalium or like suitable alloy or partly of wood and partly of steel or alloy, the lightness of the whole is ensured. The blades of the propeller are arranged turnable round their axis in ball bearings at or near the hub. A sliding tube or rod is employed inside the hollow propeller shaft and carries at its projecting end a double arm attached by small connecting rods to the propeller blades. If the sliding tube is pushed forward or drawn backwards, the blades are turned through a small angle and thus the pitch of the screw is changed. In order to balance the turning of the blades on opposite sides, the double arm may advantageously be connected to the tube by a rocking or swivelling joint; such arrangement will ensure equal thrust on the propeller blades. At its other end the sliding tube or rod has a ball or thrust bearing and is jointed by means of a connecting rod or other mechanism to a wheel round which a wire cable runs. When the wheel is set in motion one way or another, the tube slides forwards or backwards and effects the alteration of the pitch in the manner described above. The connection between the wheel and sliding tube may be any suitable mechanism, say, a worm and rack.

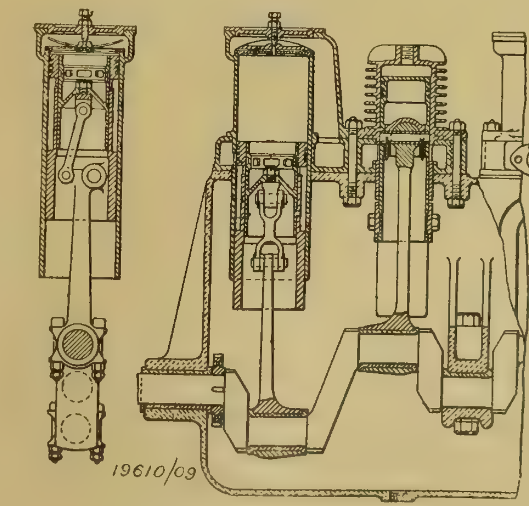




19282 Clark and Johnson: Machine for dipping and glazing bricks, tiles, pottery ware, and like articles. 19328 F. E. Adams Pressure Tool Co., and Adams: Seaming and like machines. 19340 Dunlop: Excavating machinery. 19387 Mount and Beck Flame Lamp Ltd.: Arc lamps. 19388 Wagner: Production of sheets or films of metals. 19391 Board and Ling: Conversion of starch in brewing or distilling, and the manf. of an improved brewing material. 19413 Walke: Method of and means for softening and purifying the feed water of steam generators. 19418 Gribbel and Atherton: Pleating mechanism. 19432 Whitehead and Stuart: Collapsible photographic reflector cameras. 19455 Boult (United Shoe Machinery Co.): Lasting or like machines. 19457 Filter-und Brautechnische Maschinen-Fabrik Akt.-Ges. vorm. L. A. Enzinger: Bottle-filling apparatus. [Date applied for under International Convention, August 24th, 1908.] 19496 Bambridge: Driving mechanism for use with electric motors. 19499 Shiner: Reversing gearing. 19512 Mendess: Food preparation. 19529 Thompson (Taliaferro and Krummel): Can-closing machines. 19530 Denne: Heel-seat trimming machines for use in the manf. of boots and shoes. 19543 Blackmore, Morley, and Watney: Nut locks. 19550 Fairweather (Underwood Typewriter Co.): Calculating machines, especially designed for use in connection with typewriting machines. 19553 Blackburn: Globe holders for inverted gas lamps and the like. 19579 Kirkwood: Variable-speed gear for turning lathes. [Cognate Application. 2930, 1910.]

19610 Lamplough: Charging pump specially suitable for internal-combustion engines.

The invention relates to that class of pump having ports in the walls of the cylinder and a piston having a portion of reduced diameter into which reduced portion the ports in the cylinder open. The present invention comprises an improved charging pump specially suitable for an internal-combustion engine, comprising a cylinder open at one end and closed by a non-return diaphragm valve at the other, a cover connected to the cylinder enclosing the diaphragm valve and having an outlet, lateral ports in the cylinder, a piston fitting the cylinder at each end and having an intermediate annular portion of reduced diameter forming a space open to the ports, other ports in the intermediate



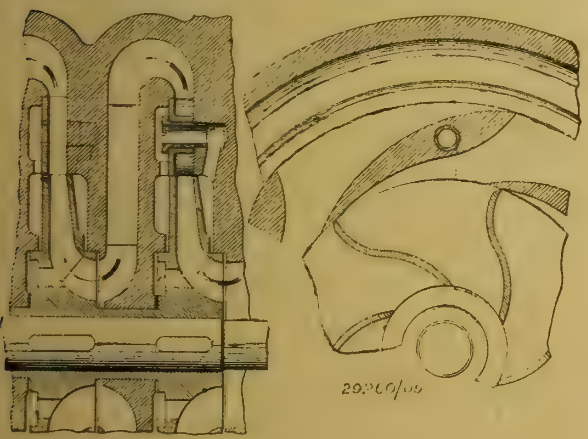
annular portion of the piston, an interior sliding part having ports and a cross web, a connecting rod pivoted to the exterior part of the piston, and a lever on the connecting rod which is positively connected to the interior part of the piston and causes it to move with relation to the exterior part and thus open and close the ports in both parts of the piston.

19619 Zelger: Flying machines. 19665 Dawson and Finlay: Manf. of blocks for colour printing. 19687 Hutchinson: Games. 19697 Jackson and Clark: Vaporisers for medical and other purposes. 19702 Howard and Dowell: Ball or other internal stopper bottle-filling machines. 19708 Hajdu and Sarlos: Spring suspensions for railway vehicles and the like. 19731 Tattersall: Aeroplanes for use with aerial vessels and the application thereof. 19764 Timm: Process and apparatus for the production of metals. [Date applied for under International Convention, October 12th, 1908.] 19785 Swanger: Dining table. 19812 Jones: Means or appliances for discharging and conveying away the coked product from vertical coke ovens or gas retorts with base discharge. 19820 Ulzer and Sommer: Manufacturing radium salts or compounds and substances containing large proportions of radium. 19850 Lentsch: Tension device for use on winding frames or like machines. 19918 Boult (United Shoe Machinery Co.): Thread-waxing devices. [Cognate Application. 28032, 1909.] 19926 Wooster: Treatment of fabrics for use as belting, fire or garden hose, and like purposes. 19943 Krummel: Lap seam body formers for can bodies. 19944 Todd: Securing of rails to sleepers. 20072 Graham, Graham, and Graham: Steam or other fluid-pressure reducing valves. 20088 McAlpine, and John J. Griffin and Sons: Devices for fitting supplementary lenses or other attachments to lens hoods of varying dimensions. 20374 Smith and Pennington: Machines for boring earth and rock. 20437 Boston: Closures for the mouths of hollow vessels. 20494 Blanc: Apparatus for producing sulphur dioxide for fumigation and like purposes. 20528 Houston: Stop mechanism for yarn-winding machines. 20530 Vessey: Flying machines. 20565 Fairhurst: Nut lock. 20593 Leclaire: Process for manufacturing viscose and similar compositions. 20678 Bentley, Slack, and Slack: Guard razors. 20697 Hughes: Reservoir penholders. 20699 Legg: Gulley sinks. [Post-dated September 21st, 1909.] 20738 Burrell and Wilson: Motor lorries. 20783 White: Button-hole making attachments for sewing machines. 20804 Yuille: Presses for tennis rackets and the like. 20846 Arnold and Forbes: Aerial machines. 20880 Leask: Apparatus for cooling water or for treating air or gases with water or other liquids. [Cognate Application. 6315, 1910.] 20907 Nydegger, and R. Wedekind and Co.: New or improved process for the manf. of pure ammonium nitrate. 20957 Wildig and Taylor: Life guards and obstruction removers for motor-propelled vehicles. 20999 Woodbridge: Hair waver or curler which can also be used to hold puff curls and the like. 21179 Barbour: Homopolar generators and motors and other electrical machines having a large number of collector rings. 21343 Kirwan and Quaney: Switches for breaking electrical circuits. 21567 Steward: Envelopes and fasteners therefor. [Post-dated February 4th, 1910.] 21652 Wirtz: Means for heating smelting furnaces and the like. 21685 A. Boake Roberts and Co., and Berry: Method of bleaching and fumigating hops. 21731 Gibb and Plant: Rolled steel piling. 21808 Nielsen: Boxes for conveying eggs and the like. 21827 Wagner: Means for obviating the vibrations of main pressure actuated valves. [Date applied for under International Convention, May 6th, 1909. Application for Patent of Addition to 19898, 1908.] 21869 Hartley: Appliance for pointing or bevelling the lead points of lead pencils. 21893 Rude: Superheaters for water-tube boilers. 21920 Hoffmann Manufacturing Co., and Schmidt: Machines for grinding rollers such as those used in roller bearings. 21958 Musgrave: Delivery apparatus for delivering envelopes, cards, and the like from high-speed cylinder printing machines. 22002 White: Closuring metal bottles and similar receptacles. 22095 Steele: Safety explosive. 22099 Jakeman: Machines for scouring knitting pins, toilet pins, needles, and the like. 22225 Bennis: Cooling devices applicable to coking stokers and the like. 22231 Mawson: Article of furniture. 22236 Allen: Pianofortes. 22266 Godwin: Spokes of wheels. 22283 West: Cotton gins. 22346 Timings: Table attachments for carrying a cigar ash tray and/or tumbler or the like. [Cognate Application 23068, 1909.] 22432 Eckersley and Creswick: Coal-cutting machines. 22529 Scott: Dust carts. 22913 Boltshauser: Apparatus for heating and drying gravel. [Date applied for under International Convention, December 23rd, 1908.] 22935 Hammesfahr: Sheath for daggers. 23031 Parkes and Sidebottom: Sash pulleys and the manf. of the same. 23068 *See* 22346 1909. 23082 Yates: Gas fires. 23202 Hopper: Sliding windows for motor road vehicles and other carriages. 23291 Siemens Bros. Dynamo Works (Siemens Schuckertwerke Ges.): Arrangements for the prevention of brush sparking in rotary electric frequency transformers having commutators. 23351 British Thomson-Houston Co. (General Electric Co.): Refractory insulating materials. 23367 Bottomley: Quick traverse winding frames. 23388 Hunter and Palmer: Bottles and other vessels for clarifying liquids and for separating and retaining the sediment therefrom. [Post-dated April 13th, 1910.] 23464 Moore: Stopper for bottles and the like. 23511 Penn: Clutch. 23630 Roger: Guards for the driving mechanism of bicycles. [Post-dated April 14th, 1910.] 23667 Marcotty: Means for supplying air to locomotive boiler furnaces. [Date applied for under International Convention, September 6th, 1909.] 23747 Graham: Electric signalling means. 23799 Parnham: Fastener. 23899 Peat: Velocipede ambulances. 23996 Goddard: Compositions for building and like purposes. 24047 Poate, and Fawcett, Preston, and Co.: Pressure pumping machinery. 24108 Krummel: Hand seaming mechanisms for cans and other receptacles. [Date applied for under International Convention, November 12th, 1908.] 24196 Thompson (Firm J. A. Topf and Soehne): Mechanical stoking apparatus. 24214 Barron: Benchings and pipes for use in the construction of sewerage inspection and like chambers. 24279 Hoskins and Sewell Ltd., and Hoskins: Terminals, vases, or mounts of bedsteads, cots, and other articles. 24327 Spencer: Buffers for railway and for like vehicles. 24331 Hollingworth (Crompton and Knowles Loom Works): Means for positioning bobbins prior to discharge from the magazines of automatic weft-replenishing looms. 24446 Robinson: Gas stoves and the like. 24479 Rexach y Torres, De la Pena y Martinez and Rexach y Mornan: Railway points and switches. 24577 Dewrance: Pressure gauges. 24585 Fisch: Cigarette, cheroot, and cigar-making machine. 24605 Marks (Columbia Postal Supply Co.): Mail-marking machines. 24744 Hollingworth (Crompton and Knowles Loom Works): Filling thread-cutting mechanism for weft-replenishing looms. 24774 Lane: Construction and method of propulsion of flying machines. 24781 Turner and Buxton: Indiarubber grips for the handles of cricket bats, hockey sticks, tennis rackets, and the like. 24805 Johnson (R. Koepp and Co.): Absorption of gas from a mixture of gases by means of hot liquor, and the apparatus employed therein. 24821 Stich: Street-sweeping machines. 24846 Ono: Axle boxes. 24859 Jones: Grain-conveying machinery. 24976 Warburton and Wright: Means for storing and separating or separating ring travellers for ring-spinning and ring-doubling machinery. 24994 Flewitt: Door closers for motor cars and other vehicles. 25021 Wm. Simons and Co., Brown and Brown: Dredgers. 25244 Kjellin: Treatment of ores in blast furnaces. 25362 Walker: Safety devices applicable for use in the raising and lowering of hoppits, cages, and other receptacles in pits or shafts. 25388 Keats: Rotary, steam, or other fluid engines. 25395 Richardson and Richardson: Automatic spooling machines for cotton and the like. 25662 George and Jobling: Aeroplanes. 25719 Hosgood: Electric plug and socket couplings or connectors. 25746 Watts: Holders for feeding bottles for infants, invalids, and others. 25871 Lake (International Match Co.): Machines for producing matches. 25924 Critchley and Jones: Alarms for level crossings. 25949 Hollingworth (Crompton and Knowles Loom Works): Mechanism for operating the fur or chenille weft carriers in looms for weaving tufted or chenille fabrics. 26003 Atkinson: Vacuum piano players and the like. 26088 Kirwan and Quaney: Switching devices for use in connection with electric lighting or power. [Post-dated May 11th, 1910.] 26125 Otto-Hilgenstock Coke Oven Co. (Dr. C. Otto and Co. Ges.): Coke ovens. 26201 Hughes: Hypodermic and other syringes. 26250 Siemens Bros. and Co., and Dieselhorst: Inductance coils for submarine and other electric cables. 26299 Williams: Breaking down appliances for coal or other minerals in mines and quarries. 26308 Goold (Heckford): Supports for coats and like apparel. 26543 Jones and Sharpe: Guides and work holders for grindstones. 26645 Smith: Wheels for vehicles. 26654 Pursell: Screw propellers. 26850 Evered and Co., and Evered: Manf. of jointed brackets for shop window fittings and other like fittings. 27058 Burton: Apparatus for separating grease or other impurities from steam. 27084 Ford: Change-speed and reversing gear. 27175 Bamberger: Electric actions for organs and the like. 27208 Benjamin: Supporting devices for electric incandescent lamps. 27355 Falk: Electric clock-driving devices. 27499 Read: Air valve for football bladders. 27531 Hornsby and Needham: Sliding sashes or lights of railway carriage and motor car doors and other structures. 27618 Williams: Valve gear mechanism of internal-combustion engines. 27672 Canton and Unne: Fluid-pressure engines for aerial machines. [Date applied for under International Convention, December 15th, 1908.] 27686 Clements: Devices for use in conjunction with display stands for exhibiting goods together with show cards or the like. 27851 Simpson: Flying machine. 27869 Sussmann: Gas burner. 27944 Elliott: Treadle-operated machines for setting staples and the like. 28032. *See* 19918, 1909. 28045 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new pharmaceutical compounds. [Samples furnished under Section 2 of the Act.] 28110 Barker: Resilient wheels for vehicles.

28127 Jones: Means for measuring a roll of fabric. 28155 Dyson: Playing boards for games. 28286 Tourtel: Barrel locks and their keys. 28304 Anzani: Internal-combustion engines. [Date applied for under International Convention, October 9th, 1909.] 28453 Higgs: Ignition apparatus for internal-combustion engines. 28470 Wilkins: Valves. 28509 Campbell: Apparatus or devices for cleaning knives and the like. 28555 McBride: Electric arc lamp. 28755 Von Schlippenbach: Method of and means for recovering gases rich in sulphur dioxide separately from gases poor therein in roasting and oxidising processes. [Date applied for under International Convention, May 24th, 1909.] 28818 Batt: Electric ignition devices for internal-combustion engines. [Cognate Application. 3417, 1910.] 28929 Delvigne: Explosives. [Date applied for under International Convention, April 2nd, 1909.] 28956 Deutsche Post-und Eisenbahn-Verkehrswesen Akt.-Ges.: Railway or other fare indicator. [Date applied for under International Convention, October 15th, 1909.] 29127 Megret: Spring mattress. [Date applied for under International Convention, December 12th, 1908.] 29240 Hubbell: Storage batteries. 29252 McNamara: Type-line casting machines. [Rights under Section 91 of the Act not granted.]

29260 Pulsometer Engineering Co., and Bjornstad: Centrifugal pumps.

> This invention relates to centrifugal pumps wherein end thrust, due to difference of pressure at opposite sides of the impeller, occasioned by unequal leakage of liquid past the impeller, is eliminated by connecting the chambers or spaces at opposite sides of the impeller, or at opposite sides of each of a number of impellers in a multiple impeller pump, by one or more passages through a stationary part of the pump casing. The present invention comprises a centrifugal pump having a diffuser or delivery chamber separate from the pump casing, connecting these two parts together by hollow screws and utilising the latter as a means for establishing communication between the chambers or spaces at opposite sides of the impeller.

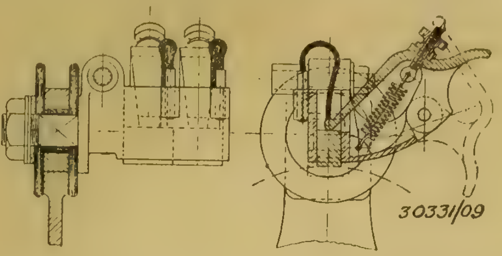


29283 Kainer: Coin-controlled vending machines. [Date applied for under International Convention, March 17th, 1909.] 29475 William Mitchell (Pens) Ltd., and Mitchell: Bobbin carriages and bobbins of lace machinery. 29561 Thomas Robinson and Son Ltd., and Robinson: Plansifters. [Application for Patent of Addition to No. 7372, 1909.] 29734 Jones and Taite: Explosive fog signal for use on railways. 29803 Wheway: Shaft hooks of the tug chains or straps and breechings of cart and like harness. 29853 Flett: Detachable rims for the pneumatic tyres of motor vehicles and the like. 30028 Wiliams: Weave or construction of fabric. 30070 Haddan (Aktiebolaget Separator): Centrifugal separators with filtering apparatus. 30075 Le Tall (Soc. Leflaive et Cie.): Double compression press for briquetting or agglomerating purposes. 30087 Schwabe: Device for preventing breakage of the picking motion of power looms. 30208 Fynn: Alternate current motors.

30331 W. A. Stevens Ltd., Stevens and Lambert: Brush holders employed in electrical apparatus.

> This invention relates to improvements in brush holders employed in electrical apparatus, and particularly to that type in which a spring finger is employed to maintain the carbon in its operative position. The invention consists of providing in brush holders for electrical apparatus of the type in which a pivoted finger lever is pressed on a carbon by a spring, a thumb nut, and a pin with a hole or holes in the nut, either of which holes is adapted to engage the pin.

30382 Spencer: Buffer and other springs constructed with indiarubber. [Application for Patent of Addition to 9391, 1909.] 30384 Fairweather (Underwood Typewriter Co.): Typewriting machines. 30496 Wiechelt: Distributor for fertilising and similar substances. 30515 Jones: Devices for gripping, fastening, or locking purposes. 30587 Arland: Machines for cleaning, blacking, and polishing boots or other leather articles.

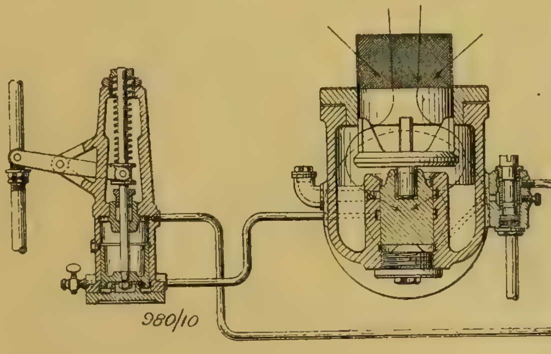


1910.

89 Lemberg: Apparatus for removing the objectionable properties of the exhaust gases of internal-combustion engines. [Date applied for under International Convention, January 23rd, 1909.] 171 Neufeld and Maitinsky: Safety aeroplane. 180 Hoffman: Jar and bottle closures. [Date applied for under International Convention, January 5th, 1909.] 201 Lake (Goss Printing Press Co.): Printing presses. 305 Northey: Sound-producing devices for fog signalling, position locating, or the like. 363 Hammond and Darlington: Automatic guns. 672 Mulacek and Hatlanek: Electrical induction smelting furnaces. [Date applied for under International Convention, March 1st, 1909.]

980 Wilson and Mathewson: Air-compressing apparatus and its automatic control.

> This invention relates to improvements in the method of and appliances for effecting the automatic control of air compressors and their driving engines or motors. The apparatus comprises in combination a valve operated direct by air from the compressed air receiver, a piston or like part for closing and opening the air inlet valve, a further piston or like part for moving and returning the throttle or engine slowing device, all co-operating in conjunction and with their necessary accessories.

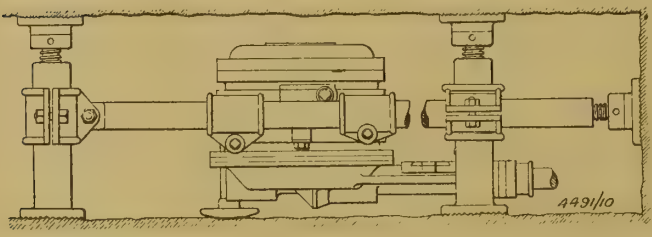


1003 Fox: Bottle that can only be used once. [Post-dated April 21st, 1910.] 1103 Soc. Hillairet-Huguet: Capstans. [Date applied for under International Convention, February 27th, 1909.] 1337 Gmeindl, Gmeindl, Gmeindl, and Gmeindl: Automatic feeding apparatus for granular materials, primarily for feeding furnaces and kilns. [Date applied for under International Convention, April 22nd, 1909.] 1511 Vogel and Poetter Ges.: Method of constructing the pin bottoms of Bessemer converters. 2110 Rheinische Metallwaaren and Maschinenfabrik: Ammunition wagons. [Date applied for under International Convention, February 15th, 1909.] 2302 Lehmann: Airships with aerostats. 2384 Prenzel: Igniting device as a substitute for matches. 2552 Stahl: Manf. of brushes. 2848 Burgess: Stair rods. 2886 Midson: Bottle for holding aerated drinks and other liquids. [Date applied for under International Convention, April 6th, 1909.] 2930, *See*

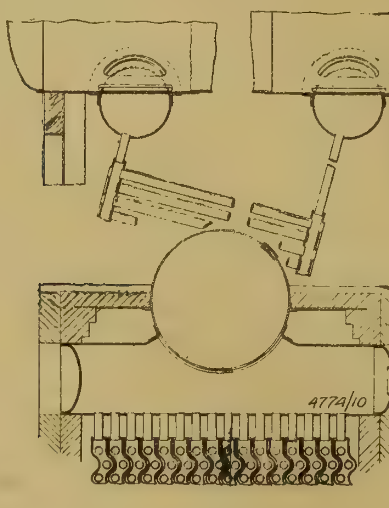
19579, 1909. 2947 Aganoor: Stocking suspenders. 3417. *See* 28818, 1909. 3579 Dussich: Recovery and purification of lubricating oil. [Date applied for under Rule 13, Oct. 11th, 1909.] 3589 Coppersmith: Joints for pipes and other purposes. 3646 Weinland: Turbines. 3759 "Perfect" Akt.-Ges. fur Maschinenbau Basel and Wenk: Kneading machines. 3862 Lake (Comins): Humidifiers. 3909 Clark: Embrocation. 3977 Dicker (Benjamin Electric Manufacturing Co.): Portable holders for electric incandescent lamps. 4023 Thorne: Miners' and like picks. [Cognate Application. 11380, 1910.] 4194 Edgar and Co., and Jay: Loose-leaf binders for ledgers and the like. 4281 Newton (R. Hoe and Co.): Printing machine. 4308 Boydell: Boat fenders and brakes. 4313 Franklin: Toy gas guns. 4332 Siegrist: Device for attaching buttons, hooks and eyes, or other articles on to material. 4433 Erdmann: Method of refilling aerial vehicles during a flight. [Date applied for under International Convention, February 25th, 1909.]

4491 Hurd: Coal-cutting machinery.

The invention has for its object to provide simple and effective means for supporting and for facilitating the handling when in use of coal-cutting machines of the well-known "Hurd" bar type, in which the motor electric, pneumatic or other, is arranged on a vertical axis co-axial with the axis of rotation of the cutter bar carrying gear casing, pneumatic or other, is arranged on a vertical axis co-axial with the axis of rotation of the cutter bar carrying gear and is in a casing more or less cylindrical vertically. A supporting apparatus made according to the invention comprises essentially what may be termed a girdle frame encircling the machine casing and within which it is rotatable through a considerable horizontal arc, a horizontal guide rail upon which the girdle frame is supported at one side and is traversible, an adjustable foot or skid also for supporting the girdle at the other side, and screw, hydraulic, or pneumatic jacks for supporting the horizontal rail with means for applying them at various points in its length.



4543 Davis: Gas washers. [Application for Patent of Addition to 2113, 1909.] 4600 Burgoyne: Attachment to bottle and like necks to facilitate stoppering and pouring. 4649 Pointu: Shuttles for automatic weft-replenishing looms. 4681 Felten and Guilleaume-Lahmeyerwerke Akt.-Ges., and Collischonn: Driving mechanism for petrol electric apparatus. [Request under Section 19 of the Act not granted.]



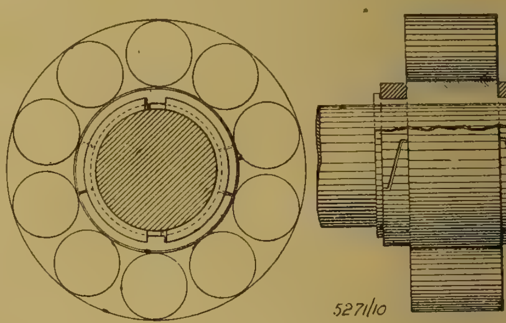
4774 Galloways Ltd., and Pilling: Cross box for connecting the headers of a water-tube boiler with the main steam and water drum.

The invention relates to improvements in the cross boxes which connect the headers of water-tube boilers with the main steam and water drum. In the present invention the cross box consists of a cylindrical drum of circular cross section except where it is cut away to fit the surface of the main top drum, the length of the cross drum being practically at right angles to the main drum. The cross box is made of sufficient diameter to enable the small tubes from the headers to be expanded satisfactorily into position without the necessity of flattening the tube or otherwise departing from the circular form of the cross section. The weakening of the drums caused by the large apertures in former constructions is avoided by the special formation of the apertures in the main drum which retain the strength of the drum at the same value as that of the riveted circular seams. Also the surface of the metal at the aperture of the cross drum is worked, as shown clearly in the drawings, so that the connection between the two drums is made by an angle iron joining surfaces which are at all parts at right angles to each other, thus ensuring satisfactory machine riveting, which was impossible in some previous constructions. The cross drums at each end of the boiler will be similarly constructed, the only difference being in the lengths of the tubes connecting the headers and the drums.

4890 Kros: Coke ovens. 4961 Goehler: Milk separator. 4972 Rodway and Esson: Means for automatically inflating the tyres of vehicle wheels while in motion. 4987 Sielaff: Delivery mechanism and coin action for automatic delivery machines. [Date applied for under Rule 13, August 25th, 1909.] 5002 Eisele: Steam boilers. 5247 Hodsdon: Tea measure and caddie. [Post-dated April 15th, 1910.]

5271 Cooper: Roller or ball bearings for shafts, axles, and the like.

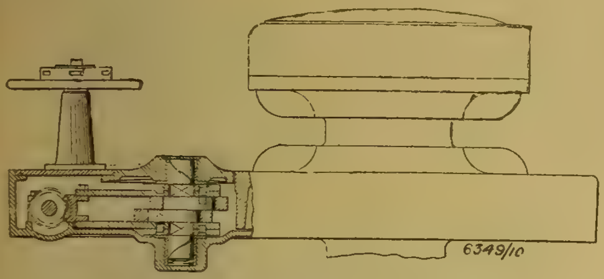
The present invention has reference to hardened divided sleeves or rings for roller bearings. According to the invention the sleeve is made of steel which in the process of manufacture is stratified and made up of two qualities, so that while one side of a bar or plate, heated or dipped in water or other liquid in the usual way becomes very hard, the other side remains unhardened and the sleeve in process of production can be machined in all parts except the roller path after the latter has been hardened. The roller path is finished by grinding. This process supersedes the usual process of case hardening. The two parts of the sleeve are severed from a bar or length of steel of suitable section and are bent into a circular form of the diameter required. The pieces are preferably cut diagonally so as to avoid (when fitted together) the joint lines being directly across the sleeve and to lead the rollers which run in contact therewith smoothly over the joints. For securing the sleeve to the shaft circumferential grooves are provided near the two edges of the sleeve and into these grooves are sprung spring clips. These clips, which lie in the grooves level with or slightly below the periphery of the sleeve, are sprung into position from opposite sides of the shaft and are placed across the dividing line of the sleeve.



5379 Hardingham (Le Feuvre): Piston rods for use in vacuum brake cylinders. 5457 Smart: Fire-iron stand or hearth furniture. 5552 Chadwick: Supports for mosquito curtains. 5597 Hunter: Apparatus for cooling and carbonating beer. 5636 Pollard: Typewriters. 5638 Osman: Cigarette-making appliances. 5984 Fraser, Fraser, and Fraser: Card cylinder for carding engines. 6315. *See* 20880, 1909.

6349 Clarke, Chapman, and Co., and Cookson: Brake mechanism for capstans, windlasses, winches, cable lifters, and other hoisting machinery. [Date applied for under Rule 13, November 19th, 1909.]

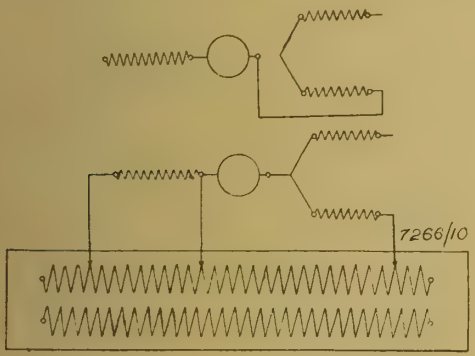
This invention has reference to capstans, windlasses, winches, cable lifters, and other hoisting machinery of the type comprising frictional brake band mechanism actuated by rotary eccentrics. According to this invention the strap or straps of the eccentric or eccentrics that move the ends of the brake band relatively to each other is or are connected to the end or ends of the brake band by a link or links.



6478 Burwell: Ship elevators, cradles, and docks. 6502 Sandmann: Gas producers. 6542 Czerniewski: Apparatus for producing animated pictures by the movement of a vehicle. 6867 Adams Manufacturing Co. (Cutler Hammer Manufacturing Co.): Electric motor controllers. 6917 Carl Zeiss: Optical squares comprising two silvered glass plates. [Date applied for under International Convention, March 22nd, 1909.] 6964 Siemens and Halske Akt.-Ges.: Connections for semi-automatic telephone exchanges. [Date applied for under International Convention, March 20th, 1909.] 7063 Dusseris and Conti: Lanterns and plates therefor. 7164 Dornheim: Devices for use in dusting or cleaning rooms and other places.

7266 Siemens Bros. Dynamo Works, and Lydall (Siemens Schuckertwerke Ges.): Single-phase commutator motors. [Application for Patent of Addition to 2303, 1908.]

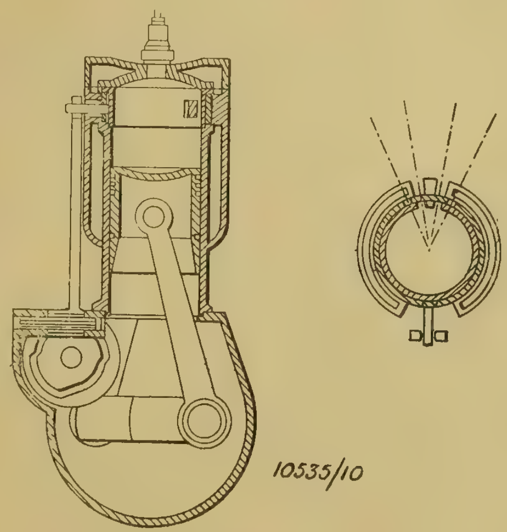
The present invention relates to improvements in single-phase commutator motors which can be operated either from a direct or alternating source of current. According to the present invention the objects which it is desired to bring about are secured in a very simple and efficient manner by making use in a motor of the kind referred to of the alternating voltage transformer which is often employed either for purposes of regulation or for transforming down from a high voltage source of supply.



7286 Crittall: Jointing metal sash bars. 7315 Wagner: Granulation of metals or other substances. [Date applied for under Rule 13, August 23rd, 1909.] 7322 Reineking: Short circuit detectors. 7668 Dr. Boes and Co., and Rode: Kites. 7829 Holzer: Manf. of beer. [Date applied for under International Convention, April 2nd, 1909.] 7993 Janes: Folding beds, cribs, and play pens. 8024 Graham: Telephonic transmitters. 8255 Slater: Bearings of swing rails of loom slays. 8291 Helm: Belt-shifting gear. 8369 Benninghoff and Klonne: Gas retort furnaces and the like. 8411 Siemens-Schuckertwerke Ges.: Electric searchlights. [Date applied for under International Convention, April 8th, 1909. Application for Patent of Addition to 12556, 1908.] 8427 Colas: Means for suspending pictures and the like. 8434 Bajon: Bottles, jars, and like vessels particularly adapted for administering liquid medicines. [Date applied for under International Convention, April 9th, 1909. Application for Patent of Addition to 10289, 1909.] 9155 Pierre: Metallic packing for piston rods and valve rods. [Date applied for under International Convention, April 15th, 1909.] 9290 Teofani: Tin opener. 9460 Morrow and Simmons: Power transmission mechanism for automobiles and the like. 9630 Warren, and Dental Manufacturing Co.: Manf. of dental plates. 9737 Wanderer Werke vorm. Winklhofer and Jaenicke Akt.-Ges.: Ribbon-fork actuating mechanism of typewriting machines. [Date applied for under International Convention, October 7th, 1909. Application for Patent of Addition to 21026, 1909.] 9947 Robertson: Method of putting up for sale and use spun or woven fibres. 10062 Rolfe: Composition for arresting and preventing the decay of tteeth.

10535 Von Devoorde and Wilkens: Valves and valve gear for internal-combustion engines.

This invention relates to explosion engines, and particularly to those for driving motor vehicles, and its object is to reduce the cost of their manufacture and increase their reliability by the simplification of the whole arrangement. The invention consists essentially in the combination with the cylinder of an explosion engine of an annular oscillating valve arranged round the explosion chamber of the cylinder and actuated through the medium of a lever projecting outwards through an aperture in the cylinder wall by a cranked lever or its equivalent which in turn is actuated by a grooved cam, which cam in the case of multiple motor cylinders serves to operate two of the cranked levers and at the same time sets the magneto or the pump in motion.

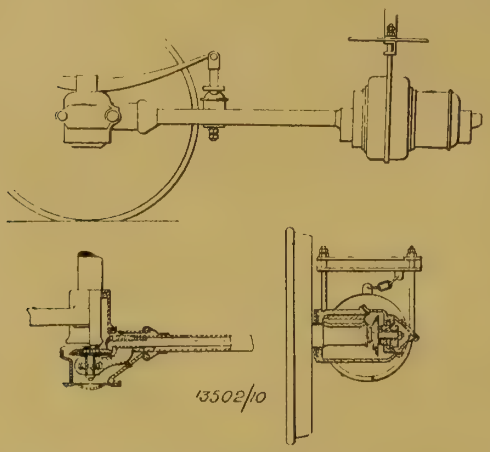


10577 Graham: Telephone systems. 11053 Graf: Sewing devices for surgical operations. [Date applied for under International Convention, April 5th, 1910. Application for Patent of Addition to 11052, 1910.] 11069 Dauker: Measuring apparatus for use in the manf. of boots, shoes, and lasts. [Date applied for under International Convention, May 15th, 1909.] 11180 Boult (Automatic Press Feeder Co.): Feed devices for printing presses. [Date applied for under Rule 13, August 20th, 1909.] 11181 Boult (Automatic Press Feeder Co.): Stop mechanism for printing presses. [Date applied for under Rule 13, August 20th, 1909.] 11253 Amme, Giesecke, and Konegen Akt.-Ges.: Reciprocating feeding gutters. [Date applied for under International Convention, April 15th, 1910. Application for Patent of Addition to 11073, 1910.] 11380. *See* 4023, 1910. 11761 Klein: Electrical warp stop motions for looms for weaving. 11901 Siemens Bros. Dynamo Works (Siemens-Schuckertwerke Ges.): Pneumatic cleaning and apparatus therefor. 11903 Fessenden: Variable electric transformers. [Date applied for under International Convention, May 18th, 1909.] 11988 Ralls: Locks and keys for the same. 11992 Kenyon: Spring top or under motions for looms for weaving. 12107 Kaiserman: Shade rollers. [Date applied for under International Convention, May 18th, 1909.] 12125 Butler and Rockman: Suspension railway crossings. [Date applied for under International Convention, May 17th, 1909.] 12220 Feigenbaum and Iserson: Styles for gramophones. 12301 Heinemann: Glass decanters. 12382 Mansfield and

Mansfield: Wastes for lavatories, baths, and the like. 12659 Bleichert: Cable cranes. 12704 Wood: Workman's time recorders. [Date applied for under Rule 13, August 28th, 1909.] 12706 Wood: Workman's time records. [Date applied for under Rule 13, August 28th, 1909.] 13087 Kindhauser: Corsets. [Date applied for under International Convention, June 29th, 1909.]

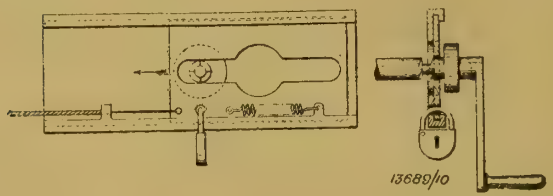
13502 Akt.-Ges. Brown, Boveri, and Cie.: Driving of dynamo electric machinery for train lighting. [Date applied for under International Convention, June 22nd, 1909.]

This invention relates to the driving of train-lighting dynamo electric machinery, and more especially to the driving of dynamos through gearing for train illumination purposes. The invention consists in the provision of an arm directly or indirectly in connection with the dynamo housing, which arm can be swung vertically and horizontally or in other directions desired. The arm may swing, for example, on one hand round the middle axis of the gear or bevel wheel driven by the wheel axle and, on the other hand, with both gear wheels round the middle axis of vertical journals supporting one of the gear wheel bearings.


13502/10

13689 Wardill and Wardill: Starting gear for motor vehicles. [Application for Patent of Addition to 26451, 1909.]

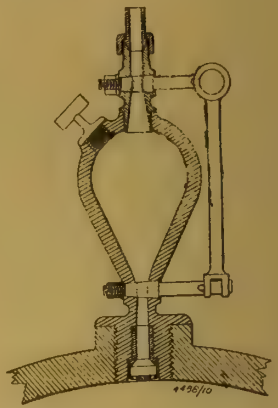
This invention relates to an improvement in or modification of starting gear for motor vehicles, and has for its object to provide simple and effective means for preventing the engine from being started by any unauthorised person. According to the invention an obturator is provided which is adapted to render the operative engagement of the starting handle with the engine shaft impossible except when the change speed lever is in the neutral position, and the obturator is provided in such manner that it may be locked in the position in which it acts to prevent the engagement of the handle with the shaft, and can only be released by the person who is authorised to do so.


13689/10

14315 Allison (Noyes): Magneto generators. 14384 Damon: Disintegrators.

14488 Miller and Bennett: Lubrication of engines.

This invention relates to apparatus of the class in which the internal lubrication of steam and other engines is brought about by blowing the lubricating medium through an atomising member into the cylinders of the engines by a pressure higher than that in the cylinders at the time of the injection, the pressure being either a blast of steam or other suitable fluid under pressure. The invention consists essentially in the provision of a container for the charge of oil, a passage connecting the container with the steam pipe of the boiler or other source of fluid-pressure supply, another passage connecting the container with the engine cylinder, valves controlling the passages, and an atomising member arranged beyond the valve in the passage leading to the cylinder.


4498/10

14857 Podszus: Vapour electric apparatus. [Date applied for under International Convention, October 7th, 1908. Originally included in 22827, 1909.] 14941 Marks (Montague Mailing Machinery Co.): Trays or drawers for holding printing plates for addressing and like machines. [Date applied for under Rule 13, August 31st, 1909.] 15616 Ross: Cartridge holders. [Request under Section 19 of the Act not granted.] 16544 Havens: Rubber heels. 19254 Smith: Inkstands. [Date applied for under International Convention, August 27th, 1909.]

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6649 Roche: Two-cycle internal-combustion engines. 9035 Traher: Book holders. 14934 Frager: Explosion motors. 15745 Ascheri: Detachable treads for pneumatic tyres. 16175 Franz: Life-saving apparatus. 16524 Levy-Stein: Tobacco pipes. 16768 Muchka: Oil separators. 17345 Dennison: Talking machines. 17624 Dunoyer: Instruments for measuring the intensity and variations in the intensity of magnetic fields. 18189 Eichengrun: Process for the production of masses capable of being moulded and pressed. 18238 Carl Zeiss: Instruments for measuring vertical angles with the help of a mirror suspended so as to pendulate. 18866 Mueller: Hydraulic air compressor or pump. 19030 Arsem: Filaments and the like for electric incandescent lamps. 19035 Schambony: Manf. of writing tablets of glass. 19095 A. E. G. Union Elektricitats-Ges.: Manf. of tungsten filaments. 19133 Horton: Carbonised fabrics and method of and apparatus for producing the same. 19136 Bilhartz: Apparatus for cutting internal and external screw threads. 19142 Schwabe: Process for obtaining cellulose from vegetable fibres. 19152 Delmage: Washing machines. 19175 Patschke: Internal-combustion gas turbines. 19177 Keller: Sieve brushes. 19178 Becker: Friction transmission mechanism. 19205 Riemann: Press. 19259 Droste: Trucks adapted for manual propulsion. 19265 Unverricht: Automatic safety devices for railways. 19271 Altrichter: Forge. 19319 Stevens: Buckles and the like. 19341 Kalle and Co. Akt.-Ges.:

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THE
PRACTICAL ENGINEER
AND ENGINEERS' GAZETTE.

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THE OUTPUT OF UNIVERSITY GRADUATES IN ENGINEERING.

WHEN the son of a rich man is entered at Woolwich or Sandhurst for a period of training intended to fit him to become an officer in the British Army, he knows that after satisfactorily passing through the prescribed course, he may rely upon obtaining a commission. In other words, after graduation he will find a post awaiting him. The same is true with the son of a rich man who graduates in a Naval College.

The young man who graduates in medicine and surgery is not so fortunate. When he has finished his course of training and passed his examination, he is entitled to do a doctor's work, but he must first find such work. In the meantime, however, whilst looking for a post or a practice, he is able to go as *locum tenens*, with advantage not only to himself, but in some cases to the patients temporarily placed under his care. For an earnest and capable young man, coming direct from daily contact with eminent practitioners who constitute the teaching staff of not a few of our medical colleges, is not unlikely to make a more accurate diagnosis than a fox-hunting old doctor in the country, or a bridge-loving doctor in the town.

But what of the young man who has graduated in engineering at a University? If, as is too often the case, he became an undergraduate because he accepted as gospel the nonsense he or his father had heard from someone, to the effect that "the function of our new Universities is to train officers for the industrial army," he leaves one of those Universities with the wisdom born of sadness. He is now a graduate in engineering, but so far from finding anyone who will give him a post as an "officer," he will meet with the utmost difficulty in getting work of any kind which appears to him to be suitable for a Bachelor of Science (Engineering) to undertake.

Engineering and the manufacturing arts could not possibly be conducted with any success on the system prevailing in the Army and Navy. A certain "service" paper recently stated quite frankly that it would be sorry to see the commissioned ranks of the Army and Navy open to men of humble birth. Military instinct and capacity are then to count for nothing unless the father of the possessor of them has a well-filled breeches pocket. Does any sane person really imagine that the possession of Dreadnoughts and a huge standing army will provide national security when such a sentiment is not only unblushingly proclaimed in the interested press, but is persistently acted upon by all Governments alike?

Fortunately for us all, our Army and Navy, though ever preparing for war, have seldom to engage in it. But engineers, and all who follow the industrial and peaceful arts, are, paradoxical as it may appear, engaged in constant warfare; and it is a warfare that demands for its successful conduct the putting of the right men in the right place. If a captain of industry is wanted, he must be selected with regard to the contents of his head rather than his pocket. It is the personality of the man himself, not the purse of his father, that matters. The selection of officers of the industrial army on any other principle is possible only at the peril of the industry, and a peril that ends in disaster.

Does this mean, then, that a University graduate is not wanted in engineering? Nothing of the kind. Engineering is a democratic art. It welcomes the ability to do its work from whatever quarter it may come. But it will not take a man who comes from the University when there is a better man available who has had no such advantage, and yet is a better man. The ability that engineering demands is the ability not merely to do its work, but to do it in such a way as no other can. In other words, the best man will win, no matter where or how he got his ability, and regardless as to whether he is of humble or exalted birth.

We are aware that we are proclaiming no mean ideal, and one that is often not realised even in so democratic a calling as engineering. But our Universities, surely, of all places, should be concerned with ideals. They cannot be said to act up to a very exalted ideal when they tempt young men with the prospect of becoming a captain of industry, and then, after having had him in hand for some four years, send him off with the suggestion that he had better go in for some such "soul destroying occupation" as someone has called it) as an Examiner at the Patent Office.

Railway Accidents and Casualties for the Three Months Ending 31st March, 1910.—During the above period the total number of passengers killed was 294, an increase of 49 over the corresponding period of 1909. Those injured were 1,894, being a decrease of 138 as compared with the corresponding period of last year. During the same period there were 113 servants of railway companies reported as having been killed, and 1,183 injured, in addition to those concerned in the accidents included in the above. Of these three were killed and 160 injured while coupling and uncoupling vehicles during shunting, five were injured while riding on vehicles during shunting, one was killed while riding upon buffers during shunting, 67 were injured getting on or off, or falling off, engines, wagons, etc., during shunting, and three were killed and 142 injured during braking, spragging, etc. Twenty were injured attending to ground points, 127 were injured moving vehicles by capstans, etc., 13 were killed and 170 injured by other shunting operations, two were killed and 11 injured by falling off engines whilst travelling on trains, one was killed and 47 injured getting on or off engines, etc., during movement, one was killed and 10 injured coming in contact with overbridges, etc.; 153 were injured attending to machinery, etc., of engines in steam; 18 were killed and 14 injured while working on permanent way sidings, etc.; one was killed whilst attending to gates at a level crossing; 44 were killed and 74 injured walking, etc., on line on duty; 10 were killed and 20 injured by being caught between vehicles; one was killed and nine injured falling or being caught between trains, etc., and platforms, walls, etc.; 14 were killed and 11 injured while walking on the line on way home from or to work; and one was killed and 143 injured from various other causes.

Fire on a New Battleship.—A fire occurred in the coal bunker of the new Dreadnought battleship Neptune after her return from steam trials. The supposition is that great heat from the stokehold caused combustion of the coals stored above it. Smoke issued in dense clouds, and though the bunker was promptly flooded, the fire continued to smoulder for the greater part of two days until the core of the fire had been removed. No damage has apparently been done to the vessel, but steps are to be taken to prevent a recurrence of the mishap by introducing asbestos lining beneath the iron floor of the bunker.

Nine Months' Clyde Shipbuilding.—The Clyde shipyards would have launched a larger new tonnage during September but for the lock-out which existed during the greater part of the month. The new tonnage put into the water amounted to 42,848, against 45,991 in the corresponding month of 1909. The Falmouth cruiser accounts for 5,500 tons, and there was an 8,000 tons steamship for Liverpool and a 7,000 tons steamer for London owners, the other considerable vessels being two of 4,300 tons, one of 4,000, and one 3,100 tons. During the past nine months the aggregate tonnage launched on the Clyde has been 338,531 tons, which compares with 268,449 in the corresponding period of last year, 245,102 in 1908, 458,351 in 1907, and 462,277 tons in 1906, the latter being the largest tonnage produced in the first nine months in the history of the trade. The new contracts placed during September were for the most part comparatively unimportant, but fresh business was hardly to be expected during the lock-out.

Iron and Steel Institute.—At a continuation of the Autumn Session of the Iron and Steel Institute, under the presidency of the Duke of Devonshire, Professor Thomas Turner and Mr. Arthur Hague read a paper on "The influence of silicon on pure cast iron." This was followed by a paper by Mr. H. I. Coe on "Manganese in cast iron and the volume changes during cooling." The paper was of an exhaustive nature, setting forth in detail the results of the author's researches into this subject. Mr. C. A. Edwards (Research Fellow and demonstrator in metallurgy in the Manchester University) read a paper which called forth some discussion on "The theory of hardening carbon steels." Mr. Edwards pointed out that the question even now divides metallurgists into two schools of thought—the so-called "carbonist" and "allotropist." While much is to be said in support of both theories, it would be strange if there were two quite distinct and equally accurate explanations of the same phenomenon. He thought it possible, if the data bearing on the subject were carefully examined in the light of physico-chemical laws, to annex the valuable points from the "carbonist" and "allotropist" theories, not with a view of extinguishing either, but rather of merging the two and sinking the difference which now existed. Mr. Edwards held that the theory known as the "beta" theory, which has been supported by one school both in this country and on the Continent, was proved from theoretical deductions to be untenable. The hardening of carbon steels by quenching suppressed the tendency for the metal to decompose into two bodies, and the suppression, he suggested, was due to the fact that a mechanical pressure was exerted on the metal by the contraction of the outer surface. This pressure and the solution pressure were no doubt the principal factors in the hardening of carbon steels by quenching.

Messrs. Dick, Kerr, and Co.—At the ordinary general meeting of this company held lately at the Cannon Street Hotel, the chairman (Mr. John Kerr), in moving the adoption of the report, said he was sorry to say that the views he expressed at the last meeting and the year before, as to the extreme competition in the electrical trade, proved only too true. Naturally, with a demand none too brisk, prices were likely to rule low, but in many cases figures were quoted by some firms below the cost of production. In times of depression all industrial concerns had to face restricted profits, but there was a point where discretion should cry a halt. Foreign competition also helped to aggravate matters. The year now being dealt with must be equally a disappointment to the shareholders and the directors. The future was brighter, and without the directors holding too optimistic views, they were of the opinion that the work at present on hand and in prospect made the outlook distinctly encouraging. The policy of keeping in reserve a goodly sum in times of prosperity had been fully warranted. The directors felt justified in trenching on the carry forward on this occasion, but it was their earnest hope that it would be the last. After due consideration the board decided to take up the manufacture of steam turbines, and arrangements of a satisfactory character had been concluded to make turbines under the Bergmann patents. It was hoped that this departure would be the means of increasing their business in large alternators, for which they had a good reputation.

PRACTICAL METALLURGY.

By Horace Allen.

(Concluded from page 325.)

The Development of Heat and Temperature in Metallurgical Processes.

In the smelting of iron ores and the heat treatment of iron and steel necessary to give the finished product the required physical properties, not only is it necessary to provide some adequate source of heat supply, but this heat must be, as far as possible, delivered at the requisite temperature.

For instance, iron commences to be reduced from its oxides at a temperature of about 400 deg. Fah., and as the temperature is increased reduction proceeds more rapidly, but any heat applied below 400 deg. is of no practical value; it is therefore evident that economy of the heat supply involves the consideration of the development of the temperature requisite for the chemical or physical operation to be effected.

While some of the chemical changes require both heat supply and a given temperature, the simple heating of metal to its softening, welding, or melting temperature chiefly depends upon the supply of heat of the necessary intensity.

In the Bessemer system of steel manufacture from pig iron, it was found that molten pig iron, direct from the blast furnace or metal mixer could be raised to the required temperature by atmospheric oxidation of some of the metals and metalloids, not only to refine the metal but to deliver the product of nearly pure metallic iron in a sufficiently liquid condition to permit of its being run into ingot moulds or into castings. The expenditure of fuel in this case included the oxidation of iron, silicon, and carbon in the metal, and coal or gas under boilers to drive the blowing engines.

The manufacture of steel by open-hearth methods could not have been effected without the intensifying of the temperature developed by means of the regenerative system invented by Siemens, and applied to hot blast stones and metallurgical furnaces. While any fuel on oxidation develops heat, and in this connection the element oxidised may be carbon, silicon, iron, manganese, sulphur, etc., or hydro-carbon gases, the resulting temperature is controlled by the heat developed and the weight and specific heat of the products of combustion. In iron and steel manufacture, where heat is disengaged through the oxidation of carbon, silicon, etc., the oxygen may be derived either from oxide of iron in the form of ferric oxide or magnetic oxide, or from atmospheric oxygen associated with nitrogen.

In the former instances the temperature resulting from the reaction is not reduced by the presence of an accompanying weight of nitrogen. In the latter case of oxidation by atmospheric air, the conditions are affected by the weight and specific heat of the inert nitrogen in the products.

The quantity of heat developed by the oxidation of any given element is definite and fixed, but the resulting temperature can be increased by raising that of the elements entering into combination. In the burning of coal by atmospheric air, the maximum temperature that can be attained depends upon the application of the minimum weight of air and the temperature of the air supplied, because if the coal were heated it would change its condition and become decomposed into fixed carbon and volatile gases.

By means of heat and partial oxidation, coal can be transformed into a gaseous condition, and then, if this gas is heated, as well as the air for combustion, the resulting temperature can be raised to a sufficiently high degree to fulfil the requirements of almost any metallurgical process.

However, in metallurgical processes, the development of heat and temperature further involves the establishment of the most suitable conditions for the *transference* of this heat and temperature to the object to which it has to be applied, so that for numerous purposes, such as heating metal and heating water in steam boilers, the highest efficiency is obtained from the propagation of a flame which is luminous and capable of heating by radiation, non-luminous flames only being capable of heating by contact.

From Table III. the heat of chemical combination of a number of elements can be obtained, but in the case of coal it must be found by direct experiment in a calorimeter, or else, approximately, by calculation.

Mr. F. Siemens and others* have shown that heating by the products of combustion should be divided into two classes—(1) by radiation and (2) by contact. An increased heating efficiency of flames may be obtained by taking advantage of their power of heating by radiation as well as by contact; this involves their propagation as luminous flames to give heat by radiation in large capacity furnaces, to permit of perfect combustion, and the subsequent heating by contact with the body to be heated when the capacity of the chamber is reduced.

The radiant heat of a flame is due to the presence of incandescent particles—obviously contact with cold material would bring about dissociation and decomposition of the flame—the flame being transparent to radiation, it radiates heat from the interior as well as from the surface. In the case of solid substances radiation takes place from the surface, and if the surface is doubled in area the radiation would be doubled, but with a luminous gas flame the doubling of the surface would increase the radiation by four times. That these qualifications of heating effect have long been known from experience is evidenced by the shape of furnaces fired with coal for puddling and other purposes where the combustion chamber proper is large in capacity, while the products of combustion pass through a narrow neck where heating by contact has been frequently applied to the pig iron, etc., previous to its introduction into the hottest part of the furnace.

---

* Iron and Steel Institute, 1884, &c., and Appendix C. "Gaseous Explosions," British Association, 1910.

Siemens went further, and applied the hot gases after perfect combustion and heating by radiation to heating by contact the brickwork in the regenerative chambers, this conserved heat being later given out to the air and gas used for generating the most intense heat.

To simplify matters with which it is intended to deal with in this connection, fuel will be considered as raw coal, and the oxidising agent atmospheric air, so that we have to consider the best means of obtaining a maximum of heat at a suitable temperature to give the highest efficiency of the fuel.

These conditions require that to obtain the best efficiency (1) the fuel shall be burned with a minimum supply of air, (2) to reduce the weight of the products, and (3) that for heating purposes the flame shall be luminous; also that heat intensity is increased by heating the elements entering into combustion.

The heating power of any coal is usually based upon that which can be obtained by combustion in a calorimeter in the laboratory, and it is common practice to calculate the efficiency of any method of burning it upon this basis. However, it must be borne in mind that, in practice, similar conditions to those applied to the calorimeter cannot be obtained, and therefore it frequently happens that a fuel which gives a high heating value in the laboratory does not give a good result when burned under practical conditions.

The explanation of this is that coal is composed of at least two very different constituents—(1) volatile gases and (2) solid carbon—and these not only require different proportions of oxygen for combustion, but also require the supply in very different proportional rates per unit of time.

Upon the application of heat the coal gives off its volatile hydro-carbon gases comparatively instantaneously, and before any of the solid carbon can commence to combine with the oxygen, and when the carbon commences to burn it is limited in speed of combustion to surface contact.

For these reasons the products of combustion of coal include luminous flames derived from the incomplete burning of the hydro-carbons; carbonic acid and carbonic oxide gases from the oxidation of carbon, and a varying excess of air and nitrogen; so that while coal gas is capable of developing a flame temperature of 3,500 deg. Fah. and carbonic oxide 3,800 deg. Fah. when burned with the proper supply of air, the excess of air and intermittent propagation of flame, with radiation losses also, the above temperatures cannot be maintained without supplementary heating of the air.

In the laboratory a sample of Lancashire coal gave the following results:—

PROXIMATE ANALYSIS.

Percentage composition.

Volatile matter	38·15
Fixed carbon	49·90
Sulphur	2·08
Ash	7·55
Moisture	2·32
	100·00

COMPLETE ANALYSIS.

Percentage composition.

Carbon	76·36
Hydrogen	5·16
Nitrogen	0·98
Oxygen	5·55
Sulphur	2·08
Ash	7·55
Moisture	2·32
	100·00
Coke	65·46

Calculated thermal value, by Dulong's formula—

$$\text{Thermal value} = 14{,}500\,C + 53{,}300\left(H - \frac{O}{8}\right) + 4000\,S$$
$$= 13{,}538 \text{ B.Th.U.}$$

Heated to incandescence, this coal would become decomposed into volatile and fixed proportions, thus (approximately):—

	Fixed.	Weight of Air for Combustion.	Volatile.	Weight of Air for Combustion.
Carbon	·50·98 × 11·6	= 5·91	·2538 × 11·6	= 2·94
Hydrogen	......	......	·05·16 (·0447)* × 34·8	= 1·55
Nitrogen	......	......	·00·98	......
Oxygen	......	......	·05·55	......
Sulphur	·01·00†	......	·01·08 × 4·35	= 0·04
Ash	·01·55	......	......	......
Moisture	......	......	·02·32	......
	·59·53	5·91	·40·47	4·53

Heat value by Dulong's formula, 7392 B.Th.U. fixed
" " " 6105·8 B.Th.U. volatile.

If the fluid and volatile constituent entered into combustion at the same rate, the above figures would not be of much value, as they are derived from an individual example, but as the volatile matters, constituting about one-third of the weight and about half the heating properties, are given off, when the temperature reaches a certain intensity, and before any of the fixed carbon is consumed, requiring for complete combustion air at about the same temperature, the problem is to provide sufficient heated air of the required weight to prevent any loss through incomplete combustion, and this applies to all bituminous coals. Further than this, it must be borne in mind that as the combustion of the fixed carbon can only proceed by exposure of surface to the air, it is evident, and the writer has proved in some coals, by experiment, that the rate of consumption is approximately one-ninth that of the volatiles, that unless a very large excess of air is provided there will be a loss of heat through the volatiles escaping unconsumed. The excess of air provided to prevent smoke and cause the volatiles to give up their heat increases the weight of products of combustion, and thereby reduces the resulting temperature developed. Therefore coals containing a high proportion of volatile hydro-carbons are not economical, and preference is given to hard coals, notwithstanding the heat value as determined in the laboratory, owing to the escape of decomposed volatile matter when burned with air in furnaces.

In a number of experiments made by the writer it was generally found that bituminous coal, when being raised in temperature, as in the addition of a charge into a furnace by the stoker, gave off at a certain stage considerable volumes of smoke which *would not ignite* even when passing through a highly-heated space with excess of air, and that it was only at a later stage that ignitable gases were evolved. This property renders it almost, if not quite, impossible to prevent smoke and loss of heating power whatever excess of air be applied, while to obtain the desired luminous flame for heating by radiation there must only be a limited supply of air.

---

* Not combustible combined with lime.

† After allowing for the oxygen present.

The complete gasification of coal in a producer and the adoption of the regenerative system has done much towards economy and the intensifying of the temperature.

Gas producers for use in connection with metallurgical furnaces do not require to be designed upon the same lines as those which make gas for power purposes, because there is not the same necessity for the gas to be free from dust, tar, and sensible heat, the two latter items indeed forming valuable assets. In fact, the earliest forms of gas producers consisted of chambers, forming part of the furnace, in which the combustion of the coal was divided into two stages. In the first chamber the volatiles were liberated and the carbon oxidised to CO, both passing in a heated condition to the combustion chamber proper, where a further supply of air completed the combustion.

In the gasification of coal by air there is developed an excess of heat over that required to bring about the reaction, and therefore the fire continuously gains in temperature, as do also the escaping gases. One pound of carbon oxidised to CO generates 4,451 B.Th.U. and gives 2·33 lbs. of CO, capable on further oxidation of developing 10,093 B.Th.U.

One pound of carbon completely oxidised by steam generates 4,451 B.Th.U., but the heat absorbed in decomposing the steam equals 10,333 B.Th.U., showing that the chemical reaction would require the provision of 5,882 B.Th.U., but there would be generated a mixture of carbonic oxide and hydrogen, in equal volumes, 2½ lbs. in weight, capable of developing 20,425 B.Th.U.'s. By the employment of a proportion of steam mixed with air, which will generate just sufficient heat to bring about the chemical changes and provide for the losses of heat from radiation from the surface of the producer, pipes, etc., a high efficiency can be obtained, as is shown by the following figures:—

PERCENTAGE COMPOSITION BY VOLUME.

	Air Gas.	Air and Steam Gas.
CO_2	1·6	5·25
CO	32·3	25·25
H_2	4·0	18·50
CH_4	0·8	2·00
N_2	61·3	49·00
	100·0	100·00

Thermal value per cubic foot at 32 deg. Fah., 132·7 B.Th.U. air gas; 171·3 B.Th.U. air and steam gas.

Thermal efficiency of gas per cent, 69·3 air; 80·9 air and steam.

A modern type of metallurgical gas producer is shown in section in fig. 71, as manufactured by Stevensons Ltd., of Preston. It is fitted with their patent fire grate and fuel distributor.

The central mushroom blower, by which the steam jet carries the air into the centre of fire, not only prevents the formation of clinker on the sides of the producer, but causes the steam and air to be so distributed that decomposition of the steam and production of H and CO are completely effected.

The fuel distributor prevents the fuel falling in a deep cone in the centre, and the poking holes provided admit of the proper stirring of the fuel and prevention of caking.

The water bath, in which the producer stands, allows of the removal of ash and clinker without interrupting the continuous action of gas generation.

The double cone of the blower head with the holes interspaced respectively prevents clogging of the passages and the falling of ash into the blower pipe, and a small pipe is fitted for the drawing off of any water which may condense. A cleaning door is also provided for the removal of any dirt which may accumulate.

The steam required for inducing the air amounts to about 0·18 lb. per pound of coal gasified. A producer of 10 ft. diameter with an air pressure of about 4 in. water gauge will gasify 26 lbs. of coal per square foot of area per hour, with 0·2 lb. of steam per pound of coal.

It is preferable to use a number of moderate-sized producers than a few of very large capacity, and, where the site will allow, they should be situated at a lower level than the furnaces to which the gas is to be applied, so that a brickwork flue, of oval section, can be arranged to conduct the gas, as in this system any tar which may condense can be removed by burning, manholes being provided to admit air and allow the products of combustion to escape into the air. Small coal slack of poor quality can be employed with success, which adds to the economy of heat conservation.

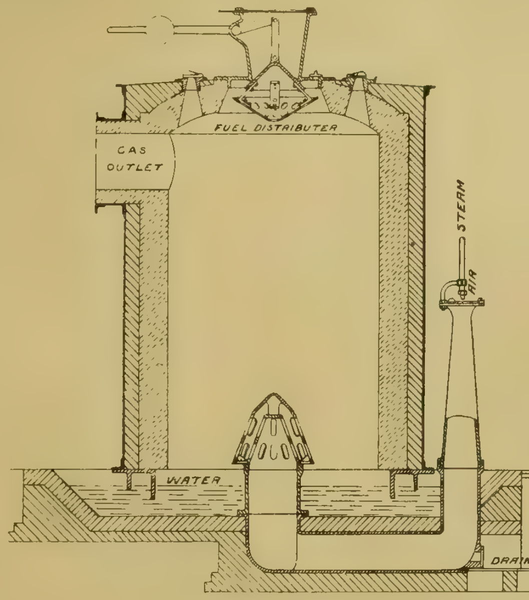


FIG. 71.

A Weardale furnace, 30 ft. long by 2 ft. wide, fired by gas, will heat a bar from cold at the rate of 8 ft. per minute on a consumption of 3 cwt. to 4 cwt. of coal per hour. This is about one-half the weight a coal-fired furnace would require. The same relative economy is obtained in large plate heating furnaces, and double the weight of metal can be heated in the time, while a more even heat under better control can be obtained with gas firing.

THE UNDERGROUND ELECTRIC RAILWAYS.—Sir Edgar Speyer, presiding at the recent meeting of the Underground Electric Railways Co., said he was able to record results which, although not yet satisfactory, were considerably better than were anticipated several years ago. The dividends paid on the share capital of the railway companies did not yet represent anything like a fair and adequate return on the large amount of money invested in those enterprises. The increase in the company's income was due not so much to an expansion of traffic as to a reduction in working expenses, brought about almost entirely by a reduction in the price paid for electric current. As regarded the traffic, they could not in the nature of things expect the same quick growth, and must look forward to a somewhat smaller expansion of earnings than had been the case during the first two or three years after the opening of the railways. The Charing Cross line had to contend with the competition of the County Council tramways, which, together with the reduction of fares on this railway, forced upon them by the very low fares charged by the County Council, had resulted in a decrease in the traffic receipts during the half year. With regard to the rejection of the extension scheme of the Charing Cross line by the House of Lords Committee, the company was asking Parliament in the ensuing session for fresh powers to build this extension on modified plans.

AN IMPROVED ARRANGEMENT FOR PREVENTING BRUSH SPARKING IN ROTARY ELECTRIC FREQUENCY TRANSFORMERS HAVING COMMUTATORS.

The following arrangement relates to improvements in rotary electric frequency transformers of the kind wherein an armature or rotor having a winding similar to that of an ordinary continuous-current dynamo; for example, a chord or diametrically wound drum armature, the said winding being connected on the one hand to a commutator and brushes and on the other hand to slip rings and brushes, is rotated by suitable means in a magnetic field system which usually consists in a plain ring built up of laminated steel plates without a main field winding. The primary supply conductors of a polyphase system are connected to the slip-ring brushes and the secondary conductors to the brushes on the commutator. The magnetising current supplied to the rotor winding from the supply conductors produces in well-understood manner the main exciting field of the transformer, the said field rotating at a fixed speed relatively to the rotor. In a three-phase, two-pole frequency transformer there would be three slip rings and a set of brushes on each ring, and three sets of brushes on the commutator equally spaced around the circumference.

A modified form of such transformers consists in the employment of a stationary "rotor" and rotating brushes in a manner which is well understood by skilled persons, but for the sake of uniformity in the description, the form having a rotating rotor and fixed brushes will be referred to throughout.

In well-understood manner, the frequency of the current delivered from the commutator brushes, the primary frequency remaining fixed, varies with the speed of the rotor (with respect to the stator). When the rotor is stationary, the secondary frequency is the same as the primary frequency, and as its speed is increased in the opposite direction to the direction of rotation of the rotating field, the secondary frequency gets less and less, becoming zero when the rotor speed is equal to the speed of the rotating field with respect to the rotor. This speed will be hereafter referred to as synchronous speed, speeds above it being designated over-synchronous speeds. This definition of over-synchronous speed applies when the current for exciting the main field is supplied to the slip-ring brushes. A more general definition of over-synchronous speed is any speed at which the sum of the frequencies on slip-ring brushes and commutator brushes at any instant is equal to the speed of the rotor multiplied by the number of pairs of main magnetic poles. At under-synchronous speeds the difference of the above frequencies will be equal to the speed of the rotor multiplied by the number of pairs of main magnetic poles.

In a transformer of this kind, when the slip rings are connected to the primary mains, the main exciting field always rotates at a fixed speed (relatively to the rotor and its winding) depending on the supply frequency, and consequently heavy voltages are induced in individual coils of the rotor winding, which give rise to heavy currents in these coils when they are short circuited by the commutator brushes, and there is consequently destructive sparking between brushes and commutator. In order to prevent this sparking, suitable commutation windings excited from the commutator side of the transformer could be arranged on the stator, the currents in said windings in conjunction with the current in the rotor winding producing a resultant magneto-motive force, which causes magnetic fields to pass from the stator to the rotor in the regions of the short-circuited rotor coils of such magnitudes and phases as will neutralise, by reason of the voltages induced in the coils due to the mechanical rotation of the rotor in the magnetic fields, the electromotive force induced in the said coils by the transformer effect of the main field, which effect is in well-understood manner only dependent upon the variation of the magnetic field embraced by the short-circuited rotor coils, the electromotive force produced by it in the short-circuited coils being proportional to the strength of the main field and to its speed of revolution relatively to the commutation poles or to the stator on which the commutation poles are situated. From the above description it will be clear that the transformer effect on the short-circuited rotor coils is not directly dependent upon the speed of the main field relatively to the rotor.

For example, if the speed of rotation of the rotor in an anti-clockwise direction is equal to n, and the speed of rotation or progression of the main field in a clockwise direction relatively to the rotor is N, then the anti-clockwise speed of rotation of the main field with respect to the stator is $n - \mathrm{N}$. Now, in any rotor coil short circuited by the brushes, the transformer voltage (given a constant main field strength) depends only on the speed of the field relatively to the stator and this $n - \mathrm{N}$. The strength of the field required to neutralise this transformer voltage is clearly then proportioned to $\frac{n - \mathrm{N}}{n}$; or, if the value of the main field is F, to $\left(\mathrm{F} - \frac{\mathrm{F\,N}}{n}\right)$. The value $-\frac{\mathrm{F\,N}}{n}$ may be termed the commutation field.

The following table shows the relative value of the main and neutralising fields at various rotor speeds on the assumption that a constant voltage is applied to the slip-ring brushes.

Percentage of synchronous speed.	For main field.	$-\frac{\mathrm{F\,N}}{n}$ or commutation field.	$\left(\mathrm{F} - \frac{\mathrm{F\,N}}{n}\right)$ or neutralising field.
10	1·0	— 10·00	— 9·00
25	1·0	— 4·00	— 3·00
50	1·0	— 2·00	— 1·00
100	1·0	— 1·00	0
150	1·0	— 0·67	+ 0·33
200	1·0	— 0·50	+ 0·50
300	1·0	— 0·33	+ 0·67

From the foregoing remarks it will be clear that the "neutralising field" in the table is the field which actually passes through the commutation pole and which cuts the short-circuited rotor coils owing to the mechanical rotation of the latter. The commutation field $-\frac{\mathrm{F\,N}}{n}$ is really the field which would be produced through the commutation poles due to the magneto-motive force of the commutation windings alone, and not including the magneto-motive force of the rotor winding.

This table shows that when, as has hitherto been the case, the range of speed of the frequency transformer is between zero and synchronous speed, the neutralising field becomes comparatively great, and at low speeds, such as ten per cent or less of synchronous speed, it is difficult or even impossible to get the required neutralising field owing either to want of space to accommodate the commutation windings or to magnetic saturation of the iron.

Now the present invention has reference to arrangements whereby the above-referred-to difficulty can be overcome and sparking prevented over the whole range of secondary frequency of the transformer, namely, from zero frequency upwards.

In putting this invention into practice, a range is taken of rotor speed from synchronous speed to twice synchronous speed or to any higher speed which may be desired. Hitherto the normal speed range of frequency transformers of this kind has been from zero rotor speed, at which secondary frequency is equal to primary frequency, to synchronous rotor speed, the meaning of which has already been defined, and at which the secondary frequency is zero. It will be clear to skilled persons that over a range of rotor speed from synchronous speed to twice synchronous speed the secondary frequency will change from zero to a value equal to the primary frequency, and thus an exactly similar range of secondary frequency is obtained from this range of speed as is obtained over the speed range from zero to synchronous speed. Moreover, from twice synchronous speed to three times synchronous speed the secondary frequency increases from a value equal to the primary frequency to a value equal to twice the primary frequency, and in fact the secondary frequency can be increased indefinitely by still further increasing the rotor speed.

At synchronous speed, for example (see table), the values of the neutralising fields are zero, at twice synchronous speed the values are equal to half the value of the main rotating field in the short-circuited regions, and at three times synchronous speed they are equal to 67 per cent of the main rotating field, and so on.

A particular feature of the invention is the magnetic polarity or direction of action of the neutralising fields. Whereas in cases where the transformer speed range is from zero to synchronous rotor speed, the magnetic polarity of the neutralising fields must be negative or in opposition to the polarity of the main rotating field (see table) in cases where, as in this invention, the speed range is from synchronous rotor speed upwards, the magnetic polarity of the neutralising fields must be positive or in the same direction as the polarity of the main rotating field.

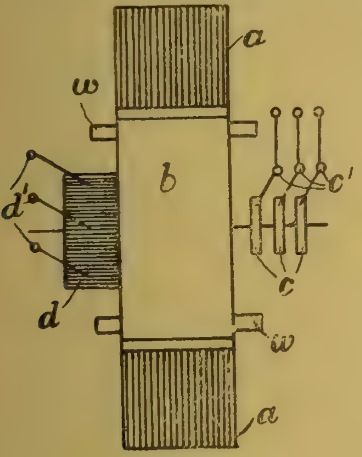


Fig. 1.

This latter feature enables much simpler arrangements to be employed for producing the neutralising fields than would be required to produce negative neutralising fields.

For example, if the correct value of neutralising field is only required at one particular value of the secondary frequency, a plain, short-circuited commutation winding may be employed, designed in such a manner that its damping coefficient has a value just sufficient to damp away the desired proportion of the main field in the region of the short-circuited rotor coils, thus leaving a neutralising field of the desired value. If on the other hand the transformer is required to work over a range of secondary frequencies, commutation windings connected in series with adjustable inductive or non-inductive resistances may be employed, and in order to secure the correct amount of damping at any particular frequency, the amount of resistance in circuit may be adjusted. At speeds near to synchronism, when practically the whole of the main field in the region of the short-circuited rotor coils requires to be damped away, the action of the damping coils could probably not be made so complete as at higher speeds. The commutation windings can, instead of acting as damping coils, be excited from a suitable source of voltage which can, for example, be adjusted according to the value of the frequency by means of a hand-regulated variable voltage ratio transformer, the primary winding of which is connected to the commutator brushes of the transformer.

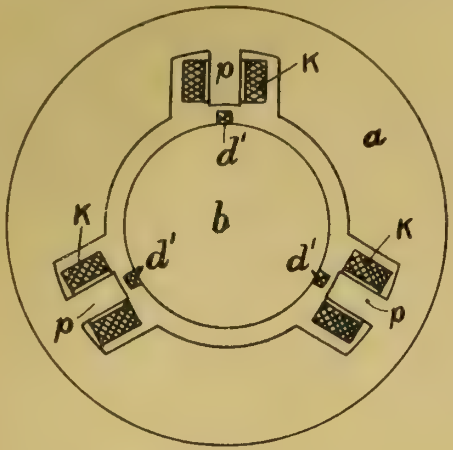


Fig. 2.

Another very simple arrangement can also be employed. Slots or depressions can be cut in the stator iron in the regions of the short-circuited rotor coils in order to introduce a greater reluctance into the path of the lines of magnetic force in these regions. The strength of the main rotary field is thus smaller in these regions, and if the slots are deep enough to decrease the main field to just the correct value for best sparking conditions at the mean rotor speed, the sparking conditions will often be satisfactory at the other speeds. If only one value of secondary frequency is required, the depth of the slot can be adjusted accordingly.

It will be understood by those skilled in the art that in order to compensate the reactance voltages in the short-circuited rotor coils, due to the change of current therein, additional commutation windings may be employed in known manner, these windings being excited in dependence on the current flowing through the commutator brushes of the transformer either directly or indirectly by using series transformers. One commutation winding may be employed to compensate both the main field voltage and the reactance voltage, provided suitable voltages are applied to the said winding.

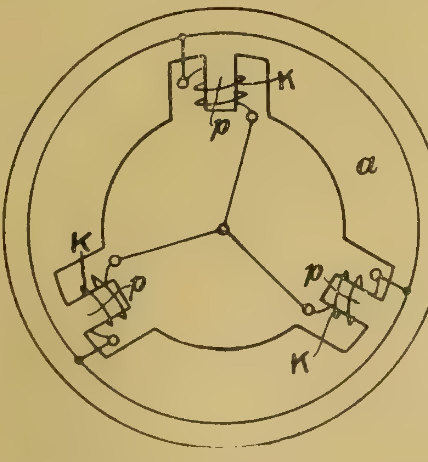


Fig. 3.

The higher speeds at which transformers run, according to this invention, give the special advantages of better air circulation and cooling, and it is therefore possible to reduce the size of the transformer for a given output.

The foregoing description of this invention refers to the conditions when the electrical power is delivered at the slip rings transformed and given out again at the commutator brushes, that is to say, to the conditions when the slip rings are the primary terminals. If the commutator brushes are made the primary terminals, the main field will rotate for any particular primary frequency at a fixed speed with respect to the commutator brushes, and it will be clear to those skilled in the art that if the applied frequency has a constant value, the applied voltage must increase in proportion to the value of the rotor speed above synchronous speed if the main field is to remain constant.

A frequency transformer of the kind referred to may be employed to transfer electrical energy from one electrical system to another, the frequencies of the two systems being different, and one or both frequencies being variable. The advantages already referred to, according to this invention, are obtained independently of the manner of employing the transformer, provided it operates at over-synchronous speeds.

The invention will be more clearly understood by referring to the illustrations, which show diagrammatical views by way of example of three-phase, two-pole frequency transformers of the kind referred to. Fig. 1 is a side elevation, partly in section, of such a frequency transformer, *a* representing the stator, *b* the rotor having a winding *w* which is connected on the one hand to the three slip rings *c* having brushes c^1, and on the other hand to the commutator *d* having brushes d^1. Fig. 2 is an end view of a frequency transformer of the kind shown in fig. 1, *a* being the stator, *b* the rotor, and d^1 the commutator brushes. This stator is fitted with commutaion poles *p* and commutation windings *k*. Fig. 3 is an end view of the kind shown in fig. 2, of the stator *a* of a frequency transformer fitted with commutation poles *p* and short-circuited commutation windings *k* already described as one arrangement according to this invention. These windings are here connected in "star." If desired, adjustable resistance can be introduced into each branch of the "starred" connections.

As already mentioned, the commutation poles and windings can be entirely dispensed with, and slots or depressions in the stator iron may be substituted.

The above device has been brought out by Messrs. Siemens Brothers Dynamo Works Limited, Westminster.

THE FRICTION OF BALL BEARINGS.

(Continued from page 420.)

IN the design adopted by the Rhineland Manufacturing Company, of Dean Street, London, W., shown at fig. 11, the balls are mounted in a containing cage.

Noise is almost entirely eliminated, as the balls cannot any longer fall on each other. Extensive use of this type of bearing has not shown any faults in its design. The bearing runs almost without any friction, requiring very little renewal of lubrication, and takes up little room. If the bearing is correctly fitted and handled, the amount of wear is quite negligible, even after several years' use.

It is advisable, however, to particularly remark that a bearing without cage should not be considered useless.

Where it is impossible for the races to be forced out of parallel, a bearing without cage can be used, and it is preferred, owing to its greater load capacity.

Such trouble will not arise where two ball bearings are fitted at a short distance from each other, as, for instance, in the hubs of motor-car wheels, also in case of very heavy shafts running at a slow speed, or only swinging, as for instance, in the case of crane pillars. Actual practice has confirmed this, and thousands of motor-car wheels are now fitted with cageless ball bearings with entirely satisfactory results.

Light shafting running at high speeds, for instance in gear boxes of motor cars, requires ball bearings with cages, on account of the possibility of the races being forced out of parallel, and also on account of the noise.

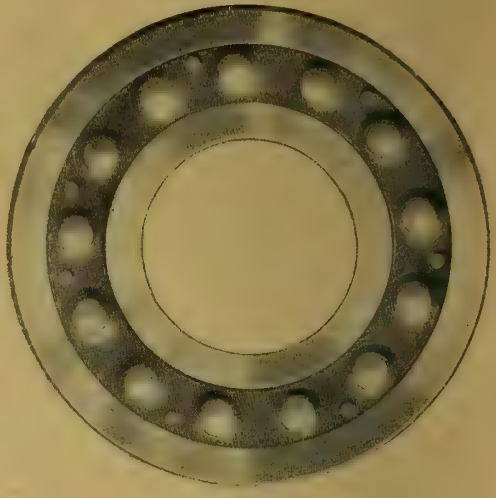


FIG. 11.

Provided the most suitable size of ball is adopted, then the greater the number contained in a bearing the greater its load capacity. The Rhineland Manufacturing Company's method of inserting the balls admits of the maximum number the bearing will contain being fitted.

It is now timely to refer to the fitting of journal bearings. This is very simple. It is only necessary to adhere to certain definite rules, which, however, must be strictly followed if serious trouble is to be obviated.

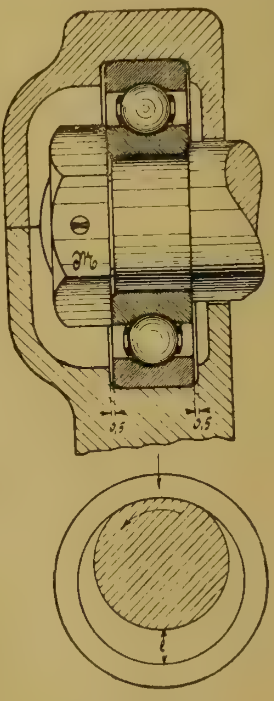


FIG. 12.

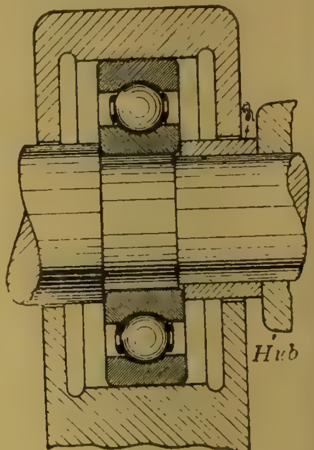


FIG. 13.

A shaft fitted with two ball bearings is shown in figs. 12 and 13. A revolving shaft is represented. It is necessary in the case of such shafts to make the ball bearing a close or driven fit, according to the load, and for these reasons. If the inner ring is a sliding fit on the shaft and a load is applied, the shape of the shaft at the point of load changing results in the inner ring obtaining a clearance on the side opposite to the load (fig. 13). Consequently, when under load, the bore of the inner ring will be larger than the shaft, and the inner ring will creep on the shaft. The movement of the inner ring is in an opposite direction to the movement of the shaft. This again causes further trouble. It can easily cause the inner ring to move with great force in a spiral direction one way or the other, and this is frequently great enough to jamb the balls. Attempts have been made to fix the inner ring by the use of wedges. This, however, has caused it to burst.

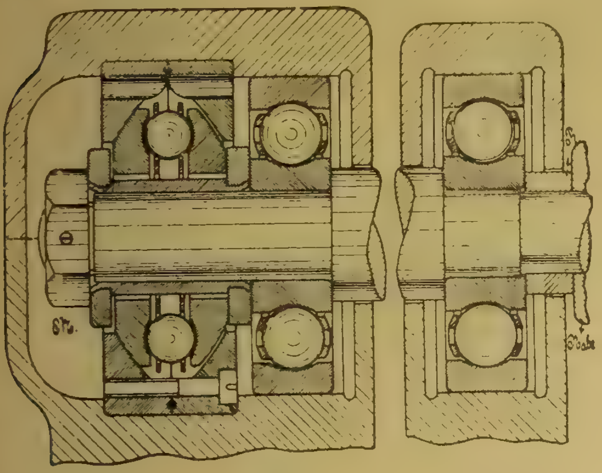
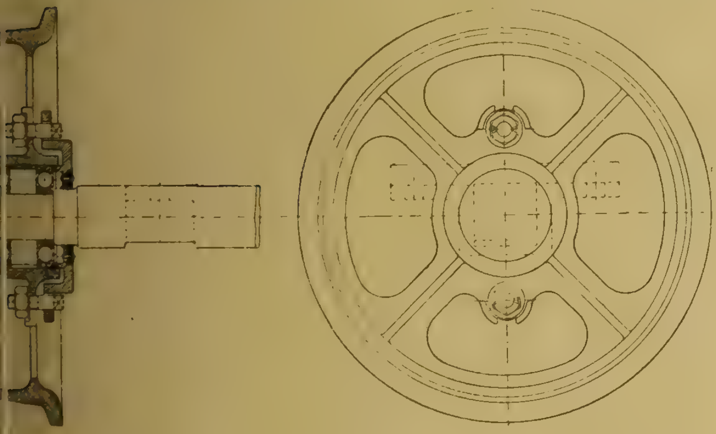


Fig. 14.

There is only one efficient method of preventing these troubles. The development of clearance *e*, shown on fig. 13, must be prevented at the outset. If the shaft has a diameter larger to the extent of *e* than the bore of the inner ring, then this must expand to that extent, so that it may go on to the shaft. In the case of particular heavy duties or jolting, a certain amount of creeping may still take place. The inner ring must first be locked firmly endways. The best method is by means of a nut M at the end of the shaft, or if the inner ring is not at the end of the shaft, then by means of a shoulder or tube, which butts against the hub or something similar. The outer ring cannot follow the inner ring, but in some cases it might move in either direction slowly; this would not cause any trouble, merely a polishing of the outer surface of the ring. The outer ring can, therefore, be a sliding fit in the housing. It is, in fact, advantageous, so that the bearing is free to adjust itself to the expansion or contraction of the shaft, arising from changes of temperature, and also to displacement owing to inaccuracy of workmanship. The outer ring can then locate itself favourably to the inner ring.



Figs. 15 and 16.

For these reasons, where several ball bearings are fitted on one shaft, as in fig. 12, only the outer ring of the one bearing should be locked. The other must have sufficient play both ways to prevent the bearings becoming jammed. If the shaft has, as in fig. 14, to stand considerable end thrust either from one or both directions (in fig. 14 a bearing is shown designed to take thrust from both directions), then this must only be taken by the thrust bearing. The outer rings of both journal bearings must then be allowed play both ways.

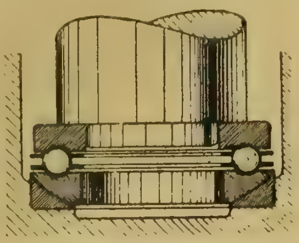


Fig. 17.

It is clear that the inner ring cannot creep along the shaft if this is stationary. If, for instance, the ball bearings are fitted in the hubs of pit tubs, as in figs. 15 and 16, then the inner rings can be a sliding fit on the shaft. On the other hand, it is advantageous for the outer ring to be a good press fit, and to be locked endways, otherwise it will creep in the hub.

Figs. 17 and 18 show a thrust bearing, consisting of two rings, between which balls are fitted. If the two races are not perfectly concentric to each other, as can easily happen, the balls might be driven into each other as explained, which frequently happens with journal bearings. Hence a containing cage for the balls is also necessary here. The stationary ring, fig. 18, is ground to a spherical form. Otherwise it is quite impossible for all the balls to bear the load evenly. The balls and rings being hardened and accurately ground, the result of the races being out of parallel, even by a few hundredths of a millimetre, would be that one ball alone would bear the load.

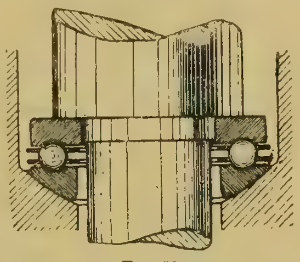


Fig. 18.

The spherical shape of the stationary ring would be a hindrance to the engineer in many cases, as he would need to form large castings correspondingly. A stationary ring is therefore fitted in an added special seating, fig. 17.

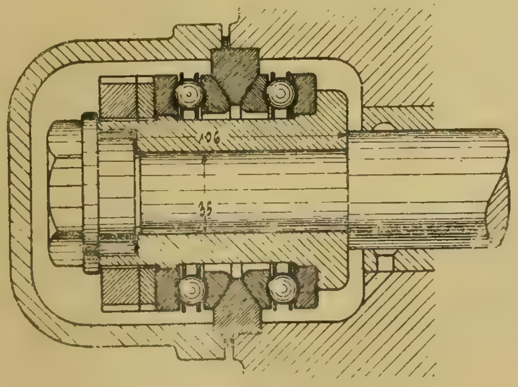


Fig. 19

Fig. 19 shows two thrust bearings fitted together in a simple manner, forming a double bearing. Up till about three years ago this was standard practice for double bearings. It is very complicated and takes up a great deal of room. Nevertheless, that system was used for worm gears, and generally where there was end thrust alternating in each direction. A very much simpler double-thrust bearing has been designed, with only one row of balls, as shown in fig. 20. A clearance of about 0·1 mm. in an upright direction is left between the end discs A_1 and A_2, and the races R_1 and R_2, also between the races and the outer rings U_1 and U_2.

These clearances can, if required, be reduced to hundredths of a millimetre. If, now, for instance, end thrust comes on in the direction of the arrow, then the ring A_1 butts against ring R_1, and sets it in motion. The ring R_2 butts against U_2, and remains stationary. A_2 will not grind against U_2, because of the clearance of 0·1 mm. developed at this point; in a similar manner R_1 will not grind against U_1 on account of this clearance. As, further, R_1 and R_2 have spherically-formed seatings, the thrust is taken up evenly by all the balls. Owing to its spherically-formed seating, the ring R_2 centres itself, the balls are centred by it, and these again centre the ring R_1. The spherical surfaces of both races further cause the whole bearing to centre itself with the variation of direction of end thrust, and in consequence of the rotary motion, all the faster and the more surely. This bearing has given complete satisfaction in practice, and has met with general approval.

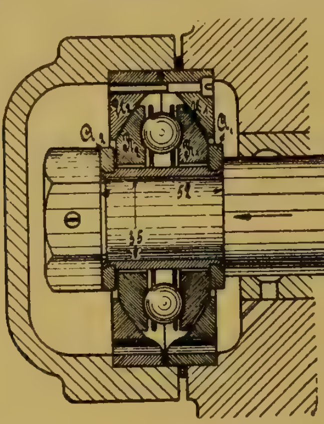


Fig. 20.

By a comparison of figs. 19 and 20, the saving of room and simplification is apparent, and the bearing, fig. 20, will stand a heavier load than that shown in fig. 19.

Of the greatest importance is accurate workmanship in the manufacture of ball bearings. In addition to the use of the most suitable material and to proper hardening, the balls and races have, after hardening, to be ground to the correct designs. The races, the bore, and the outer diameters of the rings must be correct within fractions of one hundredth of a millimetre. The accuracy and evenness of the balls is still more important. A ball bearing, when running, will cause greater noise the greater the inaccuracy.

By means of special grinding machinery used by the Rhineland Manufacturing Company, balls can be produced to an accuracy of 0·001 mm. Only in this way and under a system of most thorough supervision in the course of manufacture, added to practical experience, is it possible to produce ball bearings in full accordance with the theories dealt with.

(*To be continued.*)

Messrs. Alex. Stephen and Sons, shipbuilders, Linthouse, are laying down an experimental tank, which will be larger than that which they have at present, and will be equipped with all the necessary appliances for carrying out experiments with ships' models.

BOILER EXPLOSIONS.

Abstracts from Recent Board of Trade Reports.

Explosion from a Kier.

Report of Preliminary Inquiry No. 1,942.—The explosion took place at about 9-30 a.m. on the 24th January, 1910, on the premises of the owners of the kier, Messrs. John Lean and Son, Glasgow. The kier was a cylindrical vessel, 5 ft. 11 in. diameter, by 6 ft. 4 in. in length, and was supported, with its axis vertical, by means of columns and brackets riveted to the sides. The sides were made of one ring of steel plate $^7/_{16}$ in. thick, with a single-riveted butt joint having one strap outside. The ends were of ½ in. steel, dished, the bottom being attached to the shell by an inside flange, and the top by means of an outside flange riveted to an angle bar on the shell. There was a cast-iron circular mouthpiece, 7 in. deep, riveted to the top, the opening in which was 36 in. in diameter, and the cover for this aperture was also of cast iron, flat in shape, with four external ribs. The cover was secured steam-tight by means of nine hinged bolts ¾ in. diameter, the jointing material being wholly within the bolt circle. The cover was attached to the mouthpiece by a hinged joint, the holes for the pin being oval, so that there was no pressure on the pin when the cover was screwed down steam-tight. Resting on the bottom of the kier was a central cage, 14 in. deep, which supported a pipe that extended to nearly the top of the vessel. A grating, formed of perforated cast-iron plates, was also partly supported by the central cage, an angle bar riveted to the shell constituting the other support. A 4 in. drain pipe was led from the centre of the bottom, and steam was admitted through a 2 in. pipe, the end of which was opposite the bore of the central pipe and a few inches below it. The steam and vapour formed within the kier was free to escape through a wrought-iron pipe of 1¼ in. bore, which had no cock or valve, and was led into a chimney or "shaft" fitted through the roof for the express purpose of carrying exhaust steam and vapour from the building. The total length of the small pipe between the kier and the exhaust steam shaft was about 72 ft. A dished plate, with its edge turned downwards, was bolted to the cover opposite the upright pipe, and caused the water, as it was "vomited" from the pipe, to spread over the fabrics within the vessel. The explosion was not a violent one, and expended its force in an upward direction. The cover appears to have given way first diametrically, and the halves swinging round the outer edges broke in pieces, the slots for the bolts forming starting places for cracks. Pieces of the cover were found inside the building, about 50 ft. away, and two pieces had been projected through the roof and were found lying, one in the gutter almost directly over the kier, and the other fully 50 ft. distant. The fabrics contained in the kier were expelled with some force, and smashed the glass in the roof 23 ft. above the cover. The explosion was due to the form of the cover being defective, and the metal too thin for the stresses it had to bear. No person was injured by the explosion.

Explosion from a Cast-iron Steam Pipe.

Report of Preliminary Inquiry No. 1,943.—The pipe was made of cast iron, and was 18 in. internal diameter at one end and 16 in. at the other, and nominally ⅞ in. thick. It had a flange at one end 23¼ in. diameter by 1⅜ in. thick stiffened by eight ribs at the back; the other end was plain and entered a stuffing box, forming an expansion piece for the range; two lugs were cast on to take the guard bolts of the expansion joint. The actual thickness of the metal varied from ¾ in. to $1^1/_{16}$ in. About eighteen months ago the flange joint was re-made, and in February last the stuffing box was re-packed. The pipe fractured both longitudinally and circumferentially, and practically the whole of it between the flange and the gland of the stuffing box, a length of about 4 ft. 9 in., was blown clean away. The explosion was due to a crack which started at one of the flange bolt holes and gradually extended along the pipe until the strength of the pipe was so reduced that it was no longer able to withstand the working pressure, which at the time would be about 94 lbs. per square inch. No persons were killed or injured.

Explosion from a Boiler on Board the Fishing Vessel Sarah.

Report of Preliminary Inquiry No. 1,944.—The boiler was made of steel, and was of the ordinary vertical type. It was about 5 ft. high, and 2 ft. 4 in. internal diameter. The shell was formed of one plate $^{5}/_{16}$ in. thick, the longitudinal seam being single riveted and lap jointed. The shell and firebox crowns were formed in each case of a single plate, the former being $^{7}/_{16}$ in. thick and dished, and the latter $^{5}/_{16}$ in. thick, but flat. The firebox was $^{5}/_{16}$ in. thick, and was flanged on its lower edge to form a connection to the shell. The uptake was 8 in. diameter and $^{7}/_{16}$ in. thick; it was of steel, being welded longitudinally and flanged to form an attachment to the firebox crown. The boiler was provided with the usual mountings, including a pressure gauge graduated up to 120 lbs. per square inch, and a spring-loaded safety valve, 1¼ in. in diameter, adjusted to blow off at a pressure of 80 lbs. per square inch by the above-named pressure gauge. There was also a hand hole measuring 6½ in. by 5 in. and two sight holes 3¾ in. by 2¾ in., one situated opposite the firebox water tube, the other at the bottom of the shell. A hole about 2¼ in. by 2 in. was formed in the uptake, just above the working level of the water. Through the opening so formed steam and water escaped, putting out the fire. The explosion was caused by local corrosion of the uptake, in consequence of which it became unable to withstand any useful pressure. The corrosion was on the waterside at about the usual working level of the water; it extended round the uptake in the form of a band, 7 in. wide, the plate being reduced from its original thickness to less than paper thickness at the centre of the band. The master of the vessel was slightly scalded on the right wrist.

Explosion of a Boiler or Steam Chest at an India-rubber Works.

Report of Formal Investigation No. 1,945.—The explosion occurred at about 10-3 a.m., on Saturday, the 30th October, 1909, at the works of the owners, Messrs. G. W. Laughton and Co. Ltd., indiarubber manufacturers, Clayton, near Manchester. The steam chest was a hollow rectangular iron casting, resembling a flat table top. The external dimensions were 74½ in. long by 22⅛ in. broad, by 3¼ in. deep, having a flange on each side for the full length extending about 2½ in. beyond the body of the casting; thus the flat table portion was 74½ in. long by 27⅛ in. broad. Besides the outside edges, the top and the bottom of the chest were tied together by rectangular stays 3½ in. by ¾ in., forming part of the casting; these were in three rows, spaced about 12 in. apart zig-zag. The chest was of close-grained hard cast iron. In a small local portion, near to one of the core chaplets, slight blow holes appeared, otherwise the metal was of fairly uniform thickness, having a minimum of $^{15}/_{32}$ in. and a maximum of $^{9}/_{16}$ in. in the body, and ⅝ in. average thickness at the flanges. Along the edge of the body, at each side, were placed six holes for removing the core. These holes were filled up with screwed plugs, with the exception of one which served as an inlet and another as the outlet for the heating steam. Steam for heating the chest was supplied through a pipe ½ in. internal diameter, fitted with a small globular ¼ in. steam regulating valve; this pipe led from a larger pipe ¾ in. internal diameter which was also fitted with a globular form of steam stop valve, thence it was connected with a 2 in. main steam pipe, leading direct to a Lancashire boiler, capable of working up to a pressure of 130 lbs. per square inch, but at the time of the accident the pressure is stated to have been 95 lbs. per square inch. The outlet from the chest consisted of a reducing bend and pipe ¾ in. internal diameter fitted with a stop valve, after which the pipe led through a wall, then down, then below the level of a roadway to an open drain pipe; the length of the waste steam pipe in all was about 25 ft. The purpose of the valve on the waste steam pipe was to regulate the out-flow of steam, and if necessary to isolate the steam chest from an adjacent steam press, the exhaust from which also led into the same waste steam pipe The explosion was a violent one. The top of the steam chest, for about one-third of its area, burst, and destroyed the tressel upon which it stood. Fragments of the top of the steam chest were hurled through the roof of the building and fell again within it. The fractured top of the steam chest was broken up into about seven pieces. The explosion was caused by excessive steam pressure owing to the exhaust valve having been wholly or so much closed that the steam chest could not withstand the boiler pressure. One person was injured, but has since recovered.

Explosion from a Main Steam Pipe on Board the Steamship Highland Chief.

Report of Preliminary Inquiry No. 1,946.—The explosion occurred about 7 p.m. on the 14th March last, whilst the vessel was lying at anchor off Gravesend. The vessel is owned by the Nelson Line Limited, London, E.C. The pipe, which was 5½ in. in internal diameter and about 8 ft. 6 in. in length, was made from one copper sheet, with a brazed seam, and varied in thickness from ·225 in. to ·097 in. The pipe, without previous warning, failed suddenly at the forward end in the brazing of the seam for a length of about 3 ft. 6 in., completely rupturing round the forward flange and opening out to 15½ in. at the widest part, thus allowing the steam from the three boilers to escape into the stokehold. The pipe was also considerably distorted by the force of the escaping steam and water. The explosion was due partly to defective brazing, and partly to the lap of the seam at the point of initial failure having been so reduced by corrosion that the pipe was unable to withstand the pressure of steam and the stresses to which it was subjected. Two persons were slightly injured.

Explosion from a Water-tube Boiler.

Report of Preliminary Inquiry No. 1,947.—The boiler was of the water-tube type. The tubes are arranged in two sections, one above the other, the upper being the economiser, and the lower the generating section. The economiser section contains 48 tubes; 46 of these are 18 ft. long, one is 18 ft. 6 in. long, and one is 20 ft. 6 in long. The generating section contains 96 tubes; 80 of these are 18 ft. long, eight are 18 ft. 6 in. long, and eight are 20 ft. 6 in. long. The whole of the tubes in both sections are of mild steel, lap-welded, 4 in. in external diameter, and No. 10 S.W.G. in thickness. They are expanded at each end into malleable cast-iron boxes, and those in the generating section are arranged in eight elements, the two adjacent vertical rows forming one element, containing twelve tubes. A cylindrical steam and water drum, 20 ft. in length and 4 ft. 6 in. in diameter, is fitted above the tubes. To this the economiser section and each element of the generating section is connected, at the back end, by vertical steel tubes, 4 in. in external diameter. A steam superheater is also fitted containing 40 solid-drawn steel tubes, 1 in. in external diameter, bent into U shape, and expanded at the ends into steel boxes.

It is connected to a steam drum, about 20 ft. in length and 14 in. in external diameter, placed alongside the steam and water drum, and on which the stop valve is fitted. An arrangement is fitted for flooding the superheater while raising steam. The usual mountings are fitted to the boiler, including two sets of spring loaded safety valves, of Ramsbottom type, adjusted to blow at 150 lbs. per square inch. One tube was renewed in March last, and the boiler afterwards tested on the 17th of that month by water pressure to 250 lbs. per square inch. The bottom tube, in the second row from the left of the generating section, ruptured for a length of about 9 in. on the lower side directly above the fire. The sides of the fracture opened out 5 in. apart, the centre of the opening being about 2 ft. 3 in. from the front end of the tube. The explosion was very violent, forcing open the fire door and blowing some of the hot fuel out of the furnace. The steam pressure at the time was about 120 lbs. per square inch. Owing to an accumulation of scale on the water side, the tube became so weakened by overheating that it was unable to withstand the ordinary working pressure. A coal trimmer was burnt on the arm by the hot fuel blown out of the fire.

Explosions from Water-tube Boilers at a Corporation Electricity Works.

Report of Preliminary Inquiry No. 1,949.—The boilers are of the water-tube type, and each contains 96 mild steel tubes, the bottom row being solid drawn and the remainder lap-welded, each 16 ft. long, 4 in. in diameter, and ·144 in. in thickness. The tubes are connected by being expanded into staggered mild steel headers, there being twelve headers at each end, with eight tubes in each. Each header is connected with the steam and water drums by a steel tube 4 in. in diameter. There are two cylindrical steam and water drums to each boiler, each 3 ft. in diameter by 21 ft. 9 in. long, and made of steel plates. The end plates are dished and flanged, and a manhole is provided at each back end. A cylindrical mud drum, 7 ft. 3 in. long by 12 in. in diameter, is connected by suitable nipples to the lower end of each of the back headers, and a blow-off pipe and valve are attached. A steam receiver is fitted to each boiler. It is 1 ft. 8 in. in diameter by 6 ft. in length, and is connected to each steam and water drum by steel neck pieces. In each case a small hole had been formed in the tube, through which the hot water escaped. At the last explosion, on 8th June, 1910, a hole $\frac{3}{8}$ in. in diameter was formed in the tube, through which the hot water escaped and the fires were put out. The explosions appear to have been due to internal wastage of the tubes, caused by the corrosive action of the feed water. No person was injured.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 29th September, 1910.

ABERDEEN.—*Second class :* F. M. Fothergill.

BRISTOL.—*Second class :* T. E. Jones, H. H. Slade, J. J. Truscott.

GREENOCK.—*First class :* R. W. Bavid, T. S. Mackay. *Second class :* R. Black, J. A. McCrea, J. Porteons, D. McL. Robertson, A. M. Stewart.

HULL.—*First class :* P. B. Hodgson, H. T. Rowlands. *Second class :* J. L. Davies, J. G. Freeman, W. H. Harvey.

LIVERPOOL.—*First class :* E. T. Davies, J. C. Bagshaw, T. K. Atkinson. *Second class :* P. Caldwell, W. C. Dongan, J. K. Galloway, H. N. Jacks, M. L. Price.

LONDON.—*First class :* W. T. Hargrave. *Second class :* R. W. Billett, H. W. Drewry, H. Welch.

NORTH SHIELDS.—*First class :* J. D. Hume. *Second class :* W. J. Brown, H. Campbell.

SUNDERLAND.—*First class :* W. Jeffrey, H. S. Law, A. Snowdon, F. Tunstall. *Second class :* C. S. Smith.

A MERCURY VAPOUR CONVERTER.

THE mercury vapour converter described below is made by the Westinghouse Copper Hewitt Company Ltd., of Great Saffron Hill, London, E.C. It is a static apparatus essentially composed of a glass bulb containing mercury vapour, mounted on a panel on which is also fixed the apparatus necessary for starting and running. The transformation of alternating current into direct current takes place in the bulb immediately it is put into circuit. The results from mercury vapour converters are claimed to be much superior to those from rotary groups; the direct current is obtained at an efficiency of 80 per cent in types of 110 volts output; this efficiency is practically constant from quarter to full load.

The operation of the Westinghouse Cooper Hewitt Converter is based on the fact that the current can only pass through a vacuum chamber containing mercury vapour, in one sense, that is from the electrode serving as an anode to the electrode serving as a cathode, resembling in this respect a non-return valve.

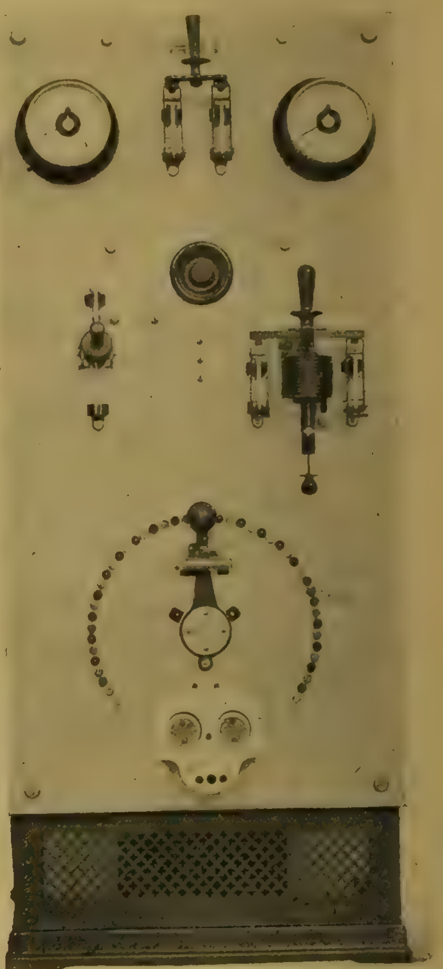


FIG. 1.

A converter of a normal type, as shown in front view in fig. 1, and diagrammatically in fig. 2, consists, firstly, of an auto-transformer, the primary of which is connected to the alternating source. On the second winding the neutral point is taken, and this constitutes the negative pole of distribution. This point divides the secondary into two equal parts, of which the outlets are connected to the anodes of the bulb. Each half of the secondary coil will in turn, according to the alternations, supply the current to the anode to which it is connected. An inductance coil is generally connected in series with the bulb cathode which smooths down and makes the current curve almost straight. (Fig. 3, comparative curves *c* and *d*.) The transformer serves further to increase or decrease the alternating voltage so as to obtain the direct current voltage required. Thus if Va is the single-phase alternating voltage between the anodes, and Vc the direct voltage, there exists between the two factors in the equation:—

$$Va = (Vc + 15)\ 2{\cdot}35.$$

The figure 15 representing the voltage loss in the bulb.

Secondly, of a glass bulb containing a small quantity of mercury, this bulb being exhausted to a high state of vacuum. The bulb is provided with two positive electrodes and a negative electrode in mercury. A supplementary mercury electrode is provided for the purpose of starting the apparatus in operation. The current is conducted to the electrodes by means of platinum wires sealed into the glass. The current enters alternately by one or other anode fig. 3, curve *b*), but always leaves by the cathode (curve *c*) which constitutes the positive pole of distribution. The upper part of the bulb forms a chamber in which the mercury vapour condenses and falls down in globules to the cathode.

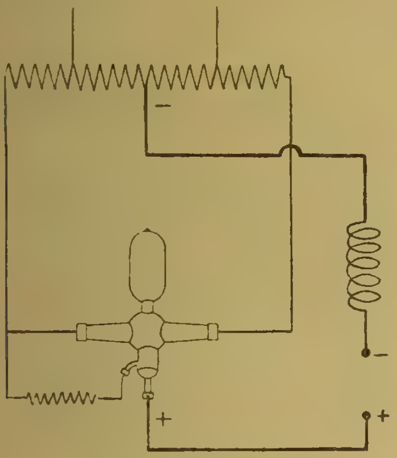


Fig. 2.

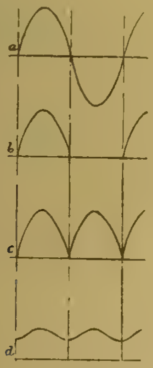


Fig. 3.

Thirdly, of various accessories mounted on a panel supported in a manner suitable for placing on a floor or table.

The auxiliary electrode referred to above is connected to one of the anodes through a resistance. In order to start the converter, the direct-current circuit must be closed; it is then only necessary to tilt the bulb slightly by means of the starting handle, the mercury making a momentary contact between the cathode and the auxiliary electrode; the arc created on the breaking of this circuit vaporises sufficient mercury to make the atmosphere of the bulb conductive between anode and cathode. No current passes through the auxiliary circuit when the bulb is in its normal position. The bulb being in the operating circuit it is essential that it should always be delivering current if it is to remain alight. If the demand is an intermittent one, as, for example, in a Ruhmkorff coil, a shunt of necessary value must be connected in circuit.

The essential part of the Cooper Hewitt Converter, namely, the bulb, is fixed on a support at the back of the marble panel; the starting resistance, the starting shunt, and the various connections are similarly placed; all are protected by a cover. On the face of the panel are switches or plugs, fuses, instruments, or other apparatus. The panel is mounted on an iron support which also carries the transformer and induction coil. The small types do not usually have measuring instruments; if these are required they are fitted on an extension panel. In the case of the larger models, if the measuring instruments and the regulating apparatus are required, these are mounted directly on the main panel. The following types are standardised—output, amperes, 3-5, 4-10, 6-20, 7-30, single phase; 8-30, three phase.

In order to obtain a higher capacity than 30 amperes, two or more bulbs can be connected in parallel. Special supports are constructed for this method of mounting. The complete load is equal to the total of the loads of each bulk taken separately.

The principal applications of the mercury vapour converter are—Charging accumulators from alternating current circuits, high and low voltage, principally electromobile batteries, telephone and telegraph batteries, and ignition batteries for internal-combustion engines; running electro-medical apparatus, small motors for dentists, Rontgen apparatus, and thermo-cauteries; operating electro-magnetic control apparatus for motors or lifts; electrolysis and electrical apparatus in laboratories situated on alternating-current circuits; operation of direct-current arcs in series; operation of projection arcs (cinematograph, etc.), the effect of which is generally very unsatisfactory when running on alternating current; and lastly, in general, in all cases where apparatus on alternating current gives a bad result, also where a silent apparatus is required having none of the objections of the electrolytic rectifier.

The bulb is the only part of the converter that undergoes any depreciation and which has to be replaced. Experience shows that life under normal conditions of working is at least 600 hours. The company will guarantee the converter bulbs, if desired, for the following minimum periods—9 months for a daily usage of 4 hours, four months for a daily usage of ten hours, and two months for a daily usage of 24 hours.

AN IMPROVED BAND-SAWING APPARATUS.

The improvements about to be described are for use in connection with band-sawing machinery and the arrangements employed for working band saws, more particularly those for use in cutting stone and the like material, and in which diamonds are employed, the application of the improvements, however, not being limited to any particular arrangement of diamonds or construction of such saws, seeing that the advantages connected with such improvements can be obtained for all band saws employed for cutting stone, marble, granite or the like hard material.

In the band saws that are at present employed for cutting stone, marble, granite or the like, in a vertical direction, it has been found necessary to arrange them so that the saws pass around pulleys of a diameter sufficient to admit of the curvature placed upon the saw being one that will not cause deformation, but in so using these large pulleys a great waste of space results from the fact that the inner halves of the pulleys project into space which might otherwise be occupied by the stone to be cut, and thus limit the available area upon which the travelling blade or blades can operate.

The improved apparatus, which is shown in side and front elevation and in plan in figs. 1, 2, and 3, is the invention of Messrs. George Anderson and Co. Ltd., engineers, of Carnoustie, Scotland, in conjunction with Mr. A. G. Grice. On any usual form of foundation, not shown in the drawings, are provided mounted guides or pillars *a* connected at the top by bars or girders *b*, the whole forming the primary framework which is to support the various parts of the band sawing mechanism. The pillars or guides *a* are adapted to receive slides *c*, to which are attached nuts engaging with threaded spindles *d*. Secured to or formed integral with the slides *c* at each end of the framework is a bracket *e* adapted to carry guide pulleys *f*, which are slidably mounted upon the shafts *g*, the shafts *g* being provided with keyways or grooves in which keys or feathers on the pulleys *f* are adapted to slide so that rotary motion from the shafts will be transmitted to the pulleys, which are at the same time capable of sliding along the shafts. Between the pulleys *f* at each end of the machine a series of smaller pulleys or rollers *h* may be mounted, the pulleys or rollers being preferably mounted in ball or other anti-friction bearings in the brackets *e*, although, if desired, the rollers or pulleys may take the form of sleeves rotatably mounted upon spindles fixed to the brackets *e*. If such intermediate rollers or pulleys are used they are mounted in a path such that when the band saw *i* passes from the segmental portion of the circumference of one pulley *f* at the entering side it will bear upon and be carried by the series of intermediate rollers or pulleys *h* which guide it to the companion main pulley at the return side of the band, so that the band *i*, instead of being carried round a pulley of large diameter, is carried upon a segmental surface of two pulleys placed side by side, and a number of other pulleys or rollers arranged between. By this arrangement of pulleys the deformation of the band saw which would result if the same were to embrace or be carried round a driving pulley of small diameter is prevented, while at the same time the waste of space which would result if the band saw were carried round a single pulley of large diameter at each end is obviated.

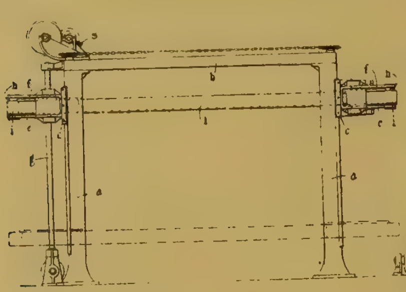


FIG. 1.

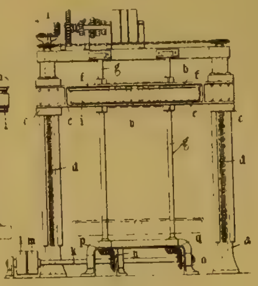


FIG. 2.

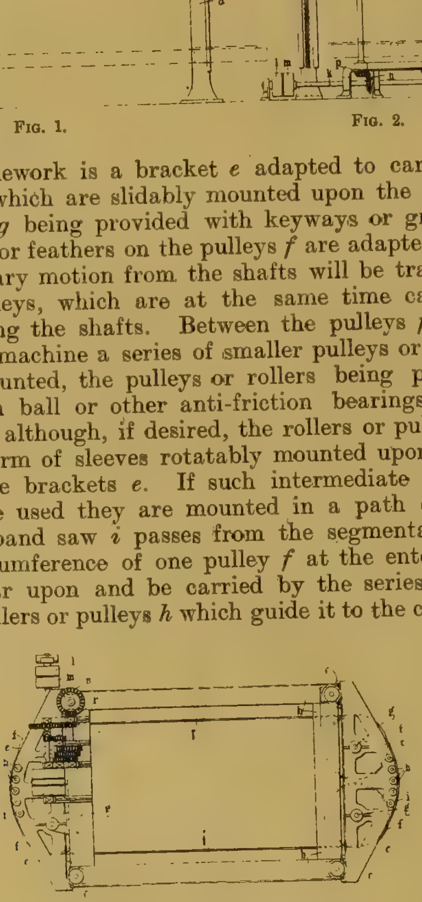


FIG. 3.

Any convenient form of mechanism may be used to transmit power from a prime mover; for example, at the base of the machine and at one end may be arranged a shaft k carried in bearings and provided at one end with two pulleys *l m*, one being loosely mounted upon the shaft *k*, while the other is securely keyed thereto. Mounted upon the shaft *k* are two bevel wheels *n o*, gearing with bevel wheels *p q* carried upon the ends of the two shafts *g*, at what may be termed the driving or power end of the apparatus. Power may by these means be transmitted from a prime mover through the shaft *k* and bevel pinions *n o* to the shafts *g* and thus to the pulleys *f* mounted thereon.

There is, however, no restriction to any particular arrangement of gearing for operating the band saw, and, if desired, the framework of the apparatus may be made suitable for carrying a motor to be driven by electricity or by any other motive power when it is desired to make a self-contained machine independent of any outside mechanical driving arrangements. Similarly, any usual arrangement of racks and pinions or spur wheels and the like for feeding or moving forward the band saw, as the latter is cutting through the stone, may be used. One convenient arrangement for effecting this feeding of the band saw is shown in the drawings, wherein motion is transferred through a series of spur wheels or pinions to a bevel wheel *r* engaging with the second bevel wheel *s* mounted upon the end of one of the screwed spindles *d* engaging with the nut on one of the slides *c*. The other screwed spindles *d* may be caused to rotate in their corresponding nuts formed in the slides *c* by means of chains and sprocket wheels or any other suitable mechanism. By this means the band saw can be fed through the stone or other material to be cut, the saw being shown in its lowest position in dotted lines in figs. 1 and 3.

The pulleys *f* may be so arranged in the framework that their positions may be altered to suit the width between the saw blades themselves upon the forward and upon the return side of the endless band; for example, this adjustment may be effected by mounting the spindles carrying the pulleys *f* in sliding blocks, which will permit of such being moved to the position necessary for any particular distance at which the pulleys are to work.

This invention is not limited to any particular method of feeding or adjusting the position of the cutting blades upon the framework; any kind of mechanism suitable for effecting the feed in combination with the improved arrangement of guiding and driving pulleys which have been described may be employed. The surface of the pulleys and the bearing rollers or the like may also be formed to suit the type of band saw and the configuration of its cutting surface with the diamond carriers that may be thereupon, and flanges or guards are provided upon such carrying and guiding pulleys where necessary.

When it is necessary to employ, in connection with the band saws, tension or other tightening gear, this is arranged to act upon the carriers of the pulleys and their intermediate rollers in the same manner that such tension gear is at present employed in connection with ordinary saw benches, modifying the methods of attachment and connection to suit the improved driving and guiding arrangement of pulleys and carriers.

Manila Electric Railroad.—The Manila Electric Railroad and Lighting Corporation was incorporated in 1903, and has an issued capital of $5,000,000 with a bonded debt of $5,512,000. The company now controls the entire street railway lighting and power business of Manila. As regards earnings, statistics show that while profits fell off slightly in the first half of 1909 they recovered substantially in the corresponding period of the current year and amounted to $313,277, as against $242,046 in 1909 and $262,045 in 1908, and the company has increased its surplus from $342,492 as at 31st December, 1907, to $433,374 as at 31st December, 1909. According to all accounts there is every reason to believe that this improvement will be maintained. The Corporation paid 3 per cent on its common stock for 1906 and 1907 and 4 per cent for each of its following years. During 1910 a distribution of 1 per cent per quarter has been made.

SMALL MECHANICALLY-COOLED COLD STORES.

The employment of mechanically-produced cold is preferable to that produced by means of ice for alimentary products, because a lower temperature can be obtained by the former means, moreover the cold air is drier and more sanitary, and the products can be preserved for a longer period without losing their natural flavour. On the other hand, ice has the advantage of forming an accumulator containing a reserve of cold which admits of a low temperature being maintained during the night—an important consideration in shops, restaurants, and hotels, particularly, where at the end of the day all the comestibles, sometimes warm, are placed in the cold store at the time when the refrigerating machinery is shut down. When refrigerated brine is used as the cooling medium, the above objection is only mitigated, the volume of the cold brine not being as a rule large. If one kilog. of ice, in melting, gives 80 units of cold, one kilog. of brine, in passing from 10 deg. to 0 deg., will only give 7 or 8.

To remedy this objection, Mr. Douane, in a paper in *L'Hygiene de la Viande et du Lait, Association Francaise du Froid,* suggests the use of an apparatus using two liquids, one uncongealable, such as a solution of chloride of calcium in water, the other congealable at a temperature of 5 deg. or 6 deg. above 0 deg. An apparatus can be then arranged which, during the time it is running, will produce the amount of refrigeration required for twenty-four hours, and the two brines are cooled at the same time. When the refrigerating machine is shut down the portion of the brine that has been frozen will maintain the other portion at a low temperature. Figures obtained from different trials made with an apparatus constructed on the above lines, are given by the author, which figures demonstrate the efficiency of the principle.

WHY CRUCIBLES OFTEN FAIL.

By Walter J. May.

In places where there is much crucible work, and plumbago crucibles are used, from time to time there appears a great increase in cost of crucibles in proportion to metal actually melted, and when this occurs it is desirable to find the reason, as crucibles are rather expensive articles to purchase. The reason may possibly be that a lot of small melts have to be made, and only large pots are at hand, a small melt often being as bad for the crucible as a large one. Where melts of varying weights of metal have to be made, crucibles of three or four sizes should be kept in stock, with, of course, tongs that fit them; and if the place where crucibles are stored can be kept dry and warm, the pots are always ready for use, and undue loss can be prevented on the actual melting costs, in so far as crucibles breaking is concerned on the one hand, and through burning away large pots when small ones will do, on the other. Besides, if properly dealt with, it takes less fuel to heat a small pot than it does to heat a large one, and over a series of melts the saving becomes really appreciable.

A matter which often causes a lot of trouble in old-fashioned built furnaces is the position of the flue, this being put too low down, the result being that the draught causes the crucibles to burn through. The flue should always be in one of the two top courses of brickwork of the furnace, the furnace itself being of an area and depth to suit the size of crucibles used, if there is much small melting done, but for occasional melts this would scarcely be necessary, as the expense of building a furnace would hardly be justified unless there was use for it. At the same time, when building a range of furnaces, it is always as well to arrange one small one for use with small crucibles, as then the expense is not great, and the advantages are many. Furnaces should always be in such a position that they can be worked without being cramped for room unduly, as the pots get knocked about a great deal when handled in confined quarters.

The tongs should fit the crucibles and not be too tight or too loose, as in either case the walls of the pots will be damaged where the tongs grip them. Stops should be on the reins of the tongs near the joint to prevent the ring used in holding them together from exerting too much pressure, because when fully heated the crucible material becomes partially plastic, and if gripped too tightly there is a serious risk of fracture. Indeed, more than a little damage is done by badly-fitting tongs, and these tools should always be kept in good order. Each size of crucible should be fitted with its own lifting tongs, and these should not be used for other sizes, or they will become altered in size and injure the pots.

Bowed coke tongs are handy for lifting small crucibles at times, but they should not be used with large ones, the proper lifting tongs being used with these, or the edges of the pots will soon get broken away. Ordinary flat-jawed tongs, such as are used by blacksmiths, should never be used in handling crucibles, while for handling metal the bowed tongs are quite as handy.

Heavy pieces of metal should be put into the crucibles carefully, and not be thrown in anyhow, because the bottoms can very easily be knocked out, particularly when the pots are hot.

Fuel as free from sulphur as possible should be used, as dirty coke burns away plumbago pots very quickly, and the slight extra cost of good fuel is more than recouped. Gas coke costs more per ton of metal melted than does hard foundry coke, and you cannot melt iron or copper at a reasonable cost with gas coke. Carefully handled by a competent fireman, foundry coke shows a considerable saving over gas coke, especially when the longer life of the crucibles is taken into consideration.

Above all things, crucibles of any kind must be kept dry and warm, or they will break when fired, and in addition it is a good plan to stand crucibles on the furnace flue for a few hours before using, as this renders them better able to stand the heat to which they will be subjected to. Wet crucibles "fly" when fired, as a rule.

Taken all round, any good make of plumbago crucibles should at least stand 30 meltings of brass or gunmetal and fifteen melts of iron, while the maximum number of melts which can be obtained under the best conditions should at least double those mentioned. Where less than the minimum number mentioned above is obtained as an average, something is wrong, and careful investigation becomes a necessity. Of course, clay pots have only a short life, and cannot be compared with good plumbago crucibles of good makes.

The British Association.—Captain Sankey made a statement at the recent meeting of the British Association that a modern gas engine converted into work from 80 to 90 per cent of the theoretically possible value. By this he did not mean that 80 or 90 per cent of the total heat in the gas is converted into work; the percentage is between 30 and 40. Captain Sankey is a member of the committee engaged in research upon gas engine problems; his statement therefore is presumably well founded. Steam turbines have converted between 60 and 70 per cent of the theoretically possible quantity of heat into work, and so an efficiency ratio of 75 per cent would probably be the limit for a gas turbine, and the chance of a gas turbine of much improved efficiency as compared with the reciprocating gas engine seems unlikely. Gas turbines are at present barely working possibilities. All about their thermo-dynamics is known, and practically all about their chemistry and mathematics, but a practical gas turbine has yet to be made.

A NEW TYPE HIGH-SPEED BOAT.

SOME interesting trials have been just carried out on the Thames with an entirely new type of high-speed boat which is the outcome of a large number of model experiments which Sir John Thornycroft has been carrying out during the last twelve months.

Much has been heard of the exceptionally high-speeds attained by the modern hydroplane type of boat, but until now no practical seaworthy craft has been produced utilising this principle. Nearly 40 years ago, when Mr. Ramus first approached the Admiralty with his hydroplane (which he then called his polysphenic, or many-wedged ship) Sir John Thornycroft was experimenting with boats intended to skim on the surface, but at that time there was no machinery light enough to enable the principle to be practically applied.

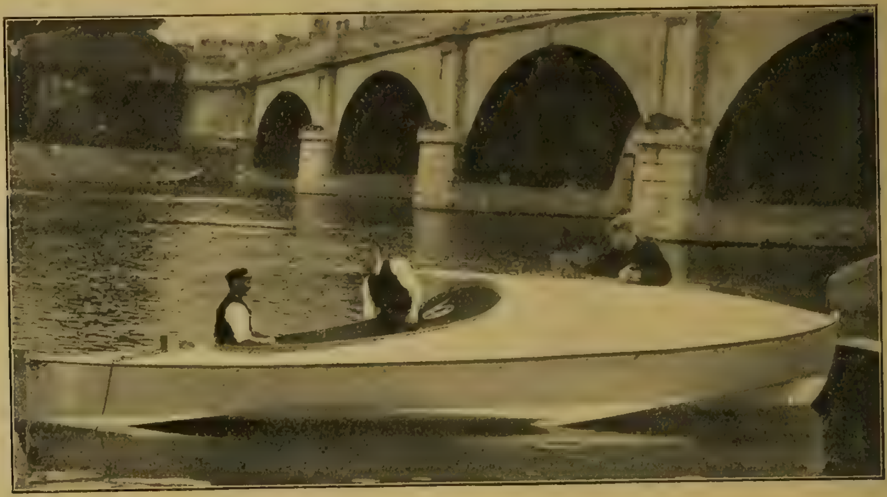


FIG. 1.

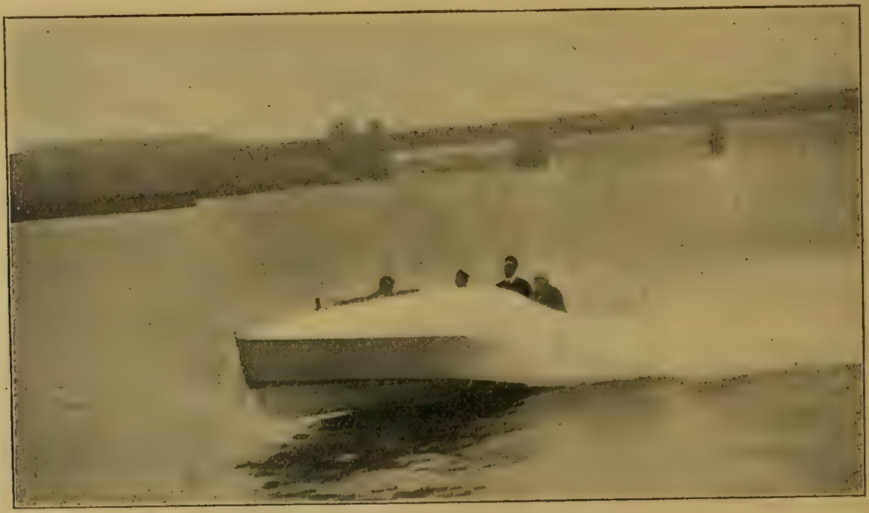


FIG. 2.

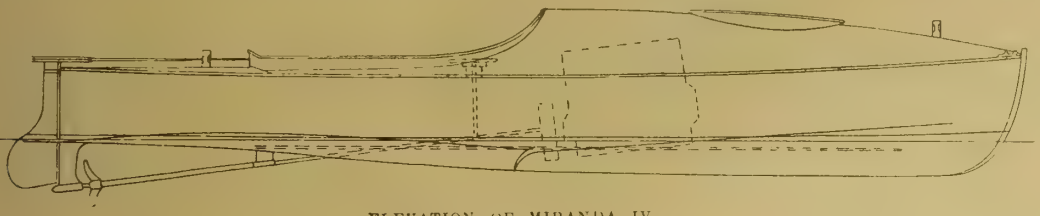
The development of the motor engine has made it possible during the last year or two to make hydroplane boats rise out of the water and skim along on the surface. The difficult problem, however, has been to produce a form which is sufficiently like an ordinary boat to run without undue resistance at moderate speeds, and when going at high speed in rough water to be equally seaworthy as an ordinary boat. This result has, however, been achieved in a most satisfactory way in Sir John Thornycroft's design; the boat when seen at rest, as shown in fig. 1, would appear in every way to represent a good wholesome type of rather beamy boat, and when running at moderate speeds it is still difficult to see anything unusual about her. However, as soon as she gets up to a high speed (shown in fig. 2) it is seen at once that there is a curious section given to the bottom of the fore body, which section dies away amidships, where there is a sudden change of form, the lines of the after part of the boat being quite hollow and terminating in a flat form of stern which is slightly wider than the section a little before it.

The effect of this form is that the boat very readily rises up right on to the surface of the water, only touching it on a small area amidships and again just at the stern, so that skin friction and wave-making are almost entirely eliminated, while at the same time there are no flat places in the bottom of the vessel which would be liable to be damaged in rough water when the boat was going at high speed from wave to wave.

The boat, which has been tried on the Thames, has been named the Miranda IV.

Much disappointment was felt that, owing to the trouble which occurred to the engine of Miranda IV. the day before the Motor Boat Sea Mile Contest, Sir John Thornycroft's skimmer did not realise something nearer the speed of over 35 knots which she has attained in the past. The reason for this was that the engine was running far from its full power, indeed the revolutions were something like 300 less than normal.

With a view to demonstrating beyond question that the boat was capable of maintaining over 35 knots at a mean of six runs on the M.Y.C. measured sea mile, Mr. Tom Thornycroft made a series of six runs, three with the tide and three against the tide, on September 21st, when he was officially timed by the Secretary of the Motor Yacht Club, Mr. W. A. Jupp. Mr. Jupp's certificate is as follows:—



ELEVATION OF MIRANDA IV.

"Enchantress,"
Motley Abbey.

SPEED TEST CERTIFICATE.

MIRANDA IV.

I certify that the above boat was officially timed by me over the M.Y.C. measured sea mile on Wednesday, September 21st, 1910, and that the times taken over the six consecutive runs were as follows:—

		Time.		Speed.
1.	With tide	1 min. 38⅖ secs.	......	36·585
2.	Against tide	1 min. 49⅖ secs.	......	32·906
3.	With tide	1 min. 37⅕ secs.	... ..	37·037
4.	Against tide	1 min. 45 secs.	......	34 285
5.	With tide	1 min. 35 secs.	......	37·894
6.	Against tide	1 min. 43⅖ secs.	......	34·816

The mean of means were as under:—

36·585					
	34·745				
32·906		34·858			
	34·972		35·087		
37·037		35·316		35·341	
	35·661		35·595		35·581 true mean
34·285		35·875		35·821	speed knots.
	36·089		36·048		
37·894		36·222			
	36·355				
34·816					

(Signed) W. A. JUPP, Secretary.

From this it will be seen that within four days of the Sea Mile Contest the Miranda has proved beyond question that she is capable of nearly six knots more speed than she attained when she won the Sea Mile Trophy, and further, that she was about 10 knots faster than her competitor in that contest.

VERTICAL MILLING MACHINE WITH VARIABLE FRICTION GEARING.

The idea of applying variable friction gearing to milling machines and other machine tools is not by any means a new one. The present arrangement, however, presents several points of novelty. For instance, heretofore, where leather or other friction faces of substantially extensive area have been used, the continued action of the engaging elements at or near any given position of adjustment has tended to stretch or change the character of the engaging elements at that particular position of adjustment in excess of the stretch or change at any other point or points causing the surface or surfaces to buckle and separate from the original support.

The device illustrated in figs. 1 to 3 is characterised by the friction surface being made up of substantially concentric areas, the action upon each of which is, or may be, quite independent of all the others, and if any one is acted upon to the exclusion of, or to a greater extent than, the others, it will simply be itself compressed, possibly flattened, or subjected to any change that may necessarily result, and adjust itself thereto without affecting in the least the surfaces that are adjacent to or remote therefrom. This segregation of the friction surfaces into generally ring-like areas is, of course, most conveniently, and perhaps most effectively and efficiently, obtained by its formation in separate and preferably continuous concentric rings, although any other desired construction that will produce the substantial results thereof might be employed, and this whether the sectional portions, of whatever length, be parts of true circles or spiral or otherwise non-circular. The improvements are the invention of Mr. John Becker, of Massachusetts, United States, and our illustrations show them applied to an ordinary milling machine. Referring to fig. 1, the machine is, it will be seen, provided near its base with a horizontal stud 2, upon which are mounted the stepped driving pulleys 3 and the main transmission pulley 4, and at or near its upper end has mounted in the overhanging arm a usual vertical spindle 5, to which the tool is secured. The work support is indicated at 6, and is of usual construction, provided, it may be, with any desired means for furnishing it with automatic movement. The vertical spindle 5 is driven from the main transmission pulley 4 by a belt 7 extended upward and over two lead pulleys 8, thence over to and about a pulley 9 fast on the said spindle.

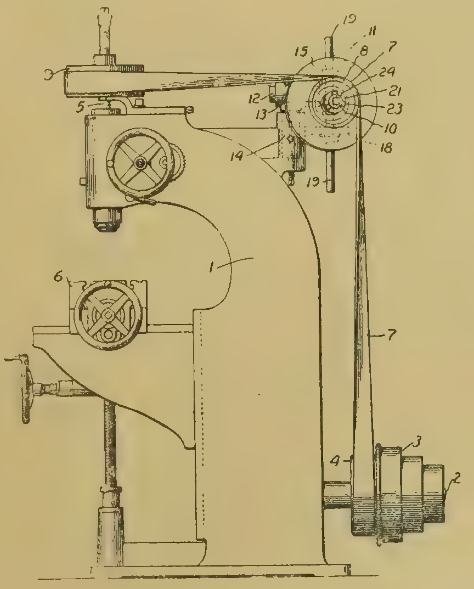


FIG. 1.

The present invention has special reference to the mechanism immediately adjacent the lead pulleys 8. These pulleys in themselves are not new, having been heretofore commonly used as mere idlers for leading the belt from the vertical to the horizontal runs, but lead pulleys are here utilised as members of an improved friction transmission mechanism.

The said lead pulleys 8 (see fig. 3) are shown as mounted loosely upon the laterally-extended studs 10, pitched slightly upward and rearward, as shown and secured at their inner adjacent ends in a socketed connection 11. This connection (see figs. 1 and 2) is provided with a forwardly and horizontally extended arm 12, which is adjustably held in the split socket 13 on the upper end of a vertical arm 14 which, in turn, is vertically adjustable in a portion of the machine frame. The adjustments referred to permit of adjustment of the pulleys 8 to any desired vertical, horizontal, or even angular position.

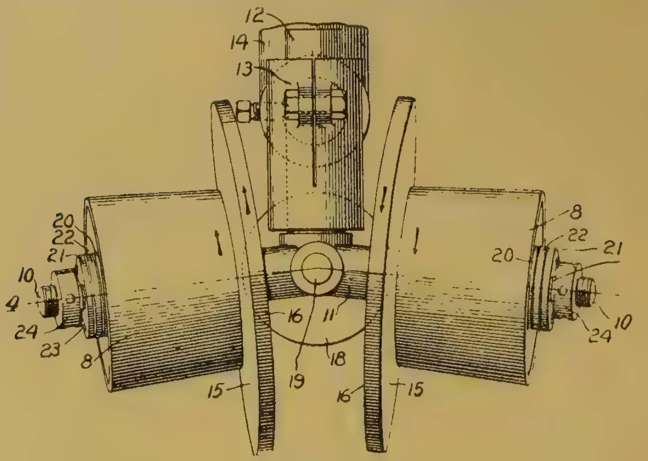


Fig. 2.

Referring again to fig. 3, the lead pulleys 8 at their inner adjacent ends are provided with preferably wide flanges 15, the inner adjacent and disc-like faces of which are shown fitted with concentric ring-like and preferably dove-tailed ribs or projections 16, between which are inserted ring-like portions or sections 17 of leather or other material, adapted to furnish suitable friction transmission or friction driving surfaces. While it is preferred to form the ring-like sections 17 continuously, like so many washers of different diameters, it is not essential that they be so formed, for they may be made up of shorter sectional portions; in fact, the sectional area may be otherwise built up than in truly concentric circular or continuous form, so long as the desired results are attained.

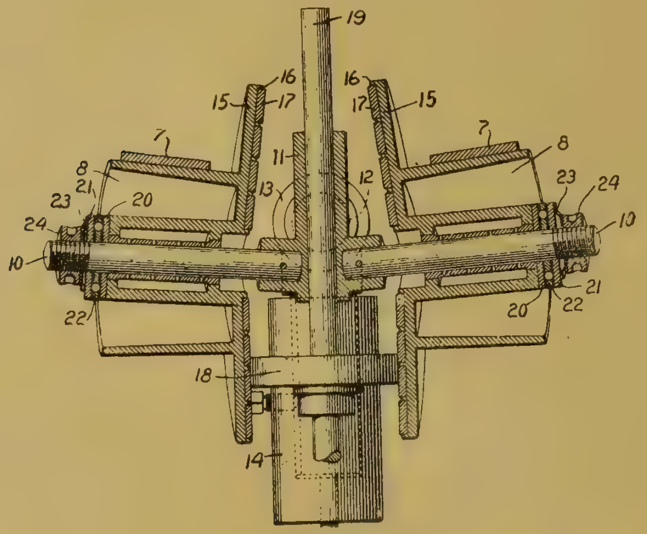


Fig. 3.

Between the two friction discs 15 (see fig. 3), and below the studs 10 upon which the pulleys 8 are mounted, is arranged a driven wheel or transmission member 18. This wheel may conveniently be of metal, or with a smooth and preferably cylindrical metal periphery, the wheel in the present instance being fast on a vertical shaft 19, journaled at its upper end in a bearing in the connection 11. The diameter of this driven wheel 18 is such as preferably to extend from one to another of the friction discs 17, which are thereby permitted to bear frictionally upon and at diametrically opposite points of the friction-driven wheel 18.

In practice, with the machine in operation, the driving belt 7 in transmitting motion from the main transmission pulley 4 to the vertical spindle 5 imparts opposite rotation to the lead pulleys 8, thereby constituting the lead pulleys, driving pulleys, or wheels for the transmission mechanism. The lead pulley studs 10 are oblique to one another, or discs or elements of the transmission mechanism, they being rotated in opposite directions as indicated in fig. 2, and since they bear upon the driven wheel or element 18 at opposite points, the driven element and its shaft 19 will be rotated to transmit motion to any desired part or parts. The lead pulley studs 10 being oblique to one another, or pitched vertically, consequently the friction discs 15 to 17 are shown as cupped sufficiently to cause the portions thereof from their axes downward to stand substantially parallel along the vertical lines of contact with the driven wheel 18.

RAILWAY EMPLOYMENT SAFETY APPLIANCES.

The Committee appointed by the Board of Trade, consisting of Col. H. A. Yorke, Mr. R. Bell, and Mr. R. Turnbull, report that for the half-year ending the 30th June, 1910, they have held three meetings, including an examination of full-size appliances at Willesden. "Several specifications and drawing of either-side brakes and automatic and hand couplings have been examined, and models of the following appliances have also been submitted and inspected—four either-side brakes, five automatic couplers, and two hand couplers. The four brakes, five automatic couplers, and one of the hand couplers failed to meet with our approval, in that the designs were either too complicated or otherwise unsuitable. One of the automatic couplers has been under our notice for four years, and we understand that a model of the appliance was recently submitted to the Commission appointed by the National College of Italian Railway Engineers, who arranged an automatic coupling competition, but the design was not one of those selected for trial. With regard to the remaining hand coupler, as the inventor was anxious to fit wagons with the appliance, we have agreed to inspect it under these conditions at some future date.

"An examination of full-size brake and coupling appliances was made at Willesden on the 18th March, by arrangement with the London and North Western Railway Company. Two either-side brakes, one of which had been previously examined by us but not recommended for general adoption, five hand-coupling appliances, and one uncoupler, were submitted and examined, with the following results:—

> The either-side brake, which had been previously examined on several occasions was merely submitted by the inventor in order to let us see its condition after three years continuous service in traffic.
>
> The other either-side brake was, in our opinion, much too complicated.
>
> All the hand-coupling appliances, one of which had been previously examined on several occasions, failed to meet with our approval.
>
> The uncoupling device proved to be fairly efficient in uncoupling. As, however, a loose pole was still required for coupling purposes, the appliance did not appear to us to be of any value.

"A considerable amount of correspondence from inventors and other has been dealt with, and a number of matters have been referred to us by the Board of Trade."

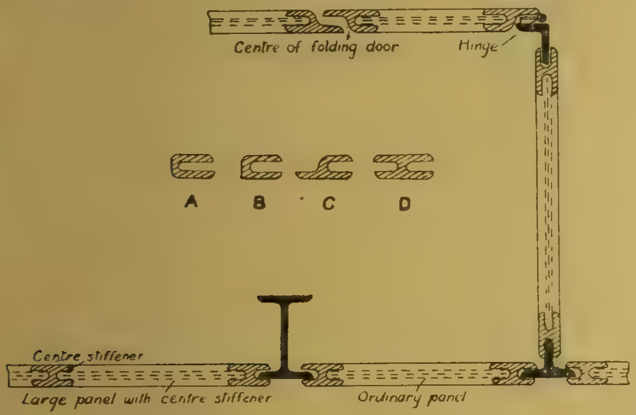
NEW METAL FRAMING FOR SCREENS, &c.

A new type of metal framing, the subject of our illustration, arranged to receive expanded metal, wire work, perforated or plain sheets, for doors, screen work, etc., is now being placed on the market, and will be found particularly suitable for screens to switch boards, departmental tool or material stores, such as forms a very necessary part of every up-to-date engineering works or factory equipment.

This new type of framing entirely dispenses with timber construction, which becomes more or less saturated with oil and so forms an element of danger from fire point of view, beside rapidly becoming untidy in ordinary shop wear.

Screens made entirely of metal are perfectly fire-proof and practically indestructible, and being built in standard sections, give an interchangeability and flexibility of construction that is not possible with timber construction.

The "H" section framing provides a groove round the edges of the frame which will slip over ordinary rolled steel sections and form perfect fixing without bolting; the lower ends of the building frame work can be planted in the floor, or fixed to an angle or other suitable section and screwed to the floor, the top ends being tied together by a similar member.



Our illustration shows a group of typical sections; A and B being a simple section, as used for doors to switch boxes, switch board screens, machinery fences, cupboards, etc.

Section C will be found particularly useful for folding doors or similar purposes, while section H lends itself for building up continuous screens, the various sections of screen being made in standard sizes; the expanded metal or wire work being put between the flange on the inside, the outer flanges being available for slipping over angle-bars, tee-bars, channels, or H section, of which the main frame work of the building is constructed, at once giving secure fixing without bolting or other fixing, and the ease with which it lends itself to structural alterations or extensions, such as are frequently required in the average works will undoubtedly appeal to every engineer or works' manager.

This H section can also be used for central stiffening or astragal of large panels. The frames are constructed with solid corners, a portion of the flanges being notched out to facilitate bending. The corners may then be left with butted joints, or, for best work, welded together with the oxy-acetylene blow pipe, which gives a remarkably neat and strong result. The expanded metal or wire work is securely held in position by rolling the inside flanges down on to it, which firmly grips the expanded metal and makes the whole frame very rigid.

The framing is the invention of Messrs, S. Wheeler Ltd., Soho Boiler Works, Smethwick, who are the patentees and sole makers, and from whom further particulars may be obtained, or from Mr. H. C. James-Carrington, A.M.I.M.E., Engineer, Winchester House, Victoria Square, Birmingham.

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

Books Received.

"Four-Figure Logarithms." By R. C. Farmer and M. M. Farmer. London: Longmans, Green, and Co. Price, 6d. net.

"Iron and Steel Analysis." Vol. I., Ordinary Constituents. L. Campion, F.I.C., F.C.S. Glasgow: Fraser, Asher and Co. Ltd.

"Compressed Air: Theory and Computations." By E. G. Harris. London: Nagraw Hill Book Co. Price 6s. 6d. net.

"Our Home Railways." By W. J. Gordon. Part IV.—The London, Brighton, and South Coast Railway. London: Frederick Warne and Co.

"Official Gazette of the United States Patent Office." Vol. CLVIII., No. 2. Published by Authority of Congress, Washington.

ELECTRO-MAGNETIC TRANSMISSION FOR MARINE PROPULSION.*

It is now generally admitted that the combination of a reciprocating engine with an exhaust steam turbine provides the most satisfactory solution of the problem of marine propulsion, whenever a high efficiency is of paramount importance. However, when he comes to put this principle into practice, the marine engineer is soon confronted with a number of difficulties which, while not actually insuperable, are only got over at the cost of both the efficiency and simplicity of the arrangement.

The use of two propellers driven by the reciprocating engine and by the turbine respectively need hardly be taken into consideration on account of the great difference between the speed and brake horse power of both machines. Under these conditions the only solution lies in an arrangement whereby the power of the turbine is transmitted, at a suitably reduced speed, to the main or reciprocating engine shaft, so as to assist the latter in the propulsion of the ship. A mechanical speed reduction gear suggests itself as the simplest realisation of this arrangement. However, it must be remembered that, under certain conditions of the sea, the reciprocating engine of a boat shows a marked tendency to race, a tendency which is by no means equally shared by the turbine. If, therefore, the connection between both machines is effected by means of the usual system of gearing, the teeth of the latter will in all probability be stripped off, as soon as from some reason or other the resistance on the main shaft is appreciably reduced. If to this we add the noise, vibrations, wear and tear, and the comparatively low efficiency of mechanical gearing for such high ratio as $\frac{3000}{75}$ revolutions per minute, it will be reasonably admitted that no mechanical gear can afford a satisfactory solution of the problem before us. Other means for transmitting power and simultaneously reducing the speed are the hydraulic and electrical transmissions, both of which have been tried in connection with marine propulsion. The former alternative, as conceived at present, can hardly be expected to meet the requirements of the marine engineer, on account of its comparatively low efficiency, excessive wear, weight and cost. The second alternative, namely, the electrical transmission, appears very attractive from the point of view of flexibility and ease of control. However important these factors undoubtedly are, other conditions must be complied with before an electric transmission can be conveniently adopted for the purpose in question. The first of these conditions is a high efficiency. In speaking of this system as a "transmission," one is apt to forget that the actual transmission is only part of the process, the latter being essentially a "transformation" of mechanical power into electrical energy, and again of electrical energy into mechanical power. Taking into consideration the individual efficiency of each single element (generator and motor) of this transmission, it will be found that the combined efficiency cannot be very high, especially when the motor is designed to run at such low speed as 75 revolutions per minute. Other serious drawbacks of this system are the weight and cost of the slow-running electric motor and also the necessity of resorting to high-tension voltage, the presence of which is more or less unwelcome aboard ships.

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* Paper read by Mr. Jules Lecoche at the Institute of Marine Engineers Meeting at the Naval and Engineering Exhibition, Olympia.

The application of the "magnetic gear" to marine exhaust steam turbines was suggested on account of its high efficiency, noiselessness, positive drive, cheapness of upkeep (there being no wear and no need for lubrication, except in the bearings), and, last but not least, on account of this valuable peculiarity that as soon as the reciprocating engine begins to race the transmission comes automatically out of gear, thus effectively protecting the machinery against injury. Compared with both dynamo and motor, the magnetic gear has the advantage that it requires only a nominal amount of electrical energy. In fact, the latter is only an accessory, and the current being of comparatively low voltage can usually be supplied by the existing lighting sets. Although the simplicity of construction and action of the magnetic gear is almost suggested by the name itself, I think a brief description of the machine may be found of interest.

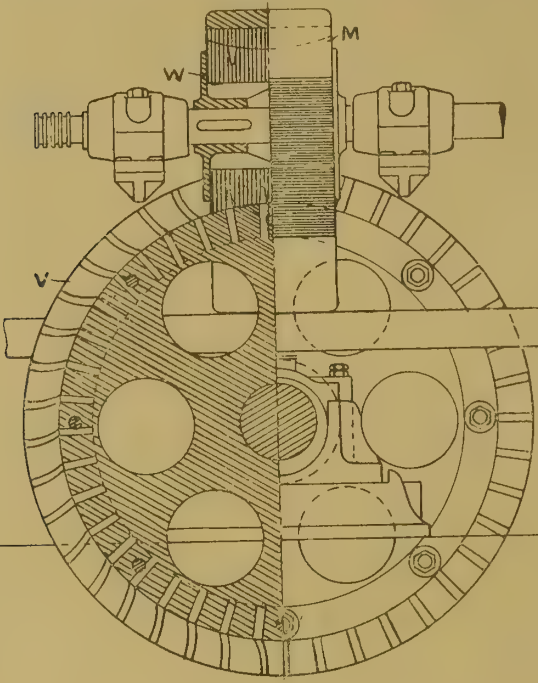


Fig. 1.

The illustration shows a magnetic frictionless gear of the screw type for an exhaust steam turbine of 300 B.H.P. running at 3,000 revolutions per minute; through this gear the power of the turbine is transmitted to the main propeller shaft driven by the reciprocating engine at a speed of 75 revolutions per minute. Such a high speed reduction is possible in this case, owing to the fact that the absence of friction between the working parts allows such high circumferential velocities as would be quite unpracticable with mechanical gearing; besides, apart from the bearings, there is no need for lubrication, and this is a point not to be despised. Unlike an electric motor, the revolving parts of the magnetic gear carry no winding whatever, so that the empty slots and helical grooves of both wheel and worm provide for a perfect cooling. The three main parts of the gear are—the field magnet M, the laminated worm W, and the wheel V.

The field magnet, made of cast steel of high magnetic permeability, is of the Manchester type; its top pole piece is laminated in order to prevent losses and heating from hysteresis and Foucault currents. The coils are wound with high conductivity copper wire properly insulated. The worm is made up of iron stampings fixed concentrically on two cast-iron spiders in exactly the same way as the armature core of a motor or dynamo. One end of the worm shaft is coupled to the turbine. The end thrust is either entirely or partially balanced by that of the turbine. A thrust bearing is shown at the other end of the shaft to take the unbalanced thrust. The wheel, being subjected to a side thrust due to the angularity of the teeth, partially relieves the thrust blocks of the propeller shaft. The wheel V has a hollow rim made up of sprockets of soft iron coarsely laminated; these sprockets have the same angle, width, and pitch as the threads of the worm opposite which they move with a clearance of about $\frac{1}{4}$ in. This wheel is keyed on the propeller shaft driven by the reciprocating engine at 75 revolutions per minute. To clearly understand how the tangential pull on the rim of the wheel is obtained by means of apparently perpendicular lines of force, it must be pointed out that the latter are not actually normal to the circumference of the wheel, but, owing to difference in the degree of saturation of the iron sprockets due to a slight advance of the worm threads under load, the lines of force cross the air gap at an angle, dragging the wheel in the same way as the armature of an electric motor is pulled back into the field when shifted along its centre line.

Losses in the Magnetic Gear and Speed Reduction.—The transmission losses are the electrical energy necessary for exciting the magnetic field and the hysteresis and Foucault currents in the iron of the worm and wheel.

Field Excitation.—From experiments I have made I found that a magnetic density of 15,000 lines per square centimetre are required to give a tangential force of 22 lbs. per square inch of iron face. With a total air gap of one centimetre, a number of ampere turns equal to 800 × 15 = 12,000 is required for producing the necessary magneto motive force; as there are two parallel magnetic circuits (wound in series) it will really be 24,000 ampere turns, to which we must add 6,000 ampere turns to overcome the resistance of the iron circuit, and this brings the total to 30,000 ampere turns. Let us now assume that the pressure of the electric supply is 120 volts, that the wire with which the coils are wound has a sectional area of ·012 square inch, to which corresponds an ohmic resistance of ·2 ohms per 1,000 yards, and that we allow a current density of 1,000 amperes per square inch, say, 10 amperes for the section of our wire; then, 3,000 turns of such wire will be necessary to give the 30,000 ampere turns required. The length of each turn of wire being two yards, the total length of the electric circuit will be 6,000 yards, whose total resistance (at two ohms per 1,000 yards) is 12 ohms. The formula R × I = E, in which R is the resistance of the circuit, I the intensity of the current, and E the electro motive force, is verified; 12 ohms × 10 amperes = 120 volts. The total electrical energy corresponding to these figures is 10 amperes × 120 volts = 1,200 watts, which is less than 1 per cent of the total power transmitted (300 H.P.).

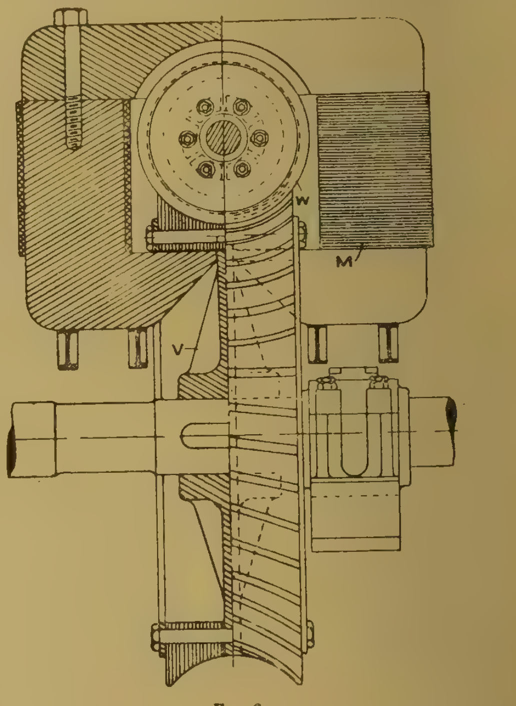


Fig. 2.

Loss through Hysteresis and Foucault Currents.—Owing to the laminated state of the worm, and also the sprockets of the wheel, the loss through eddy curents and hysteresis is very low and always less than 4 per cent of the total power, which, added to the 1 per cent of the field excitation, will give a total transmission loss of 5 per cent.

The total weight of the 300 B.H.P. gear for reducing the speed from 3,000 to 75 revolutions per minute is 11 tons, of which two tons for the worm with its shaft and bearings, four tons for the wheel, and five tons of the field magnet. Comparing these figures to electrical transformation, it would be in the latter case: One 250 k.w. dynamo at 3,000 revolutions per minute, three tons (approximately); one 300 H.P. motor at 75 revolutions per minute, 27 tons (approximately); total 30 tons. The magnetic gear can run in both directions if the turbine is reversible; if such is not the case, the excitation is cut off by means of a switch, and the reciprocating engine gives alone the reverse motion without the assistance of the turbine.

TRADE CATALOGUES.

We have received from **Messrs. Veritys Ltd.,** Plume and Victoria Works, Aston, Birmingham, copies of their new catalogues of the "Aston" electric radiators and crystal glass fittings; also circulars relating to the "Aston" electric light economisers, auto-transformers, electric kettles and cooking plates, electric soldering irons, arc lamps, and other electric specialities.

We have received from **Messrs. W. F. Stanley and Co. Ltd.,** Great Turnstile, Holborn, London, W.C., a small pamphlet dealing with the Payne-Gallwey computing dials, of which they are the sole manufacturers.

We have received from **Messrs. R. Becker and Co.,** 53, City Road, London, E.C., a little publication, entitled "Shop Notes," descriptive of their Albrecht chuck and the various uses to which it can be advantageously put.

We have received from **Messrs. Wassermann and Co.,** Lausanne, Switzerland, a catalogue of their castolin compound for welding cast iron. Messrs. Wassermann, we are informed, have appointed Mr. J. Glass, of 121, Rusholme Road, Manchester, as their agent.

We have received from **Messrs. J. H. Heathman and Co.,** of Parson's Green, Fulham, S.W., a copy of their catalogue of their fire escapes, fire towers, extension ladders, and other specialities.

NOTICES OF MEETINGS. &c.

October 7th.—The Aberdeen Mechanical Society. Annual General Meeting and paper by Mr. James Laing, M.I.M.A.

October 8th.—The North of England Institute of Mining and Mechanical Engineers. General Meeting will be held in the Wood Memorial Hall, Newcastle-upon-Tyne, at 2 o'clock. The following papers will be open for discussion: "Experiments illustrative of the Inflammability of Mixture of Coal Dust and Air," by Dr. P. Phillips Bedson, and "Some Memoranda concerning Coal Dust and the Essential Principles of the Coal Dust Theory," by Mr. H. W. G. Halbaum.

October 10th.—The Junior Institution of Engineers. Meeting at Caxton Hall, Westminster. First of the series of six lectures on "The Law Relating to Engineering," by Mr. L. W. J. Costello, M.A., LL.B. (Camb.).

The Institution of Mechanical Engineers: Graduates Association. Meeting at 8 p.m. A paper, entitled "Recent Improvements in Woodworking Machinery," will be read by Mr. Albert E. Harris. The chairman will be Mr. Allan Ransome.

Institute of Marine Engineers. Discussion on the Internal-combustion Engine for Marine Use," by Mr. W. R. Cummings, and "An Experimental Study of an Oil Engine," by Mr F. J. Kean, B.Sc. The meeting will be held at 58, Romford Road, Sratford, London, E

October 12th.—Northern Polytechnic Institute A new generating station of the above Institute, Clerkenwell, will be formally opened by the Chairman of the London County Council.

The Incorporated Institution of Automobile Engineers. Presidential address: "Factors that have contributed to the Advance of Automobile Engineering, and which control the Development of the Self-propelled Vehicles," by F. W. Lanchester, Esq., M.Inst.C.E., President-elect.

October 14th.—Institution of Marine Engineers. Bohemian concert, on the invitation of the Junior Section.

October 15th.—Institution of Municipal and County Engineers. Home District Meeting to be held at Guilford. 10-15 a.m., Reception of members at Town Hall, Guilford. 11-15 a.m., Proceed to Sewage Works and Corporation Farm. 12-30 p.m., Opening of new Destructor Works. 3-0 p.m., Inspection of Ejector Chambers. 4-0 p.m., Visit Waterworks, Markets, and Pleasure Grounds.

THE HISTORY AND DEVELOPMENT OF REINFORCED CONCRETE.

Introductory to a course of about 60 lectures on reinforced concrete which is to be given this session at the London County Council School of Building, Ferndale Road, Brixton, S.W., by Mr. H. Kempton Dyson, secretary of the Concrete Institute, a special free public lecture on "The History and Development of Reinforced Concrete" was delivered on Tuesday, 27th September, of which the following is a summary:—

It is only within recent years, namely about the last 12, that reinforced concrete as a method of construction has come into prominence. The subject, however, is not entirely now, because it is over 50 years since attention began to be directed by inventors thereto, and, indeed, reinforced concrete of a kind has been done for ages almost. The roof of a tomb constructed by the Romans 100 years or more B.C., situated on the Via Appia, has been found to consist of a slab of lime concrete in which bronze rods were placed crossing each other lattice-ways to strengthen or reinforce it. In the wide sense the Romans reinforced concrete in other ways, by timber and tiles, while at one point it has been found that the Great Wall of China on a bad sub-soil was built on a kind of concrete raft in which timber, reeds, and rushes were embedded to strengthen it. In the middle ages timber was frequently employed to reinforce rubble concrete walls.

The first suggestion of an idea of reinforcing concrete in modern times seems to have been a statement in J. C. London's "Encyclopædia of Cottage, Farm, and Village Architecture," published in 1830, in which it was suggested that flat roofs might be constructed of a lattice work of iron tie rods thickly embedded in cement and cased with flat tiles. In 1840 about two systems of floor construction were employed in Paris, known as the Vaux and Thuasne systems; the former consisted of round rods, closely spaced, hooked over flat wrought-iron bars placed on the edge some distance apart, and embedded in a slab of plaster of Paris concrete, while the latter employed small iron joists with hangers or stirrups placed over them in which round rods were suspended placed in holes in the stirrups. Plaster of Paris was, however, not a proper cement to be employed, as it caused the embedded iron to rust, and probably the reason reinforced concrete did not arrive sooner was that the world was waiting for a suitable cement for making concrete; it needed Portland cement, which was invented in 1824, but was not manufactured to any extent until some years later. The first real inventor of reinforced concrete in the modern sense seems to have been W. B. Wilkinson, a plasterer, of Newcastle-on-Tyne, who took out a patent for floors and beams of the same in 1854. M. Francois Coignet, a Paris contractor, took out a patent in 1855 for reinforcing slabs with a network of iron rods, and a M. Lambot, another French contractor, proposed the construction of ships by means of concrete with an embedded skeleton of wire, and he constructed a punt of the kind which was shown at the Paris exhibition of 1853, and is still in service in a pond at Miraval where he resided. The development of the subject was extended by the following inventors: C. C. Dennett (1857); Matthew Allen (1862); Frederick Ransome (1865); H. Y. D. Scott (1867); Philip Brannon (1870), who first suggested the driving of reinforced concrete piles; Monier (1867-1873); Thaddens Hyatt (1873-1877), who conducted a great many tests on reinforced concrete beams and showed how to make calculations for determining their strength; W. H. Lascelles (1877); W. E. Ward (1875); H. J. Jackson (1877); E. L. Ransome (1884); J. C. Golding (1884); W. H. Lindsay (1885); William Simmons (1885-1886), who designed the block of offices, No. 63, Lincoln's Inn Fields, London, which, constructed of reinforced concrete, is still in use and in excellent condition; Lee and Hodgson (1885), who invented a spirally reinforced concrete column; Bordenave (1887); Cottancin (1889); W. H. Briggs (1889); J. Mayoh (1890); A. J. B. Ward (1891); C. A. Day (1891); Franz P. Meyenberg (1891), who introduced the first loose stirrups in beams; F. G. Edwards (1891); P. Stuart (1892); Koenen and Wayss (1892); Francois Hennebique (1892). It is the last-named system which has been chiefly responsible for a great deal of the development in this country in recent years. There have been many systems invented subsequently, over 70 being upon the market in Europe and America to-day. Reinforced concrete is now used for the following: Beams and slabs, cantilevers, arches, columns, piles, pipes, masts, telegraph, tramway, and electric light poles and standards, reservoirs, barges, boats, punts, pontoons, caissons, ordinary walls, retaining walls, warehouses, railway sleepers, chimney shafts, sea protection walls, and groynes. Reinforced concrete posesses the advantages of strength, durability, freedom from continual painting and upkeep, hygiene, fire resistance, freedom from vibration, and economy.

TRADE NOTES.

Messrs. Henry Adams and Son have been called in by the Holme Cultram Urban District Council to examine and report upon the sea wall at Silloth which is showing signs of failure.

The **Ailsa Shipbuilding Co.,** Troon, have booked orders for two light draught steamers for West Coast of Africa and one steel barge for the Niger.

We understand that Messrs. Edward Lawrence and Co., of Liverpool, have placed an order with the **Greenock and Grangemouth Dockyard Co.** (Grangemouth) for two coasting passenger steamers to Board of Trade requirements for the Bombay Steam Navigation Co. for next season's work. The vessels, which will be built to Board of Trade requirements, will be handsome, substantial boats of good speed, with awning decks, and all the house and cabin work will be of teak. Machinery will be supplied by Messrs. Dunsmuir and Jackson, Glasgow.

LAUNCHES AND TRIAL TRIPS.

Laristan.—On the 21st September Messrs. Short Brothers Ltd. launched from their shipbuilding yard at Pallion, Sunderland, the steamship Laristan, built to the order of the Hindustan Steam Shipping Co. Ltd., of Newcastle-on-Tyne. The leading dimensions of the vessel are: Length, 360 ft; breadth, 50 ft. 10 in.; and depth moulded, 25 ft. 8 in. She is built on the Isherwood principle, with single deck, poop, bridge, and top-gallant forecastle, to take Lloyd's highest class, and is designed to carry a dead-weight cargo of 6,200 tons on a moderate draught of water. Ample water ballast is provided throughout double bottom, and in fore and after peak tanks to enable the vessel to run in ballast with safety. Six watertight bulkheads are fitted across the ship, and steel centre line bulkhead between hatches with wood shifting boards for grain cargoes in way of hatches. Eight steam winches, steam windlass, steam steering gear placed in engine room, controlled from standards in wheel house and on flying bridge and connected to quadrant on rudder by rods and chains, will be fitted, taking steam from large donkey boiler fitted on main deck. Eight derricks are provided on masts worked from strong derrick tables with cross trees above, and two derricks working from strong posts at cross bunker hatch. The propelling machinery will be installed by Messrs. John Dickinson and Sons Ltd., Sunderland, and will consist of engines with cylinders 24½ in., 40 in., 66 in. diameter, with a stroke of 45 in., driven from two large multitubular boilers of 180 lbs. pressure.

Broompark.—The steamer Broompark, built by the Greenock and Grangemouth Dockyard Co., Greenock, has carried out successful speed trials on the Firth of Clyde. She exceeded her contract speed over the measured mile, and on the run between the Lights attained an average speed of 10·6 knots per hour. After her trials she left on her maiden voyage to Copenhagen. The vessel, which measures 245 ft. in length, 37 ft. in breadth, and 17 ft. 8 in. in depth, was engined by Messrs. Dunsmuir and Jackson, Glasgow.

France.—The new liner France, belonging to the Campagnie Transatlantique, which is destined for service between Havre and New York, was successfully launched on the 20th September. The France, which will be the largest vessel in the French merchant marine, is 701 ft. in length, and has a displacement of 27,000 tons. She will carry about 2,000 passengers, and will be fitted with every modern convenience.

Messrs. R. Williamson and Son, Workington, have launched a steel screw steamer of the following dimensions: Length, 163 ft. 9 in.; breadth, 26 ft. 6 in.; depth moulded, 13 ft. 2 in. The vessel is built to the highest class at Lloyd's, and will be propelled by triple-expansion engines.

Krishna.—This twin-screw steamer, built by Messrs. John King and Co., Bengal, to the order of Raja Sreenath Roy and Brothers, managing agents for the East Bengal Steam Navigation Co., ran official trials on the 12th inst. The propelling machinery for the vessel, which has been supplied by Messrs. Bow, M'Lachlan, and Co., Paisley, consists of two sets of inverted triple-expansion surface condensing engines, with cylinders 10 in., 16 in., and 26 in., by 18 in. stroke. On the trials they developed 750 I.H.P.

NAVAL NOTE.

H.M.S. Neptune.—The battleship Neptune, which put into Plymouth Sound to coal on the completion of the first 30 hours' steam trial, left again in order to commence the second 30 hours' trial, which, if successful, will be followed by an eight hours' full-speed trial. During the completed trials the machinery worked without a hitch, the anticipated horse power being exceeded. The Neptune, with her sister ships, Hercules and Colossus, now building, constitute a distinct group. They exceed in their principal dimensions and displacement the Collingwood group, which immediately preceded them, and, owing to their thicker belt of armour and the better disposition of the main armament, which gives a bow fire of eight guns, to the six of the Collingwood, they are superior to that class. Parties of men from the Excellent and Vernon are carrying out the preliminary tests of the fittings and preparing for the firing trials of the Neptune.

CORRESPONDENCE.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only; and if accompanied by sketches, these should be neatly drawn, and forwarded on a roll, to prevent creasing. We cannot undertake to return rejected communications, or to reply to inquiries by letter. In all cases letters must be accompanied with the name and address of the writer.

We do not hold ourselves responsible for the opinions of our Correspondents.

EXHAUST FROM GAS ENGINE.

To the Editor of "The Practical Engineer."

Sir,—I am interested in the paragraph in your issue of September 23rd referring to the utilisation of exhaust from gas engines.

The company with which I am associated, the Power-Gas Corporation, control several patents for methods of dealing with and utilising exhaust from gas engines, and as regards raising steam, they have a large number of installations at work where the exhaust from the gas engines raise steam for different industrial purposes.

If the boilers are properly designed and installed, the corrosion is not excessive, as stated.—Yours, etc.,

S. Hutchins.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2249. **Exhaust Valve Seat Refacing Tool.**—Will any reader kindly state the number of teeth advisable for an exhaust valve seat refacing tool to be used by hand, the diameter being 5 in.? If the teeth are radial, will chatter marks be formed on seat; and if the teeth should be at an angle on face of cutter, kindly state angle and which way inclined—*i.e.*, whether inner or outer diameter of tooth leads?—Exhaust Valve.

2252. **Converting Gas Engine to Oil Engine.**—I should be glad of the assistance of any reader as to the best method of converting a 10 H.P. gas engine into an oil engine, giving place where I can get the extra fittings required, and giving sketches of same.—Gas Engine.

2255. **Sparking Plug Trouble.**—Having under my care for a time a 14 H.P. Tangye suction engine and plant, I have had a great deal of trouble sometimes with my sparking plug being covered with oil deposit, while perhaps another time the plug would not want cleaning for perhaps a fortnight, being perfectly dry, the oil supply being always the same. I have had to clean it every morning last week because of this trouble. Do you think the quality of the gas has anything to do with it, for this happens with the same style of coal? I should be pleased if I could have some solution to this difficulty.—Attendant.

2257. **Welding by the Electric Arc.**—I should be glad to hear of a practical book on the subject of welding by electric arc. In the absence of such a book, would any reader say whether a rotary transformer or a storage battery would be the better meaus of reducing a voltage of 220 continuous to the proper voltage for welding plates up to, say, ¾ in. thick, and what current would be required ?—DYNAMO.

2258. **Boosters.**—Will a reader kindly give me some working data for boosters for supplying the extra volts when charging accumulators from dynamos used on lighting circuits ; also diagram of connections for same ?—ATTENDANT.

2261. **Manganese and Chrome Steel.**—I shall be very much indebted to any reader for a reliable method for distinguishing manganese and chrome steel from ordinary cast steel, and from each other ?—M. K. H.

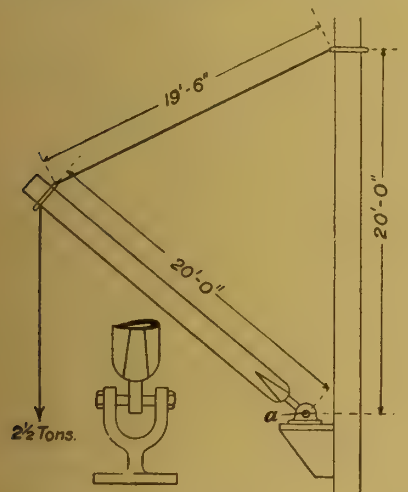
2268. **Dimensions of Engine.**—Should esteem it a great favour if any reader could give me suitable dimensions for inlet, transfer, and exhaust ports for two-stroke engine 2¾ in. bore by 3 in. stroke, also compression ratios in cylinder and cylinder case. Do you know of any simple method of ascertaining these dimensions ?—A. P. S.

2269. **Brazing Sheet Brass.**—Can a reader of *The Practical Engineer* inform me of a firm where I can buy metal suitable for brazing sheet brass up to $\frac{1}{32}$ in.? Also metal for repairing aluminium utensils, or books relating thereto ?—F. T.

2270. **Hand Portable Boring Bar Rig.**—Will any reader give rough sketch of an up-to-date light and handy hand portable boring bar rig for boring out the stern posts of small vessels, small steam boats, tugs, etc. ; largest bore 8 in. diameter ? Any information on this subject as regards the making of same would greatly oblige.—STERN POST.

2276. **Blast Furnace.**—Could some of your readers inform me whether the blast temperature, percentage moisture in blast, and the combustion temperature reached in blast furnaces can be conveniently related, and, if so, how exactly ?—TAP.

2278. **Diameter of Jib.**—Will any reader answer the following ? The illustration represents a derrick on the mast of a ship, and it is required to know the diameter of the jib if made of steel plate, and also the diameter of the steel pin *a*.—S.



2279. **Composition for Filling Floats.**—Can any reader of *The Practical Engineer* give the writer particulars of the composition used for filling floats ?—W. M.

2280. **Temperature of Oxy-hydrogen Blow-pipe Flame.**—Could any of your readers explain this calculation, relating to the temperature of the hottest part of the oxy hydrogen blow-pipe flame ? Data given : The heat of combustion of 1 cubic metre of H = 2613 calories ; the mean specific heat of water vapour = ·34 + ·00015 t_1^2 ; the answer given is 3191 deg. Cen. How is it arrived at ?—HYDROGEN.

2281. **Centrifugal Pump Vanes.**—Will any reader oblige the writer by supplying some practical data for determining the curvature of centrifugal pump vanes, the revolutions per minute, head to be pumped against, and quantity to be delivered being known ?—C. B.

[Probably the writer of above could obtain much of the information required from "Centrifugal Pumps, Turbines, and Water Motors," by C. H. Innes, M.A. Technical Publishing Co. Ltd.—ED.]

MISCELLANEA.

H.M.S. BRISTOL on her late trials attained a speed of practically 27 knots. This is a rate of speed never before achieved by any British warship larger than destroyers.

PRESENTATION.—At the conclusion of the Engineering Exhibition at Olympia Mr. F. W. Bridges, the organiser, was presented by the exhibitors with a gold card case, suitably inscribed.

THE Union Castle liner Balmoral Castle, manned by a new naval crew, proceeded into Southampton Harbour on the 22nd September to make final preparations for the voyage of the Duke and Duchess of Connaught to South Africa.

THE Commercial Motor Users' Association has compiled a set of rules and regulations satisfactory to the police authorities, and are now issuing some mounted on varnished cards which they will supply at 6d. each, or as folding cards for waistcoat pockets at 2s. per 100.

WE have received from Messrs. The Chaddesley Manufacturing Co. Ltd., of Cookley Ironworks, near Kidderminster, a post card illustrating a number of their hydraulic pressed steel stampings. The firm make pressed steel stampings of all descriptions up to 6 ft. diameter.

WE have received from Messrs. Page's Publishing Co. Ltd. the first number of the European edition of *Wood Craft*, a journal devoted to the wood-working trades. The journal, which is, nicely got up and illustrated, will doubtless be of interest to those specially interested in the conversion of timber.

EQUIPMENT OF NEW LINERS.—The White Star Line are said to have placed contracts for the final equipment of their large new steamers Olympic and Titanic, which are at present building in Belfast. The vessels, which will be the largest in the world, will have displacements of 45,000 tons. The company have ordered 50,000 pieces of plate from Messrs. Elkington and Co., Birmingham, Liverpool, and London.

ANGLO-JAPANESE EXHIBITION AT MANCHESTER.—An Anglo-Japanese Exhibition is to be held at Rusholme, Manchester, from November 26th to January 21st next by the Manchester Exhibition Co. Ltd. There will, we understand, be an engineering section. The main hall of the buildings, which has been erected expressly for the purposes of exhibitions, measures 500 ft. by 180 ft., and is claimed to be the largest of its kind outside London.

USE OF THE MICROMETER.—The micrometer (says our American contemporary, *Machinery*) is defined by a well-known instructor in machine shop practice to his classes as being essentially a measuring instrument of precision, but in order to be an instrument of precision in the hands of the unaccustomed it must be used with extreme care. Especially is it an instrument that must be used carefully and slowly by the beginner—first, to obtain accurate adjustment, and second, to read the measurement correctly. With careless adjustment or incorrect reading or both, the micrometer is anything but an instrument of precision; on the contrary, its use may cause more mistakes than the use of ordinary calipers.

NEW HATCH COVERING.—The new British India steamer Cocanada, which was launched recently by Messrs. Barclay, Curle, and Co., Whiteinch, has been fitted experimentally with one specimen of a new type of appliances for securing the tarpaulins or outer coverings on the hatches. The new system, which is the invention of Mr. Hugh Cameron, ship's officer, Glasgow, and is fitted to one hatch, is intended to supersede the loose bars and wedges at present universally used for securing tarpaulins. It consists of a bar hinged to the coaming of the hatchway, and secured against the coaming by screws in such a manner that it can be easily fixed, will hold the tarpaulin firmly in position, and can be easily released whenever necessary. The invention, which has been approved by Lloyd's Register, is applicable to all ordinary hatches.

NEW MOTOR MAIL SERVICE.—A mail service by motor car has been inaugurated betwewen Aberfeldy, Kenmore, and Acharn. The mail service has been conducted during the past half century by means of a horse-drawn vehicle. A motor car mail service from Pitlochry to Kinloch Rannoch by Strathtummel has also been inaugurated, taking the place of the mail gigs. The contract, which has been secured by Mr. John Kennedy, motor engineer, Pitlochry, is for five years. The vehicle provided is a 20 H.P. Argyll car of the ordinary char-a-banc type, with a locker for the mails. The tyres are solid. The distance to Kinloch Rannoch is 21 miles, but it is probable that the service will ultimately be extended to Rannoch Station, linking up with the West Highland Railway at the west end of the loch. The Postmaster-General is also considering the expediency of deputing an official to visit Garve and Ullapool for the purpose of inspecting the road and conferring with the local authority on the subject of a motor car mail service between Garve and Ullapool.

PATENTEES' CHRONICLE
OF
Applications for British Patents.

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*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

SEPTEMBER 26th, 1910.

22226 Cycle brake. Austin.
22227 *Recording device. Cox.
22228 Taps. Jones.
22229 Hurricane lanterns. Jones.
22230 Looms. Francis.
22231 Relating to paraffin, etc. Banner.
22232 Automatic sounding machine. Progne.
22233 Game. Brading.
22234 Carriage door lock. Wilson.
22235 Tobacco pipe cleaner. Holland.
22236 Horses hoof pad. Holland.
22237 Bank cheques. Simpson.
22238 Bath cleaning. Holden.
22239 Telephone system. White.
22240 Electric conductors. Morris.
22241 Ledger cheque system. Ruscoe.
22242 Wire netting. Field.
22243 Boots, etc. Yardley.
22244 Boots, etc. Southall.
22245 Jets for fire purposes. Mills.
22246 Process for annealing, etc., copper, etc. Maccormack.
22247 Dental syringe needles. Fletcher.
22248 Bottle stoppers. McQueen.
22249 Twiners. Bottomley.
22250 Bottle stoppers. Townley.
22251 Treatment of sewage. Waddington.
22252 Internal-combustion engine. Watson.
22253 Stud clip. Parkin.
22254 Attaching filleting to flat bars. Dronsfield.
22255 Chimney. Charlton.
22256 Steam superheater. Bolton.
22257 Embossing presses. Waite.
22258 Sheet delivering mechanism. Waite.
22259 Hydraulic apparatus. Hele-Shaw.
22260 Ball bearings. Jones.
22261 Furniture castors. Lambert.
22262 Advertising device. Lambert.
22263 *Tube manf.
22264 *Safety mine cage device. White.
22265 *Furnaces. Paul.
22266 *Motors. Rockingham.
22267 *Propagation of fish. Parry.
22268 *Pressure gauges. Hammond.
22269 Wearing apparel. Goldman.
22270 Sewing machine. Goldman.
22271 *Submarines. Hosch.
22272 Tyres. Roberts.
22273 *Register gates. Abbott.
22274 *Spark arresters. Whiteman.
22275 *Spark arresters. Whiteman.
22276 *Moisteners. Molley.
22277 *Non-refillable bottles. Gill.
22278 Steam dryer. Schreiber.
22279 Internal-combustion engine. Lucas.
22280 Carburetter. Legger.
22281 Bedsteads. Samms-Hudson.
22282 *Air gas production. Krause.
22283 *Card shuffling device. Vielhaber.
22284 *Furnace stoker. Artman.
22285 *Hydraulic apparatus. Ehrhart.
22286 Portable bioscopes. Linnen.
22287 *Explosive projectile fuse. Schneider.
22288 *Isolated alkali salt of indoxyl manf. Lucius.
22289 *Dye manf. Lucius.
22290 Carriage window fastenings. Muhlberger.
22291 *Photographic tray. Rice.
22292 *Recording apparatus. Leeds.
22293 *Steam generator. Shelton.
22294 Aeroplanes. Brown.
22295 *Safety valves. Halter.
22296 Tyres. Sullz.
22297 Sash fastenings. Cowthorne.
22298 Vegetable cutter. Mudkin.
22299 *Hat, etc., manf. Minchinton.
22300 *Vehicle wheels. Donaldson.
22301 *Valves. Lake.
22302 *Mechanism for turning bridges. Carrez.
22303 *Indicating gas escapes. Legger.
22304 *Electric lamp socket. Darby.
22305 Spring motor. Davies.
22306 Dye manf. Ransford.
22307 *Game. Christmas.
22308 *Blast furnace. Hohrath.
22309 *New solvent manf. Walker.
22310 *Relating to pipes. Arthur.
22311 Felt hat manf. Royle.
22312 Paper manf. Priem.
22313 *Sweating crude paraffin. Pyzel.
22314 *Pneumatic tyre. Grenier.
22315 Collar stud. Smith.
22316 Straw hats. Tress.
22317 Kindling appliance. Halle.
22318 Coin freed apparatus. Price.
22319 *Producing nitric oxide. Pauling.
22320 Producing nitric acid. Pauling.
22321 *Sprinklers. Pauling.
22322 *Aqueous solvents of nitric acid. Pauling.
22323 *Flying machine. Gore.
22324 Plant cleaning. Johnson.
22325 *Driving gear mechanism. Stuhlmacher.
22326 *Combs. Salzer.
22327 *Surgical plasters. Ponds.
22328 Railroad ties. Olsen.
22329 *Metallic hoop manf.
22330 Coin freed apparatus. Fairweather.

SEPTEMBER 27th, 1910.

22331 Calipers. Long.
22332 Self-feeding water boilers. Jackson.
22333 Cigar, etc., holder. Hough.
22334 Pneumatic tubes. Barker.
22335 *Purification of gases. Burkeiser.
22336 Military tents. Wheeler.
22337 Cake stands. Lane.
22338 Trouseers. presses. Schurr.
22339 Dynamo control. Stevens.
22340 Carding engine cylinder doors. Law.
22341 Motor cars. Robinson.
22342 Motor car indicators. McLoughlin.
22343 Producing a foam on beer, etc. Preston.
22344 Candle holder. Williams.
22345 Steam pipe covering. Proudfoot.
22346 Cycle pedals. Yoxall.
22347 *Centre stop hinge. Hughes.
22348 Trimming device. Stagg.
22349 Lace braiding machine. Price.
22350 Route chart holder. Gibbs.
22351 Game playing apparatus. Morris.
22352 Knife cleaners. Goddard.
22353 Carriage door lock. Sparks.
22354 Vacuum cleaner. Etchells.
22355 Electric switch. Etchells.
22356 Electric lamp holder. Beale.
22357 Carding engines. Chadwick.
22358 Kettles. Wright.
22359 Photo printing arc lamp. Hall.
22360 Cycles. Livermore.
22361 *Hatpins. Simpson.
22362 Cake. Thompson.
22363 Stop sink. Adams.
22364 Screw thread cutters. Mills.
22365 *Electric lamp manf. Siemens.
22366 *Water tube boiler. Schreier.
22367 *Lifting jacks. Coddington.
22368 *Time switch. Pugh.
22369 Hydrolysis. Bamberg.
22370 Seat protector from rain. Weller.
22371 Aeroplanes. Chidell.
22372 Manhole. Legg.
22373 *Weights. Lug.
22374 Photo postcards. Major.
22375 Showcards. Stain.
22376 Signalling apparatus. Lockwood.
22377 Pneumatic tyres. Yarworth.
22378 Hinge. Broughton.
22379 *Heating burners. Fairbrother.
22380 *Electric switches. Berry.
22381 Cigarette box. Turner.
22382 *Relating to shoring. Ver-Mehr.
22383 *Fruit jars. Grimwade.
22384 *Gas burner. Michl.
22385 *Water closets. Katz.
22386 Rotary gear. Rössler.
22387 Peat briquette manf. Booth.
22388 Sunblinds. Chamberlain.
22389 Motor cars. Chambers.
22390 Weighing device. Balfour.
22391 Hub, etc., cleaning device. Birt.
22392 Fastening. Mitchell.
22393 Jar, etc., sealing. Hudson.
22394 *Electro-magnetic device. Forsberg.
22395 *Riveting device. Würzner.
22396 *Valve gear. McCallum.
22397 Valve controlling device. Rorke.
22398 *Breech mechanism for ordnance. Schneider.
22399 Road manf. Turnbull.
22400 *Anastigmatic objectives. Graf.
22401 *Flying machine. Appley.
22402 *Hydraulic power transmitting device. Radcliffe.
22403 *Door check. Ball.
22404 *Non-refillable bottle. Daignault.
22405 *Ticket printing machine. Mackenzie.
22406 *Ticket printing machine. Mackenzie.
22407 *Optical instruments. Rich.
22408 *Internal-combustion engine. Smith.
22409 Vacuum cleaner. Bourke.
22410 *Telephone. Fairweather.
22411 *Telephone system. Fairweather.
22412 *Switching device. Fairweather.
22413 *Cocks. Greatorex.
22414 Footstool. Schreiner.
22415 *Tapping rubber plants. Lacy.
22416 Sight-feed lubrication. Roberts.
22417 Dye manf. Ranaford.
22418 Traction engine. Diplock.
22419 *Compressed gas canisters.
22420 *Heading, etc., device. Schneider.
22421 *Ore concentrating jigs. Doubledee.
22422 *Spacer selecting, etc., mechanism. Boult.
22423 *Internal-combustion engine. Thomsen.
22424 *Hats. Doniger.
22425 *Roll films. Dropiowski.
22426 Photographic sensitive surfaces. Fulton.
22427 Cinder, etc. collectors. Pearce.
22428 Railway truck. Crispin.
22429 *Carburetter. Meyer.
22430 Chain grates. Bennett.
22431 *Waiters' combination tool. Steiber.
22432 Porcelain artificial teeth. Dukes.
22433 *Purifying apparatus. Theisen.
22434 *Artificial marble. Füredi.
22435 Bottles. Gunniel.
22436 Buttons, etc. Gaunt.

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22437 Colour changing signs. Cattel.
22438 Child's cycle carrier. Wasdell.
22439 Tacking, stapling, etc., machine. Fisk.
22440 Motor wind screen. Walker.
22441 Internal-combustion engine. Ruckstahl.
22442 Furnace door. Brown.
22443 Submarine escape. Gasson.
22444 Safety pin. Dunstan.
22445 Multiplication, etc., device. Gray.
22446 Roller skates. Crawley.
22447 Fog signalling. Simpson.
22448 Artificial teeth. Jennings.
22449 Watch wristlet. Smith.
22450 Cutting, etc., machine. Collins.
22451 Looms. Cook.
22452 Spring wheels. Cope.
22453 Steam generator. Bone.
22454 Safety pin. Baker.
22455 Tar spraying device. Ames.
22456 Ship's propulsion, etc. Micallef.
22457 Rigid dirigible. Cox.
22458 Receptacle for powder. Walker.
22459 Conveyor. Wrigley.
22460 Contact switch. Starkie.
22461 Wind screen. Preen.
22462 Iron roof. Thompson.
22463 Flexible coupling. Burt.
22464 Motor steering wheel. Smith.
22465 Eyeglasses. Grimes.
22466 Seed box. Ellis.
22467 *Trip-valve gear. Hargreaves.

22468 Railway trains. Row.
22469 *Gas scrubbers. Lloyd.
22470 *Letter copying. Klaber.
22471 Looms. Harling.
22472 Electric lighting device. Seal.
22473 Non-refillable bottle. Shaw.
22474 Heating, etc., substances. Morton.
22475 Railway switcehs. McMurdo.
22476 Closets. Adams.
22477 Cryptograph. Southby.
22478 *Siphon heads. Anderl.
22479 Phonographic machine. Boam.
22480 Toys. Parks.
22481 Electric horns. Lucas.
22482 Electro magnet. Lucas.
22483 Rotary valve. Temple.
22484 *Internal-combustion engine. Bell.
22485 Piano seats. Mitchell.
22486 Upholterers' springs. Joseph.
22487 Hairdressers' appliances. Snell.
22488 Spring frames for velocipedes. Shelton.
22489 Pipe wrench. Leipnik.
22490 Saucepan lids. Ireland.
22491 Hairpin. White.
22492 Hydraulic lifts. Carey.
22493 Hydraulic lifts. Carey.
22494 Sounding boards. Waller.
22495 Furnace. Smallwood.
22496 Firebox. Smallwood.
22497 Purse fastening. Raupach.
22498 Card game. Lee.
22499 Paper manf. Parker.
22500 *Wax refining. Boyen.
22501 Artist's canvas clip. Luker.
22502 Knife, etc., polishing device. Schwieso.
22503 Lubricator. Schwieso.
22504 Mattress. Roberts.
22505 *Pipe filler. Essinger.
22506 *Pure tetra-phosphor-trisulphide manf. Stock.
22507 Communicators. Williamson.
22508 *Hair nets. Kempf.
22509 Guns. Dawson.
22510 Mudguards. Harris.
22511 Brake. Reddie.
22512 Valves. Holmes.
22513 *Instruments. Baroni.
22514 Boot manf. Jerram.
22515 Pipe union. Prictor.
22516 Aerial machine. Smith.
22517 *Electric ignition apparatus. Riese.
22518 Tobacco cartridges. Williams.
22519 *Chimney flues. Schofer.
22520 Motor car fittings. Bann.
22521 Type casting machine. D'Aix.
22522 Treatment of water. Meff.
22523 *Ships. Keisslen.
22524 Lamp. Noblett.
22525 *Packing nitro-glycerine. Boult.

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22526 Nut locking. Ricketts.
22527 Water tube boiler. Petrie.
22528 Mouthpiece for ageing machine. Arnfield.
22529 Hairpin manf. Page.
22530 Carburetter. Kelly.
22531 Cots. Marriner.
22532 Indicating device. Hoyle.
22533 By-pass. Prosser.
22534 Brake. Turner.
22535 Cycle rest. Bond.
22536 Rifle. Accles.
22537 Carriage door, etc. Jones.
22538 Chairs, etc. Docherty.
22539 Tent, etc. Parrock.
22540 Ladder. Mizen.
22541 Automobiles. Bell.
22542 *Mouse trap, etc. Atkinson.
22543 *Cycle brake. Sangster.
22544 Linen manf. Anderson.
22545 Aeroplanes. Worswick.
22546 Gas production Hopkins.
22547 Lead melting device. Hill.
22548 Printers' blankets. Curbishley.
22549 Calico printing. Taylor.
22550 Variable speed gear. Slaughter.
22551 Coke filler. Hunt.
22552 Doors. Colman.
22553 Wheel. Hosch.
22554 Dynamo. MacDonald.
22555 Boot sole, etc. Wolfe.
22556 Dye manf. Levinstein.
22557 Wheels. Harris.
22558 Inkwell. Salisbury.
22559 Motor spring suspension. Tomson.
22560 Garters. Morton.
22561 *Trousers presses. Cliff.
22562 Tread stirrup iron. Craddock.
22563 *Internal-combustion engine. Crossley.
22564 *Internal-combustion engine. Crossley.
22565 Knife, etc., blade sharpening. Hibbins.
22566 Cycle. Gedge.
22567 Curtain pole and rings. Krogmann.
22568 Belt fastenings. Wood.
22569 Steel manf. Mackie.
22570 Drawing table. Buckle.
22571 Handbag. Abbott.
22572 Alarms. Rucker.
22573 Advertising device. Dickson.
22574 Delivery of liquids. Lee.
22575 Trolleys. Russell.
22576 *Photo records of curves of rheographs, etc. Blondel.
22577 Tyre. Cann.
22578 *Artificial wood grain. Bassler.
22579 Locking motor cars. Smith.
22580 *Internal-combustion engine. Bosch.
22581 *Hardening metals. Graf.
22582 Swimming device. Alexander.
22583 Cinematographs. Barber.
22584 Match lighter. Payne.
22585 Watches. Anderson.
22586 *Ammonium carbonate manf. Bulb.
22587 Pipe filler. Spero.
22588 *Internal-combustion engine. Fornaca.
22589 *Fire extinguisher. Davey.
22590 *Submarine boats.
22591 Furnace. Jack.
22592 Screw cutters. Spear.
22593 Taxi-cab indicators. Maxwell.
22594 *Electric detonators. Curtiss.
22595 Dust removing. Cooper.
22596 Cycle construction. Hiller.
22597 Pulley. Farmer.
22598 *Taps. Benkiser.
22599 Vacuum cleaner. Pride.
22600 Vacuum cleaner. Pride.
22601 Ball game. Jumeaux.
22602 Safes. Bridger.
22603 Toy. Budisaoljevic.
22604 *Gyroscopes. Smith.
22605 *Alcohol production. Morgenstern.
22606 Submergibles. Santis.
22607 Watering pots. Reeve .
22608 Gramophones. Green.
22609 *Clips for duplicating books. Black.
22610 Acetylene generator. Aron.
20611 Valve. Ripley.
22612 Door stop. Campbell.
22613 *Printing device. Droitcour.
22614 Cardboard box. Boivin.
22615 *White lead manf. Rinak.
22616 Steam engine. Wigham.
22617 Game. Isner.
22618 Reinforced concrete. Mohun.

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22619 Pencil. Moore.
22620 Tobacco pipe. Durban.
22621 Tyres. Atkinson.
22622 Hat fixing device. Haworth.
22623 Steam boiler. Bone.
22624 Steam boiler. Bone.
22625 Kettles. Hateley.
22626 Tube drawing. Schemanoff.
22627 Baby carriage. Redfern.
22628 Game Ayling.
22629 Lamp holder. Townley.
22630 Tobacco pipe. Tait.
22631 Serviette rings. Bellamy.
22632 Extraction of rubber. Clarkson.
22633 Cycle wheels. Keir.
22634 Fog signalling. Howgate.
22635 Yarn spinning. Holmes.
22636 *Internal-combustion engine. Gold.
22637 Internal-combustion engine. Beeching.
22638 Non-refillable bottle. Pugh.
22639 Bottle stopper. Mallett.
22640 Air compressor. Rees.
22641 Boiler cleaner. Gerlich.
22642 Fire alarm. Williamson.
22643 Golf club. Nicoll.
22644 Game. Thomas.
22645 Sight feed lubricator. Kirkham.
22646 Pipe joint. Yarrow.
22647 Heelpads. Lynas.
22648 Boot, etc., attachment. Relph.
22649 Forks. Myatt.
22650 Infusers. Myatt.
22651 Cap adjuster. Haworth.
22652 Push cart. Headley.
22653 Golf, etc., ball. Thain.
22654 Musical instrument. Waller.
22655 Razor sharpeners. Wareing.
22656 *Cutting weft pile fabrics. Drey.
22657 *Spinning mules. Fogg.
22658 Stoves. Helliwell.
22659 *Ventilation. Parry.
22660 Renovating foundry sand. Poulson.
22661 Speed gear. Wheeler.
22662 Massage apparatus. Winzer.
22663 *Gas generation. Kilburn.
22664 Amusement device. Taylor.
22665 Paper bag. Smith.
22666 *Valve. Alley.
22667 Fireproof fabrics. Watts.
22668 Electric generators. Burgess.
22669 *Nail dressing device. Wood.
22670 *Nail dressing device. Wood.
22671 *Nail dressing device. Wood.
22672 *Nail dressing device. Wood.
22673 Conveyors. Whitaker.
22674 Excavators. Whitaker.
22675 *Gas compressing. Schuh.
22676 *Steam boiler. McClellon.
22677 Barrels. Smith.
22678 *Wells. Azspian.
22679 Collar supports. Barnett.
22680 *Flooring. Louis.
22681 Powder puff box. Shippard.
22682 Railway trucks. Curwen.
22683 Electric lamp. Harrison.
22684 Treatment of aluminium. Pucillo.
22685 *Flat iron.. Wunderlick.
22686 Books. Fletcher.
22687 Tailors' shears. Nunn.
22688 Fastenings. Crawford.
22689 *Labels. Harper.
22690 Signals, etc. Warren.
22691 Envelope closing. Macdonald.
22692 Windows, etc. Turnidge.
22693 Game. Williams.
22694 Valves. Mort.
22695 Concrete piles. Kahn.
22696 *Kneading apparatus. Mannes.
22697 *Telegraphic characters. Urban.
22698 Furnace. Anderson.
22699 Treatment of metals. Andrews.
22700 *Steam suply to engine. Compagnie.
22701 Carriage door lock. Barrow.
22702 *Recording mechanism.
22703 Nuts. Paton.
22704 *Suppository introducer. Glover.
22705 Food. Hartley.
22706 Ordnance sight. Holt.
22707 Fruit cases. Briskin.
22708 *Electro motors. Case.
22709 Wheel manf. Keegan.
22710 Aerial craft. Cody.
22711 Tobacco pipe. Edson.
22712 Tyres. Elmer.
22713 Box lid fastening. Jobson.
22714 *Motors. Girardelli.
22715 *Means for soldering chains, etc. Lake.
22716 Rubberising hides, etc. Withey.
22717 *Induction motors. Milch.
22718 *Relating to tentering machines. Hoey.
22719 *Hosepipe. Schwarz.
22720 Tack holding device. Smith.
22721 *Plough. Rower.

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22722 Siphon baffles. Peczenik.
22723 Motor cycles. Smith.
22724 Liquid proof basket. Cuthbert.
22725 Wheels. Hargreaves.
22726 Cloth expanders. Birch.
22727 Wire fencing. Bain.
22728 Bearings. Kay.
22729 Manf. of pickers. Butcher.
22730 Filtering wet carbonized peat. Crossley.
22731 Looms. Aspinall.
22732 *Hulls of vessels. Fawkes.
22733 Electric lamps. Holway.
22734 Internal-combustion engine. Croft.
22735 Over-head tramways. Mittelhausen.
22736 Heating asphalte. Stapley.
22737 Foot hold for golfers. Rynd.
22738 Rope haulage device. Morgan.
22739 Tyres. Cairns.
22740 Mirrors. Cotterell.
22741 Wash boilers. Smith.
22742 Printing machines. Hamilton.
22743 Milk heating, etc. Nersfield.
22744 Wheel axle cap. Birchenough.
22745 *Producing nitrogen compounds. Heys.
22746 Sprinklers. Bateson.
22747 *Lift suspension device. Gladstone.
22748 *Prevention of over-winding of lifts, etc. Gladstone.
22749 Intrenching tool, etc. Beath.
22750 Barrel tilter. Andrews.
22751 Gramophones. Grindshaw.
22752 Carburetters. Garner.
22753 Carburetters. Garner.
22754 Looms. Hollins.
22755 Bottle. Gartshore.
22756 Furnace. Derrick.
22757 Tea caddies. Greenlees.
22758 Filtration of air. Brown.
22759 *Heating apparatus. Bouneau.
22760 *Time switch. Liddle.
22761 *Pump. Day.
22762 Reversing gear. Westwood.
22763 *Telescope stays. Sanders.
22764 Looms. Pilkington.
22765 Braces. Latore.
22766 *Percussion fuses. Krupp.
22767 Ornamentation of cakes, etc. Parsons.
22768 Electric heaters. Barron.
22769 *Cooking utensils. Keller.
22770 Type casting machine. Grant.
22771 Air pump. Rainey.
22772 Lamps. Pripper.
22773 Tyres. Knight.
22774 Target. Rose.
22775 Lamp. Harrison.
22776 *Lighthouses. Barbier.
22777 *Electric furnaces. Massip.
22778 Railways. Weymouth,

22779 *Salicyclic acid manf.
22780 *Dye manf.
22781 *Railways. Converse.
22782 Internal-combustion engine. Rayner.
22783 Speed gear. Kent.
22784 Tyres. Smith.
22785 Tyres. Smith.
22786 Fasteners. Whitehead.
22787 Corsets. Warren.
22788 *Drying meat. Michelsen.
22789 *Horseshoes. Twiss.
22790 Alarms. Stansfield.
22791 Cooking utensiles. Johnson.
22792 *Bessemerising copper mat. Smith.
22793 *Wood bodies. Lake.
22794 *Gas mantles. Cohn.
22795 Building blocks. Merrylees.
22796 *Rock drills. Schwarz.
22797 *Preservation of cheese. Rouy.
22798 *Rotary engine. Wheeler.
22799 Cricket bats. Sherrin.
22800 *Clocks. Boult.
22801 *Saddle. Boult.
22802 *Box. Collins.
22803 Arc lamps. Lewis.
22804 Speed indicator. Cahill.
22805 Indicators. Trelease.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to November 7th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

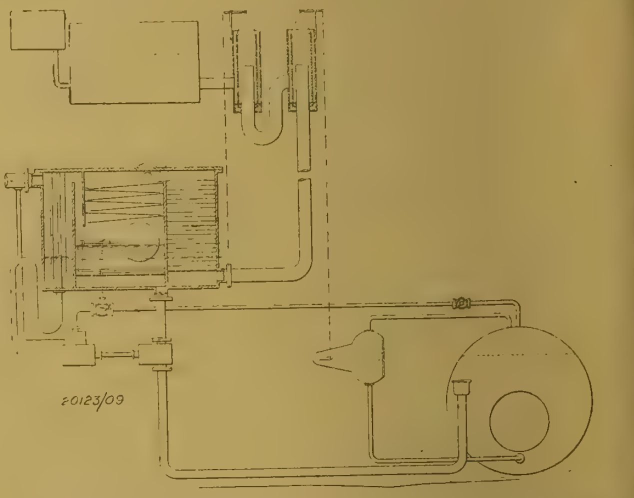
1908.

28237 Hawkins, Hawkins, and Rimmer: Propellers. [Post-dated June 26th, 1909.]

1909.

12746 Daniel and Bullock: Machines for supplying and affixing stamps and the like. 13071 Lawton: Means for preventing injury to paper, cardboard, fabrics, and other materials by insects. [Post-dated November 17th, 1909.] 15084 Rees: Centrifugal pumps, turbines, or compressors. 17286 Parker: Carburetters for internal-combustion engines. [Post-dated February 24th, 1910.] 17459 Lake (Fried. Krupp Akt.-Ges. Grusonwerk): Separation of substances by the wet magnetic process. 17486 Delage and Woog: Lighting of gas burners electrically. [Request under Section 19 of the Act not granted. 17510 Jackson and Banks: Domestic firegrates. 18368 Martin: Machine for applying to fabrics ornaments interwoven with a metal wire. [Rights under Section 91 of the Act not granted.] 19533 Sielaff: Automatic delivery machines. 19617 Smith: Internal-combustion engines. 19618 Smith: Cooling of motors especially applicable to motor vehicles. 19620 George Anderson and Co. (1905), and Grice: Band sawing apparatus. 19630 Nosworthy and Prescott: Knife and the like cleaning, polishing and sharpening surfaces. 19639 Cambridge: Apparatus for generating or producing gas. 19655 Spencer and Dawson: Means for locking wheels in position on varying gauges of tramway and like rails. 19664 Rose, and Rose Bros. (Gainsborough) Ltd.: Apparatus for applying bands, wrappers, or labels to boxes, blocks, or packages. [Application for Patent of Addition to 16740, 1909.] 19701 Wallace: Production of Isoprene. 19716 Strachan: Tyres for motor vehicles. 19741 Wood: Workman's time recorders. 19744 Koepe: Sinking of shafts. 19747 Brooks: Electrical means for securing the safe starting of motor cars and the like. 19768 Greenwood, Stocks, and White: Manf. of gum tragasol. 19779 Gwozdz: Sound boxes of talking machines. 19781 Gwozdz: Talking machine records and devices for recording and reproducing sounds. 19784 Sutcliffe: Vacuum hand cleaning and dust-collecting appliances. 19879 Sutcliffe: Combined carpet sweepers and vacuum cleaners. 19885 Koerner and Baines: Adjustable foot rest and pedal extension for pianos. 19903 Barkowsky and Trogisch: Device for milling annular grooves. 19932 Chapman: Soldering devices. 19950 Horti and Vilagossy: Recording target. 19951 Horti and Vilagossy: Automatic disappearing target for ranges. 19960 Futers: Conveying or driving chains. 19964 Torkington: Cushion or the like tyres for the wheels of road vehicles. 19969 Umpleby: Rotary internal-combustion engines. 19981 Kemp: Portable revolving stand for use in the icing and ornamenting of wedding, birthday, and other cakes. 20006 Beharell and Beharell: Protection of trees from insects. 20014 Bruckert: Carburetters of internal-combustion engines. 20020 Cowper-Coles: Armour plate. 20031 Fletcher: Apparatus for the compression of gas or air for lighting or heating purposes. 20039 Webb: Non-skid studs for the outer covers of pneumatic tyres and the like. 20046 Albert: Manf. of photographic printing paper. 20057 Cowper-Coles: Apparatus for electro-plating. 20117 Goddu: Machines for inserting previously-formed fasteners. [Date applied for under International Convention, September 3rd, 1908.]

20123 Barker: Apparatus for feeding water to steam boilers. This invention relates to apparatus for feeding water to steam boilers. The present invention aims at an improved form of water-feeding or pump-regulating apparatus of the kind that is capable not only of regulating the speed of the pump in accordance with the amount of water passing into the reservoir, but also of heating the feed water and of cleansing it from dissolved or suspended impurities which would otherwise become deposited on the boiler plates and lessen the efficiency of the boiler as well as tending to deteriorate it. An important part of the aim of the invention is so to construct and arrange the apparatus that it will regulate the amount of the feed in a simple and effective manner and that the boiler itself will have a direct influence on such regulation. According to the invention the level within the reservoir and the level within the boiler are respectively controlled from the reservoir and from the boiler. For this purpose between the supply tank and the reservoir there are provided valves which are controlled respectively from the reservoir and from the boiler or a single valve controlled from both. The reservoir is of the kind in which exhaust steam is used for heating the feed water, and according to the invention there is provided within the reservoir means for separating from such steam any oil it may contain.

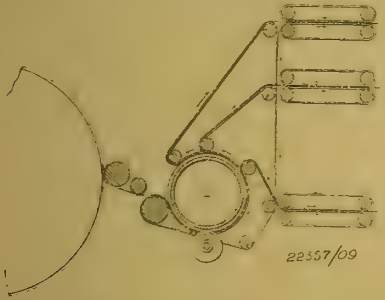


20129 Johnson (Badische Anilin and Soda Fabrik): Means for the production of long continuous electric arcs. 20132 Shortland, and British United Shoe Machinery Co.: Brakes for use in connection with slugging machines. 20137 Langford: Control of internal-combustion engines. 20150 Field: Paint-cleaning fluid. 20156 Cutler: Lenses or reflectors of lamps for motor cars, carriages, and other vehicles or for bicycle and other lamps, lanterns, or the like. 20161 Browning and Crawshaw: Ventilating apparatus. 20197 Crocker: Means for sharpening and setting saws. 20203 Landon: Apparatus for amplifying and improving the tone of musical and other sound-producing instruments, applicable also for other purposes. 20204 Marshall: Folding portable plate or drainage rack. 20213 Mavor, and Mavor and Coulson Ltd.: Floating docks. 20230 Marconi, and Marconi's Wireless Telegraph Co.: Wireless telegraph transmitting and receiving stations. 20238 Carey: Construction of mechanism for opening and closing doors and the like. 20297 Dental Manufacturing Co., and Rowse: Dental impression tray. 20321 Robertson, and Wililam Boulton Ltd: Machinery or appliances for shaping earthenware and similar articles from plastic clay or the like. 20373 Pickering and Krall: Hoisting appliance. 20382 Gilbert-Russell: Elastic metal tyres for the wheels of cycles and the like. 20398 Grant: Apparatus for casting type. 20408 Charles: Electro-thermal garments for therapeutic purposes. 20456 Chubb: Heaters of water and other liquids. 20457 Bush: Indicator for showing the time of adjustment of barometers.

20460 Houvenagel: Glass for glazing windows, paving, or other purposes. 20469 Mercer: Washing and separating machines. 20471 Cobb (Cobb): Extraction and separation of gold and silver from their ores. 20478 Richards: Apparatus for counting coins and for like operations. 20730 Walker: Hand levers working on quadrants. 20976 White: Stops for sliding sashes of windows. [Post-dated January 28th, 1910.] 21013 Parker: Automatic box-making machines. 21045 Turnbull: Flying machines and gliders. 21121 Manuel: Canister body-making presses. 21126 Blake: Valves for controlling the supply of gas to gas burners. 21245 Standring: Clarionets. 21373 Jacquelin: Flying machines. 21648 Salmon and Frost: Printing machines. 21702 Barnett: Flash lamp for signalling and the like. 21776 Holland: Tobacco boxes. 21801 Messter: Toy cinematographs. 21855 Edgeworth: Bacteriological treatment of sewage. 22054 Swainson-Brooke: Universal quick action pin hole drill jig. 22221 Eriksen: Devices for screwing and releasing boats, rafts, and the like carried on the decks of ships. 22351 Smith: Buckets or pails and mop wringers connected therewith. [Post-dated May 2nd, 1910.] 22354 Snow: Haulage clip for colliery corves and the like.

22357 Bamforth: Fleece-dividing apparatus for condenser carding engines.

This invention relates to the dividing of the fleece or sliver after it leaves the doffer of a condensing carding engine, and comprises improved apparatus for effecting the division of such fleece or sliver into as many threads or ends as may be desired for delivery to two, three, or more condenser bobbins, the object of the improvements being to effect a clean separation of the fibres and leave on each ribbon of sliver clean straight edges, any strong fibres lying across the path of the dividing apparatus and not giving way thereto being cut or severed. According to present arrangement the fleece is stripped of fibre from the doffer in the usual way and preferably by means of an intermediate roller is passed forward to the dividing apparatus which in its preferred form comprises a plain driven roller having a series of annular grooves or recesses therein of suitable depth, or the roller may be made up of a series of collars or the like secured to a shaft or small roller at intervals apart to form the series of annular grooves or spaces desired.

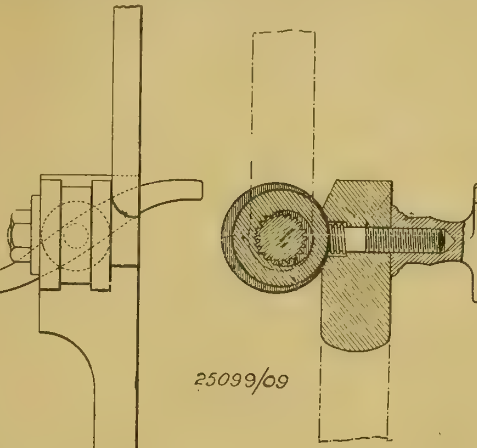


22557/09

22534 Coats: Valves of the combined mechanically and fluid-operated type. 22681 Boult (Troy Laundry Machinery Co.): Apparatus for pressing cuffs and the like. 22715 Johnson (Badische Anilin and Soda Fabrik): Means to be employed in the production of long stable electric arcs. 22736 Robinson: Vaporiser or gasifier for vaporising or gasifying petroleum or paraffin oil, benzol, petrol, and the like for internal-combustion engines. 22779 Beldam: Pneumatic tyres for vehicle wheels. 22851 Thomas: Non-refillable bottle. 23137 Klein: Swell apparatus for looms having automatic pirn, cop, or the like changing motions. [Date applied for under Rule 13, September 15th, 1909.] 23335 Wilkie: Game and apparatus therefor. 23370 Hope: Means for consuming smoke in steam boiler and other furnaces. 23445 Hudson: Coupling hoses and other pipes. 23462 Fox: Float chamber of carburetters. 23586 Forster: Tile and like cutting appliances. 23688 Silk: Flush lever bolts for doors and the like. 23823 Dean: Internal-combustion engines. 23856 Kimberley, and James Cycle Co.: Steering parts of velocipedes. 23954 Lawry: Beds capable of adaptation for surgical and other operations. 24003 Lockwood Treatment of auriferous or argentiferous minerals. 24061 Amson, Eaton, and Amson: Means for resiliently supporting wheel barrows, hand carts, trolleys, carriages, carts, and other vehicles. 24117 Pearson and Seward; Actuating mechanism. [Date applied for under International Convention, October 20th, 1908.] 24152 Sisson: Adjustable eccentrics for reciprocating engines actuated by expansive fluid. 24186 Brown and Beauchamp: Self-closing plug for casks and the like. 24379 Wetter (F. Hoffmann-La Roche and Co.): Opium preparations or products suitable for pharmaceutical purposes. 24388 British Radio Telegraph and Telephone Co., and Balsillie: Apparatus for receiving messages by wireless telegraphy or telephony. 24405 Consolidated Brake and Engineering Co., and Luard: Couplings for flexible pipes. 24504 Sharp, and Air Springs Ltd.: Telescopic air springs. 24597 Garcia: Tap or faucet for water piping. 24724 Lake (Empire Duplex Gin Co.): Cotton gins. [Application for Patent of Addition to 11428, 1908.] 24814 Smith: Game devices. 24968 Fine Cotton Spinners' and Doublers' Association Ltd., Haigh, Haigh, Bunting, and Bunting: Combing machines. 24973 Burnside: Cardboard, paperboard, or like boxes. 25006 Tilley: Atmospheric gas burners. [Application for Patent of Addition to 23810, 1904.] 25033 Seidel: Spring wheels.

25099 Auster and Auster: Joints of adjustable wind and dust screens of motor cars and other vehicles and for analogous uses.

This invention relates to the joints of angularly adjustable wind and dust screens or shields of motor cars and other vehicles and for analogous uses, and has for its object to provide a simple form of joint which can be positively locked in any angular position according to the desired position of the screen or the like, in which the fastening device is situated on the near side of the screen, facing the driver, so as to facilitate the manipulation and adjustment, and which admits of being cheaply and easily manufactured. A joint for wind or dust screens of motor cars and other vehicles and for analogous uses comprises a pivot or trunnion carried by the one part of the screen having teeth or their equivalent around its periphery, and an eye or ring surrounding the pivot adapted to be traversed by suitable means so as to cause the teeth or the like of the pivot to be engaged with corresponding teeth upon a part carried by the other or relatively stationary portion of the screen.

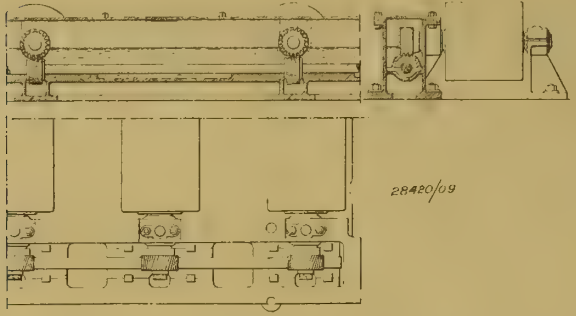


25099/09

25261 Muller: Nozzles for burning gas. [Date applied for under International Convention, November 3rd, 1908.] 25288 Booth and Booth: Installations of electric incandescent lamps connected in series. 25832 Roberts: Mechanism for filling liquids into bottles, cans, jars, and other receptacles. [Application for Patent of Addition to 1538, 1906.] 25946 Wilson and Soutar: Horticultural device for removing moss from lawns and the like. 26123 Salzmann and Co.: Lining of textile fabric for covers of automobile tyres. [Application for Patent of Addition to 18369, 1909.] 26407 Woodrow and Parkinson: Loom dobbies. 26611 Firm Geb. Regensteiner: Flat brushes and an appliance for use in the manf. of such brushes. [Date applied for under International Convention, June 11th, 1909.] 26632 Newey: Variable jet carburetter for internal-combustion engines. 26678 Mason: Metal frames to be filled with concrete or other suitable material for stair treads and the like. 26701 Paulin and Fortune: Ships' steering gear. 27013 Mannesmannrohren-Werke: Torpedoes. [Date applied for under International Convention, November 21st, 1908.] 27024 Schneider: Film packs. 27115 Birchall and James: Loose-leaf ledgers or the like binders. 27124 Burrows and Philips: Self-locking attachment for securing handles or grips to bicycles, go-carts, and the like. 27140 Arnoux: Aeroplanes and like machines. [Date applied for under International Convention, November 27th, 1907.] 27200 Walton and Smith: Device for controlling the flow of low-pressure or exhaust steam to a mixed pressure steam turbine. 27276 Matteson and Gould: Apparatus for etching printing plates. 27374 Bioletti: Reels or swifts for winding or unwinding skeins. [Date applied for under International Convention, November 26th, 1908.] 27391 Bangle and Hunter: Warp beams for looms. 27507 Hipkins: Construction of steelyards. 27737 Farrow and Smith: Speed indicators for motor cars and other vehicles. 27832 Ostergaard: Holders for sacks or other flexible receptacles. 28018 Bristow: Malt mills. 28247 Strange: Means for locking doors, gates, and the like. 28278 White and Little: Chains or chain links for elevators, conveyers, and the like. 28312 Holyoak: Lamb shelters and the like. 28331 Khuri: Self-cleaning hair brush. 28371 Stohr: Manf. milk food preparations.

28420 Lamberton: Live roller tables for rolling mills and the like.

While worm gearing is known in connection with live roller tables for other purposes, it is not usual in rolling mill practice in which bevel gearing is usually employed. This latter form of gearing not only involves a considerable occupancy of lateral space, but is also practically impossible of protection from grit and of maintenance in a state of proper lubrication. The invention has for its object to provide an improved arrangement of helical gearing obviating these disadvantages. In carrying out the invention the rollers are driven by helical ("skew") gearing from a lay shaft at right angles to their axes, and in a plane beneath them, there being secured upon the lay shaft suitably proportioned helical gear wheels meshing with like wheels secured upon the axle ends of the rollers outside the bearings therefor in known manner, but according to the invention the lay shaft and axle ends with their gear wheels are arranged in a closed casing adapted to contain lubricant immersed in which the lay shaft gear wheels run, while a stuffing box or equivalent device prevents the escape of lubricant where the lay shaft (which is driven in any convenient manner) issues from the casing.



28420/09

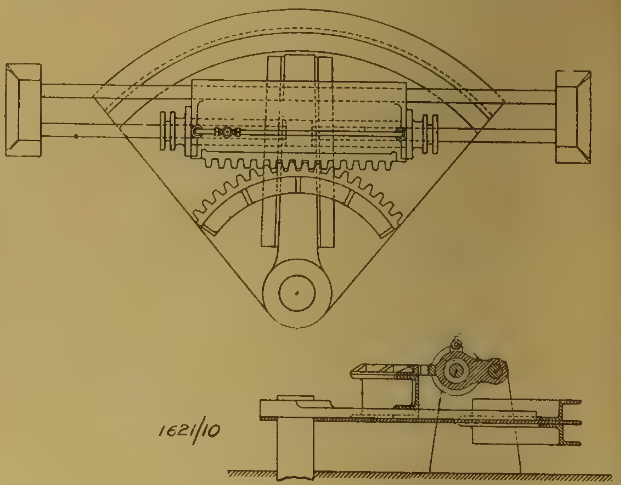
28445 Antunes: Automobiles and similar vehicles. 28462 Romer: Inter-communication telephone systems and apparatus therefor. 28489 Burnet, Temple, and Burnet and Temple Ltd.: Key chains. 28538 Whitnear: Combined means for holding pins, and means for holding a ring or rings. 28587 Wild: Racquet presses. 28603 Meker: Furnaces or ovens. [Date applied for under International Convention, January 14th, 1909.] 28609 Glaser and Muller: Process of refining salt and recovering its impurities as by-products. 28635 Baker: Machines for dividing dough and other plastic material. 28944 Ott: Hand drilling machines. [Rights under Section 91 of the Act not granted.] 29122 Greenfield: Bottles. [Date applied for under International Convention, May 18th, 1909.] 29208 Fried. Krupp Akt.-Ges.: Ordnance elevating gear. [Date applied for under International Convention, March 1st, 1909.] 29222 Maschinenfabrik F. Weigel (Nachfolger) Akt.-Ges.: Process for transporting wet spent malt. [Date applied for under International Convention, August 28th, 1909.] 29227 Gordon: Propellers. 29502 Soc. du Gaz de Paris: Apparatus for automatically controlling luminous signs. [Date applied for under International Convention, June 18th, 1909.] 29953 Hirst and Taylor: Electric conduit systems. 30145 Gehre: Automatic regulating devices for the funaces of steam generators.

1910.

179 Caldwell: Expansion augers. 665 Steel: Milk cans. 666 Steel: Glass-lined milk cans. 681 Mohrig: Subsoil ploughs. [Date applied for under International Convention, January 20th, 1909.] 1035 Dawson: Bust form. 1125 Riester: Aeroplanes. [Date applied for under International Convention, January 16th, 1909.] 1153 Yoxall, Wadhams, and Richmond: Driving chains for cycles, motor vehicles, and other purposes. 1184 How and Younger: Bench for carpenters, joiners, engineers, and the like.

1621 Paulin and Fortune: Ships' steering gear.

This invention relates to ships' steering gear, and has special reference to brakes or shock preventers or absorbers therefor of the kind comprising a cylinder mounted on a fixed rod which passes through each end of the cylinder and is fitted with a piston normally disposed centrally therein, the cylinder being filled with liquid and being adapted, when the rudder is moved, to displace liquid from one side of the piston to the other through a valve-controlled pipe or passage connecting the ends of the cylinder, and the invention has for its object to provide an improved construction or arrangement of such brakes or shock preventers that will prevent any turning of the cylinder on the piston rod and also help to take up the great thrust on the latter when a sea strikes the rudder and prevent any bending or tendency of the rod to bend thereunder. According to the invention there is combined with the fixed piston rod a fixed guide, guide rod, or the like arranged parallel to the piston rod, and the cylinder is provided with a corresponding lug or lugs or sleeve or sleeves or the like adapted to co-act therewith and to slide thereon or therein, the guide, guide rod, or the like and the piston rod together constituting a girder-like frame or structure on or within which the cylinder moves or travels in operation.

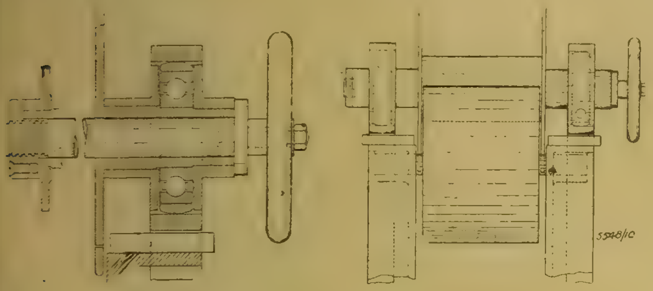


1621/10

1693 Van Praag: Drip-feed acetylene generator. 1771 Craig: Stage scenery. 1867 Muhleisen: Drilling apparatus. 1880 Campbell: Acetylene generators especially applicable for motor cars and for domestic use. 1989 O'Donnell and Abrey: Means for securing railway rails. 2227 Brinkhaus: Eyeglasses. 2275 Stromberg and Willis: Counting apparatus for meters and the like. 2480 Smith: Chain attached to wheels of motor vehicles by clips or brackets acting as non-skid and mud-splash preventer. 2591 Lord: Construction of railway passenger carriages. 2820 Dalen: Pendulum lamps. 3084 Von Mera (Brick): Apparatus for spraying or atomising liquids particularly in public places, sick rooms, hospital wards, and similar localities. 3095 Zipper: Machines for measuring, rolling up, and cutting off lengths of piece goods and also for issuing checking coupons. [Date applied for under International Convention, February 10th, 1909.] 3116 Paterson (Paterson): Surveying apparatus. 3120 Von Lossau: Steam pressure gauges and devices for measuring the speed or volume of steam. [Date applied for under International Convention, July 30th, 1909.] 3190 Von Pittler: Frictional igniting appliance. 3528 Jones and Scott: Circular knitting machines. 3767 Macomber: Trousers stretchers. 3769 Storm: Projectiles. 3770 Samaia: Mechanical block system for tramways. 3778 Olinger: Geographical clocks. [Date applied for under International Convention, February 15th, 1909.] 3915 Siemens Bros. Dynamo Works Ltd. (Siemens Schuckertwerke Ges.): Voltage regulation of dynamo electric machines. 3967 Gauthier: Apparatus for the manf. of packing rings. [Date applied for under International Convention, June 15th, 1909.] 4307 Cornell: Combined cock and lubricator. 4426 F. H. Ayres Ltd., and Rook: Handles for cricket bats, hockey sticks, and the like. 4571 Kestner: Apparatus for concentrating liquids. 4601 Williams: Suspension hooks. [Application for Patent of Addition to 7778, 1909.] 4686 Thompson (Excelsior Needle Co.): Spring beard needles. 4687 Thompson (Excelsior Needle Co.): Manf. of spring beard needles. 4730 Paul, and William Bain and Co.: Double-cased timber and metal-framed buildings. 4732 Hayward: Windmills. 4862 Delecot: Automatic feeding apparatus for horses and other animals. 4988 Paquette: Wrenches. [Date applied for under International Convention, March 15th, 1909.] 5269 Morin: Apparatus for measuring the surface area of skins and leather. [Date applied for under International Convention, March 15th, 1909.]

5548 John Hetherington and Sons Ltd., and Hamer: Sliver or ribbon lap machine.

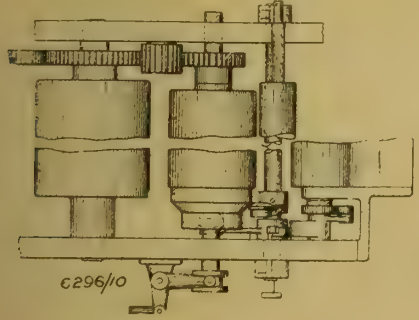
This invention relates to improvements in sliver or ribbon lap machines, and has for its object to minimise friction on the bosses of the lap plates. This object is attained by the application of ball or roller bearings applied to the weight racks by which the necessary pressure is given to the lap as the slivers or ribbons are wound on the bobbin. All the foregoing parts are of the usual construction and operate in the ordinary way as is well understood. For the purposes of the invention the head of each weight rack is in the form of a ring, inside which is fitted any suitable type of ball or roller bearing in which the balls or rollers are free to rotate in a race and travel round the lap mandrel as their centre of motion, but preferably the ball bearing shown best in the detail view, fig. 2. To this end upon each lap plate is fitted a boss and a pair of flanged sleeves *h*, *h*ʹ. These flanged sleeves, in conjunction with the ring or circular head of the weight rack, form a box within which is fitted tightly on the boss so as to turn with it a ring grooved to receive a series of balls (or rollers) also fitted in an outer grooved ring and positioned by an intermediate perforated ring. This outer ring is preferably surrounded by a ring with a convex outer surface which bears against the interior of the rack head to diminish friction in the event of the rack not hanging in a truly vertical position, or, in other words, to allow the rack to adjust itself automatically to the bearing.


5948/10

5812 James: Machine for cleaning tin (and other metal) covered plates. 5837 Lee: Furnace grates. [Date applied for under International Convention, March 23rd, 1909.] 5927 Thompson (Maschinenfabrik Augsburg-Nurnberg Akt.-Ges.): Form of horizontal injector for internal-combustion engines using liquid fuel. 5942 Heinrich Lapp Akt.-Ges. fur Tiefbohrungen: Drill head for core drills. [Date applied for under International Convention, October 28th, 1909.] 6033 Firm Weckerlein and Stocker: Rotary contact breakers for magnetos for dual ignition systems. [Date applied for under International Convention, April 20th, 1909.] 6054 McCarthy: Rope clamps. 6055 Tetzner: Heat, sound, and moisture-proof lining or facing block for buildings. 6148 Johnson: Metal cans, boxes, bottles, and the like.

6296 Hollingsworth: Inking apparatus for printing machines.

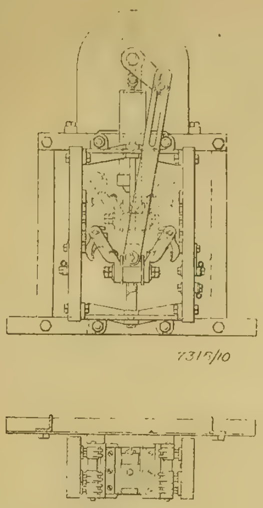
This invention relates to improvements in the mechanism for operating the fountain and messenger rolls of an inking apparatus. In a convenient construction the messenger roll is mounted in rocking arms carried by a shaft which is operated to oscillate the messenger roll between the distributing and the fountain rolls, and secured upon this shaft is a lever arranged to be engaged by a conical cam on the distributing roll. The fountain roll is actuated by means of pawl and ratchet mechanism, which mechanism in turn is actuated by an oscillating lever acted upon by the conical cam on the distributing roll. Means may be provided for adjusting the oscillating lever to increase or diminish its distance of travel upon the cam, and the distributing roll has cylindrical surfaces of different diameters at the sides of the conical cam.


6296/10

6397 Wolfram Lampen Akt.-Ges.: Support for incandescence filaments in electric glow lamps. [Date applied for under International Convention, March 15th, 1909.] 6515 McCallum: Method of making tags. 6557 Harrison: Chandelier and other analogous chains. 6868 Konecke: Three-phase current arc lamp. [Date applied for under International Convention, March 19th, 1909.] 6941 Smith: Method or system of and means for preventing the wooden felloes, spokes, and hubs of vehicle wheels from shrinking or expanding and for preserving them from decay. 7071 Edwards: Wrapping machines. [Date applied for under International Convention, April 9th, 1909.] 7079 Mackenzie (Reid): Apparatus and method of hydrating lime. 7190 Treude: Lead seal.

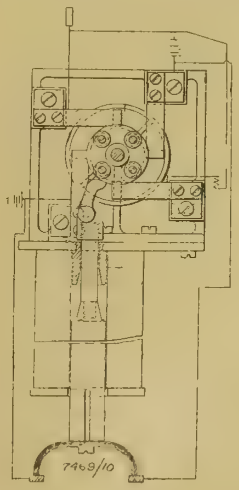
7318 Adams Manufacturing Co. (Cutler Hammer Manufacturing Co.): Starting switches for polyphase alternating-current induction motors.

This invention relates to improvements in alternating-current motor starters. In addition to the two sections of vaiable resistance, a third resistance is used, so that a section of resistance is provided for each of the three phases of the secondary winding. These resistances are so proportioned that the current in the three phases of the secondary winding will be sufficient to start the motor under a given load with the resistance in circuit. The controller is provided with means for removing the third section of resistance from circuit when the other two sections are removed from circuit. The third section of resistances is preferably short-circuited after the other two sections have been removed from circuit.


7318/10

7469 J. Stone and Co., and Darker: Change-over switches for electric lighting and other systems for railway carriages and other vehicles. [Post-dated ctober 27th, 1909. Originally included in 7425, 1909.]

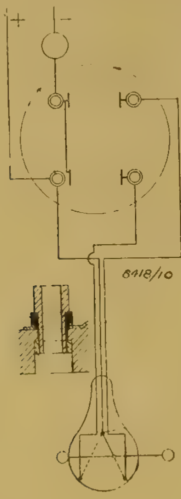
This invention relates to improvements in and connected with change-over switches for electric lighting, heating, cooling, and ventilating systems for railway carriages and other vehicles. The particular systems to which this invention is applicable are those in which at least two batteries of accumulators are employed. According to this invention the solenoid is arranged vertically and has no spring, so that the core is sucked up quickly when the winding is electrified, and when the circuit is broken the core drops by gravity. The result is a quick operation of the change-over switch which, however, need not be arranged to change over the batteries at every operation of the solenoid, but if desired only after several operations of the solenoid, which operations take place each time the dynamo is switched in or cut out.


7469/10

7567 Post: Machines for surfacing parquet floors. [Date applied for under International Convention, March 29th, 1909.] 7580 Slater and Benham: Vehicle wheels. [Date applied for under International Convention, June 19th, 1909.] 7581 Stocker: Gauging attachments for rules. 7799 Novak: Cut-outs or circuit breakers for overhead electric conductors.

8418 Lundberg, Lundberg, and Lundberg: Electric switches.

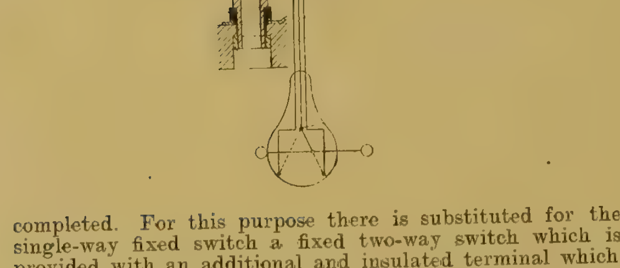
According to this invention all difficulties with wiring are obviated and the necessity for the making and insulation of soldered joints is done away with when it is desired to obtain full control of a lamp or of lamps from an additional, and it may be a movable point after the wiring has been completed. For this purpose there is substituted for the single-way fixed switch a fixed two-way switch which is provided with an additional and insulated terminal which serves to receive and connect electrically the end of one of the supply leads with an end of one of the leads connecting the two switches.



8515 Schneider: Shrapnel or other similar projectiles. 8611 Lavertine: Clamping devices. 8645 Antoni and Antoni: Propellers. [Date applied for under International Convention, April 10th, 1909. Application for Patent of Addition to 28481, 1909.] 8709 Galaine: Process for the hermetic closing of thin metal tubes and receivers after they have been filled. [Date applied for under International Convention, November 10th, 1909.]

8922 Chamberlain and Hookham Ltd., and Sprague: Prepayment electricity meters. [Patent of Addition to 3250, 1910.]

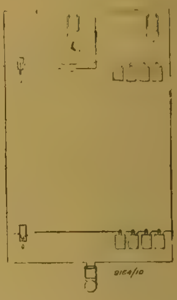
The present invention consists of certain improvements in prepayment mechanism for the prevention of fraud and increased certainty of operation, and consists of three parts, viz., making both pallets of the escapement capable of movement independently, means for making the whole escapement movable to allow of the escape wheel being forced backwards, and making one or both pallets of the escapement double so that such pallet operates to some extent as a subsidiary escapement.



9043 Miller: Means for joining up lead and compo pipes to be used in substitution for plumbers' joints.

9164 Snow and Radley: Electrical signalling apparatus.

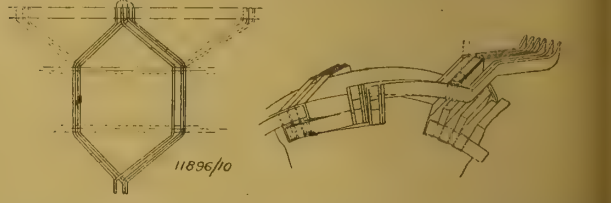
This invention relates to an improved system and apparatus for electrical signalling, intended more particularly for pit shaft signalling, but applicable also for like purposes where the transmission of code signals in a clear, distinct, and definite manner is essential. A switch box and battery are provided at the pit bank and a similar switch box and battery at the pit bottom, the switch boxes being fitted respectively with sliding keys. Each sliding key has a pair of contact arms engaging one one side with a continuous contact plate having wire terminal and engaging on the opposite side with one or other of a pair of separated contact plates fitted with terminals, the contact plates being recessed into renewable insulating liners in the sides of the box. The sliding key is fitted with a spring or other equivalent device by which it is retained in its lower and normal position. The battery in each case is connected to the upper terminal of the switch box, the battery being arranged in circuit with the bank bell and bottom bell on the main wire, whilst the battery is likewise arranged in circuit with the bank bell and bottom bell on a the main wire, and also with the engine room bell on a branch wire.



9261 Coates: Production of fertilisers. [Date applied for under International Convention, April 26th, 1909.] 9330 Brown and Court: Toasting forks reversible either before or over the fire. 9344 Marks (Hill): Brake shoes. 9498 Wagner and Von Radinger: Manf. of tubes of paper or other fabric. [Date applied for under Rule 13, December 4th, 1909. Application for Patent of Addition to 9240, 1909.] 9572 Smith: Apparatus for facilitating the reading of time tables and the like. 9773 Clough and Edmondson: Damping and dewing machines. [Date applied for under Rule 13, November 24th, 1909.] 9816 Mack: Warp let-off motion for weaving looms. 9884 Salpetersaure Industrie-Ges., and Pauling: Process of manufacturing nitrites and nitrates. 9950 Walters: Apparatus for teaching the art of aeroplaning, applicable also for amusement purposes. 9973 R. and W. H. Symington and Co., and Cox: Ladies' bust improvers. 10054 Ettlinger and Ettlinger: Protecting devices or conduits for underground electric cables. 10167 McCanlis and Leder: Handles for pails and similar vessels. 10180 Robinson: Nails. 10219 De Saint-Senoch: Pneumatic suspensions for vehicles. [Date applied for under International Convention, April 28th, 1909.] 10236 Johnson: Spark arresters. [Date applied for under International Convention, October 8th, 1909.] 10365 Nicholls: Knitting machine. 10467 Ainge: Tube cleaners. 10536 Von Devoorde and Wilkens: Automatic lighters. 10563 Beelman: Endless chain water motors. [Date applied for under International Convention, May 3rd, 1909.] 10613 Wright: Cigar, cigarette, and like cases. 10828 Hooppaw: Means for preventing draught and the like in windows. 10833 Jonsson: Milking machines. 11133 Roat: Hat. 11148 Dowell: Caps or stoppers for bottles, jars, tins, or the like. 11498 Tremblay: Box openers, nail extractors, ice picks, and the like. [Date applied for under International Convention, May 20th, 1909.]

11896 Siemens Bros. Dynamo Works Ltd., and Pickering: Armature windings of dynamo electric machines.

This invention relates to formed coils for drum armature windings made in well-understood manner by bending strips or bars of copper or other conducting material into suitable shape for insertion into the slots of the armature core, and consists in providing in a dynamo electric machine a stepped armature winding of the kind referred to consisting in coils without joints at their back ends, the collective insulation of those half coils which lie side by side in the top of any armature slot being performed after the coils have been assembled around the circumference of the armature core.



11907 Gabet: Bullets. [Date appied for under International Convention, May 29th, 1909.] 12040 Valour: Machines for separating caoutchouc from the bark of rubber-yielding plants and for other similar purposes. [Date applied for under International Convention, November 29th, 1909.] 12124 Butler and Rockman: Construction of suspension railways. [Date applied for under International Convention, May 17th, 1909.] 12705 Wood: Workman's time recorders. [Date applied for under Rule 13, August 28th, 1909.] 12715 Kubicek: Method of and means for analysing the composition of colours. [Date applied for under International Convention, May 25th, 1909.] 12722 Kaufmann: Loom heddle frames. 12740 Walton: Garment supporters. 12798 Hampel: Inkstand with pen wiper. 13127 Fresen: Furniture locks. 13496 Samuel: Automatc vending machine for small address books arranged in groups. 13940 Seabrook: Method of forming a self-lubricating bearing, and product of the method. [Date applied for under International Convention, July 6th, 1909.] 13982 Akt.-Ges. Hannoversche Eisengiesserei: Tube cleaners. [Date applied for under International Convention, June 21st, 1909. Application for Patent of Addition to 28433, 1908.] 14016 Sefton-Jones (Firm of Johann A. Wulfing): Digestive remedy and process for preparing the same.

14355 Siemens Bros. and Co. (Siemens and Halske Akt.-Ges.): Signalling apparatus operated from a distance. [Application for Patent of Addition to 14240, 1909.]

> The present invention refers to a modification of the method in which, for greater certainty and precision in working, a magnet, serving the function of a detent, is mounted on the stationary or other part of a signalling apparatus, in front of the poles of which masses of magnetic material, or magnetic material provided with teeth or projections, move as the indicator shaft rotates, the magnetic masses or projections being arranged upon the periphery of a disc or drum at equidistant intervals. These drawbacks are obviated by making use of the magnet or magnets forming the main magnetic field of the signalling apparatus for the auxiliary directive force, for which purpose the main magnet ot magnets are provided with projections or polar extensions which extend to the disc or the like carrying the magnetic masses or projections. These polar extensions thus form a magnetic shunt to the main field of the instrument.

14364 Farbenfabriken vorm. F. Bayer and Co.: Process for the production of pressed or shaped cellulose compounds from cellulose esters. [Date applied for under International Convention, July 26th, 1909.] 14587 Hatherell: Staples for wire fencing. 15020 Boult (United Shoe Machinery Co.): Thread-waxing devices. [Date applied for under Rule 13, August 31st, 1909.] 15123 Potts: Automatic telegraph transmitters. [Date applied for under Rule 13, June 29th, 1909.] 15129 British Loose Leaf Manufacturers Ltd. (Sieber and Trussell Manufacturing Co.): Loose-leaf binders. 15369 Loughney: Abdominal-fat reducing apparatus. [Date applied for under International Convention, July 1st, 1909.] 15392 Bloxam (C. F. Boehringer and Soehne): Manf. of new quinine compounds. 15409 Bader: Eyeglass mountings. 18096 Rheinische Metallwaaren und-Maschinenfabrik: Artillery ammunition. [Date applied for under International Convention, January 22nd, 1910.] 19178 Becker: Friction transmission mechanism. [Date applied for under International Convention, November 9th, 1908. Originally included in 25239, 1909.]

COMPLETE SPECIFICATIONS OPEN TO PUBLIC INSPECTION BEFORE ACCEPTANCE, UNDER THE PATENTS ACT, 1907.

1909.

23641 Beskow and Ramen: Feeding device for mechanical roasting furnaces.

1910.

1879 Niclausse and Niclausse: Steam boilers. 3421 Soc. Anon. Electro-Metallurgique (Procedes Paul Girod): Method of supplying electric furnaces with polyphase currents. 6240 Fried. Krupp Akt.-Ges.: Safe or steel chamber walls. 7279 Calphas: Machines for cutting candied peel and other kinds of foods and analogous purposes. 9963 Firm P. Paul Laucks: Penholder. 13700 Pulvermacher and Bremermann Ges.: Machine for forming articles from plastic material by means of formers. 13985 Siemens and Halske Akt.-Ges.: Receiving and registering appliances for electric signals. 14839 Bradley: Pipes. 14844 Cassel: Crude oil soap or soap lye and process for manufacturing the same. 15316 Anker-Werke vorm. Hengstenberg and Co.: Automatic intermittent couplings. 16154 Johnson, Johnson, Johnson, and Johnson: Machine for imitation stitch marking in the manf. of boots and shoes. 16922 Robertson: Packing devices for rods and the like. 17078 Vogel: Process of working internal-combustion motors and apparatus therefor. 17195 Shaw: Combined cocks and needle valves. 17550 Berrigan: Apparatus for expression of liquids from solid matters. 17733 Viette: Combined visible indicator and luminous signal-indicating apparatus. 18119 Carl Zeiss: Levelling instruments with reversible spirit level and an arrangement to enable the level to be used also in the opposite direction. 18670 Siemens and Halske Akt.-Ges.: Railway

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traffic protecting device. 19255 Bateman and Levett: Anchors. 19257 Clark: Piano actions. 19547 Garwood: Runner cutters and plant toppers. 19562 Chemische Werke vorm. Dr. Heinrich Byk: Process for dehydrating perborates. 19591 Lund: Dies. 19601 Caille: Photographic reproduction of colours. 19602 Magnesite Co.: Process for freeing liquified carbon dioxide from air and apparatus therefor. 19671 Galvao: Incandescent vapour lamps. 19718 Le Rouge and Chapuis: Aeroplanes. 19779 Regnard: Automatic stabilisers for aeroplanes and the like. 19799 Lassen: Machines for stoppering bottles by means of capsules. 19806 McLane: Wrenches for screwing flanges or sockets on pipes. 19807 Von Risch: Fuses for ordnance shells. 19887 Mautner: Apparatus for determining the passage of a ship's gun on board ship through a given elevation. 19935 Von Pittler: Machinery for the transmission or distribution of motive power by means of liquids. 19949 Blum, jun.: Device for closing drag nets. 19965 Bates: Machines for lasting or otherwise forming or shaping boots and shoes.

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Patents and Designs Act, 1907.

Notice is hereby given that Dr. Adolf Frank, of 26, Berlinerstrasse, Charlottenburg, near Berlin, Germany, Professor, seeks leave to amend the Specification of Letters Patent No. 19534, of 1909, granted to him, for "IMPROVEMENTS IN AND CONNECTED WITH METERS."

Particulars of the proposed amendment were set forth in the illustrated Official Journal (Patents), issued on the 28th September, 1910.

Any person, or persons, may give notice of Opposition to the Amendment (on Patents Form No. 18), at the Patent Office, 25, Southampton Buildings, London, W.C., within one calendar month from the date of the said Journal.

(Signed) W. TEMPLE FRANKS,
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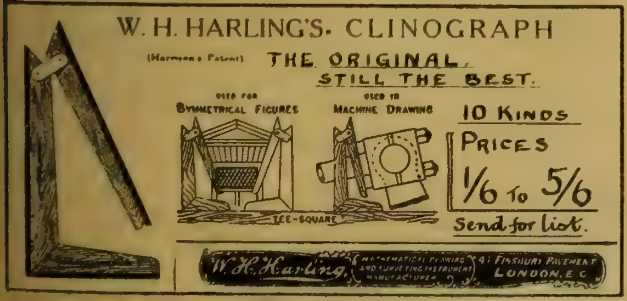
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THE FUTURE OF AERONAUTICS.

THE second season of flying performances as a popular spectacle has come to an end, and, from an engineering point of view it may be worth while reviewing the progress, if any, which has been made since the first public demonstrations made by the Wright Bros.

As a spectacle the great so-called "Aviation Meetings" have fallen somewhat flat. They do not compare favourably with a good circus. The uncertainty of the flights coming off, and the general tediousness and long intervals between the events, are features which the public who frequent such affairs will not put up with; and to the average man the events themselves are somewhat meaningless, if not senseless. For instance, great jubilation is displayed among aviators over height records, but to the plain man such records have little interest. If a flying machine is to be of any earthly use whatever, it will be as a means of locomotion from place to place on the earth, or as a military scouting machine, whose business will be also closely connected with earthly affairs. Neither passengers nor goods will be booked for a station in the clouds a mile or two overhead, nor will much scouting be required among the clouds. All the events are much the same; as a spectacle for the education of the public, and the advancement and encouragement of the science and art of aviation, these meetings have been a flat failure; and the money spent would have done more good laid out in other directions for the advancement of the flying machine's construction problems.

The encouragement of the solution of engineering problems of great difficulty, and requiring profound knowledge and talent, by means of prize hunts is a new feature of the times; the prizes going to the men who display the greatest skill and nerve in *driving* the flying machine, nothing being held out to the man who may spend his time and money in *improving* the very defective machine.

This prize-hunting phase of the flying machine's course of progress is, however, likely to be short-lived. The results, except to the prize winners, are too insignificant.

Looking back to the first of the accomplished flights, there is an extraordinary lack of improvements, more extraordinary inasmuch as it is such a novel subject for improvement. The machines are not much different from Professor Langley's of 10 years ago; it is the same machine, with Wright Brothers' improvements for lateral balancing, and a petrol engine as the prime mover. At this date we have the monoplane and biplane in considerable numbers, but taken as a whole from an engineering point of view the differences between one machine and another are so slight that they hardly constitute a feature of novelty. Some carry a tail; some have no tail; another puts the propeller in front, and calls it a "tractor"; another puts his propeller behind; some use wing warpers, others for the same purpose use auxiliary aeroplanes; rotary cylinder engines are affected by many, others try their luck with a rotary crank engine, and so on—ringing the changes.

Given half-a-dozen elements, it is possible to make a great many different combinations; but all that is not improvement. It may be experimental, and result in experience which may enable a choice to be made between one combination and another, but they do not make for fundamental improvements.

Apparently it is the only type of flying machine which can fly at all, is this aeroplane machine. No other machine differing essentially has made any show of flying.

The number of drivers who can fly the machines has much increased; this was to be expected; these are the people for whom the prizes are offered; and the past season of flying-machine circuses has shown that under favourable circumstances the aeroplane can be managed in flight by any robust persons with all their faculties—if they care to take the risks.

The subject has come to stay as an engrossing one for mechanical engineers; and although the sporting interest may decline, the scientific interest will never grow less. So much accomplished will compel study and investigation, and in that way lies the hope for the future of the flying machine, in any utilitarian sense.

Proposed Sugar-beet Factory for Dorset.—A public meeting was held in the Victoria Hall, Wimborne, on the 4th October, to discuss a project for the growing of sugar beet in Dorset, and particularly for the erection of a factory on Lord Alington's estate at Crichel. Mr. George Richards, chairman of the Wimborne Urban District Council, presided, and was supported by Mr. Hill, agent to Lord Alington, Mr. Sigmund Stein, of Liverpool, who has carried out many experiments in sugar beet growing, Sir John Hanham, Captain Carr S. Glyn, and Captain Gooden-Chisholm. Mr. Hill exhibited a number of roots of sugar beet which were grown on Lord Alington's home farm at Crichel; and Mr. Stein estimated that they would weigh 35 tons to the acre, but as a fair average he thought they could count on growing 20 tons to the acre, comparing with an average of only about 12 tons in Germany. Both the soil and the climate of Dorset, he said, were highly favourable to the growth of sugar beet. Mr. W. H. Baxter, of Sherbourne, had grown excellent sugar beets, of about double the yield of the German beets, and much richer in saccharine constituents. It cost only about £10 an acre to grow sugar beet; the haulage of the roots to the factory might cost about £3, and £1 per ton would be paid for the beet, leaving a profit of about £7 net, besides which the residuals were of much value. They wanted 2,000 acres of roots to begin with. Telegrams in favour of the movement were read from landowners of the district, owning between them some 300,000 acres. Lord Alington had set apart a farm of 550 acres entirely for beet growing and for the erection of a factory. Mr. Stein said that the factory would cost £150,000. If the farmers would guarantee another 1,500 acres of beet they could proceed.

New Clyde Graving Dock.—The Clyde Navigation Trustees at their last monthly meeting unanimously adopted the report and plans of the special committee on the proposed graving dock and the acquisition of Renfrew Ferry. The committee, which was appointed nearly two years ago, decided that a graving dock of greater dimensions was necessary, and that the financial position of the trust justified the trustees in taking steps with a view to its construction. Plans which had been prepared by the engineer were approved generally, and were submitted to the Admiralty, who assured the committee that the dock would be suitable for his Majesty's ships of the largest type. The dimensions of the dock, as shown on the plan, are 1,020 ft. long on the floor, divided into two sections of 600 ft. and 420 ft., the width of entrance being 100 ft., and the depth on sill 36 ft. at average high water of ordinary spring tides. The capital cost is estimated at half a million sterling.

Railway and Harbour Material.—According to the Straits Settlements *Government Gazette* plans and estimates have been prepared for a hill railway to be constructed in the Settlement of Penang at a cost of £214,000 dols. (about £25,000). A contract has been made, according to H.M. Minister at Mexico City, between the Mexican Government and Senor Francisco S. Noriega for the construction of a railway line from Tomacoco, State of Mexico, to Xochitepec, State of Morelos, a distance of 31 kiloms. The line may be extended to Totolápam, provided that notice of the proposed extension is given to the Government within four years from the present time. Materials, etc., for the construction of the line may be imported free of duty. Regarding the concession for the construction of a railway in Honduras, the line is to run from the port of La Ceiba, on the Atlantic coast, to Yoro, a distance of about 100 kiloms. A branch line may also be built to the Bay of Hizopo or Obispo. The concessionaire undertakes to build a wharf 700 ft. long and 34 ft. wide, either in the Bay of Obispo or at La Ceiba. Materials and plant for the work may be imported free of duty. The *Diario Official* publishes a decree, approving the plans of the San Paulo-Rio Grande Railway Company, for the construction of 38 miles of line on the San Francisco section of the Company's line. The cost of construction is estimated at 4,343,500 milreis (about £290,000). The company engages to increase its rolling stock by the addition of three locomotives and a number of passenger coaches and goods wagons. A notice has also been issued by the Ministry of Communications and Public Works, inviting tenders for the construction and service of harbour works at Fortaleza, State of Ceará. The upset price is put at 16,019,000 milreis (about £1,068,000). A deposit of 40,000 milreis (about £2,700) will be required to qualify tenders, to be increased to 80,000 milreis (£5,300) by the successful tenderer. All the material, etc., which may have to be imported for the execution of the works will be exempt from import duties. The Gold Coast *Government Gazette* states that a survey has been sanctioned with a view to the construction of a branch line of railway to serve the Bibiani gold fields, which are situated some 70 miles north-west of Dunkwa station. Survey work has also been carried out with a view to the ultimate extension of the railway northwards from Mangoase. The *Reichsgesetzblatt*, Austria-Hungary, contains a notice granting to Josef Mosdorfer, of Weiz, Johann Hutter-Höfler, of Birkfeld, Richard Hofbauer, and Karl Rintelen, of

Graz, a concession for the construction and working of a light railway from Weiz to Birkfeld. The concession is for a term of 90 years. The *Bolletino Finanze, Ferrovie* (Rome) states that the "Società Generale Italiana Edison" have applied for a concession for the construction of an electric tramway from Milan to Crema, passing by way of Pacello, Bisnate, Spino, Pandino and Ombriano. The line will be 26 miles long.—*Board of Trade Journal.*

Shipbuilding Returns.—From the returns compiled by Lloyd's Register of Shipping, it appears that, excluding warships, there were 368 vessels of 1,154,197 tons gross under construction in the United Kingdom at the close of the quarter ending 30th September. These figures represent an increase of 36,000 tons more than that which was in hand at the end of last quarter and exceeding by 376,000 tons the total building twelve months ago. Also big warships were under construction representing a tonnage of 312,515. Other countries' totals are as follows (excluding warships):—

	No. of vessels	Gross tonnage.
Austria-Hungary ...	9	38,620
British Colonies	10	10,133
France	22	91,426
Germany	50	139,117
Japan	24	37,112
U.S.A.	66	117,603

Cadiz Harbour Works and Plant.—With reference to the Cadiz harbour improvement works, the British Acting Consul at Seville (Mr. A. Henderson) reports that, since the rescission of the contract with the Società Veneta, negotiations have been going on between that company and the Cadiz Board of Harbour Works with a view to the acquisition by the Board of the dredging and other plant belonging to the company, but the negotiations have broken down owing to the demands of the latter. Should no agreement be arrived at, operations on the harbour works will probably be suspended for another eight or ten months while the necessary plant is purchased elsewhere. It is understood that the Harbour Board will be authorised to finish the construction of the first quay, already begun, under their own management. Tenders will then be invited for the remainder of the works, which are not considered so urgent.—*Board of Trade Journal.*

Members of the Manchester Association of Engineers opened their fifty-fifth "discussion session" on October 8th. In the afternoon a visit was paid to the University, where, after being received by the Vice Chancellor, they visited the laboratories, the Christie Library, and the Museum. In the evening, at the Grand Hotel, the President, Mr. William Fox, chief mechanical engineer of the Manchester Ship Canal, gave his inaugural address. Mr. Fox reviewed the progress of engineering during the lifetime of the Association, and in the course of this review he emphasised the part mechanical engineers had played, and must continue to play, with increasing efficiency in securing economical methods of production, and especially economy in the use of coal. The chief note of the address was an insistence on the need of more theoretical education. In the past, he said, it has been our endeavour to develop our practical qualities, which object it was admitted we had very successfully accomplished, but, he regretted to say, at the expense and to the detriment of theoretical training. While we had been so contented, our great competitors, Germany and America, had realised the true value of technical training, and their systems of education might be described as the finest in the world. It was interesting to note that while our position was principally due to practical ability, that of Germany and America might be said to be almost entirely due to superior educational training; and when we considered that practice was in no way antagonistic to theory, but, on the contrary, that the one was supplementary to the other, it was easy to see the enormous advantage which would accrue to us when we realised our responsibilities, individually and nationally, and did our duty by providing the means which would enable our educational authorities to solve the complex and difficult problem upon which they were engaged. Our technical institutions, which represented our system of higher engineering education, were in some instances splendidly equipped and staffed, in others very much the reverse. In the case of the latter this unsatisfactory condition was almost entirely brought about by the dependence of these institutions upon municipal and voluntary contributions for their maintenance—a very haphazard system, to say the least of it. It was to the State that we must look for the provision of the means. The best talent of the nation, in whatever rank it might be found, would be required to make the engineer of the future, and such talent should be developed by and at the expense of the State. It would take a very great effort to establish a complete system, and the first important step towards the attainment of this object should be the co-operation of all members of the profession in the initiation of reform. By such co-operation representations could be made to the State educational authorities for a national system of education financed by the State, specialised for the thorough instruction of engineers, and systematised by the combined knowledge of the educational authorities and the profession.

THE PRINCIPLES OF IRONFOUNDING.

By Prof. A. Humboldt Sexton, F.C.S., F.I.C.

(*Continued from page 357.*)

Geological Distribution of Sands.

The sands which are used are usually not those which are being deposited now by the rivers, but those which have been deposited in the past. Constant changes are taking place in the rivers of the world; they cut for themselves new channels and so abandon the old ones; as they cut deeper the currents tend to become less rapid, and the fall to the sea is less, and changes also are constantly taking place in the level of the earth compared with that of the sea, it rising in some places and falling in others. As a result, the masses of material deposited by the streams are left, and undergo changes.

1. There are the quite recent sands obtained from rivers as they exist to-day. These are but little used, though the sands of the Clyde Estuary and, no doubt, of some other rivers are collected to some extent at low tide and used in the foundry, if not too coarse and rounded (see fig. 85).

2. *Sands of the Tertiary Period.*—These have been deposited in times geologically very recent, but historically very remote, usually by existing rivers when they flowed in a different course from that in which they now flow. Such sands are usually found in the valleys of the great rivers. They differ from quite recent sands in being sands and not silts, in being partially drier or having become partially oxidised, so that the organic matter has to a large extent disappeared, and the clays are usually yellowish in colour, from the presence of ferric hydrate. Most of the sands in ordinary use belong to this group, and contain angular grains, as shown in figs. 86 and 87.

3. *Sands of the Secondary Period.*—These were deposited in times much more remote, and have therefore undergone more change. They are usually more or less consolidated into rocks; the clay has lost its excess of water and has become hardened into a sort of shale, so that it is not plastic, but becomes so on the addition of water. In some cases the sand particles are cemented to-

gether by clay partially hardened, and when these are crushed and moistened they become sufficiently plastic for use. The rock sands of Scotland and other places are of this character.

4. *Sands of the Primary Period.*—These, as a rule, have passed beyond the stage of being useful sands for foundry work, and have become hardened into sandstones, the grain being cemented in various ways. If the cementing material is clay still not dehydrated, as in its ganisters, it may be useful after crushing. Shales are common in the upper part of the series; these clays are partially hardened, still retaining their water of hydration, and are largely used for brickmaking. Many of the sands have become so hard as to be of no use, except as sandstones for building purposes; if the cementing material is clay it has lost its water of hydration, and so no longer becomes plastic when moistened.

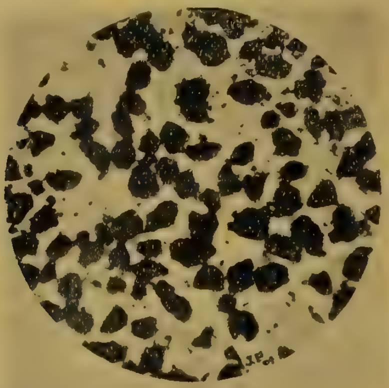


FIG. 85.—Photomicrograph of Clyde River Sand through 80 mesh. Magnified 30 diams. Showing partially rounded grains.

It must not be supposed that any one type of sand is strictly confined to the geological period mentioned; they are only given as being typical, and almost any variety occasionally occurs in all the periods.

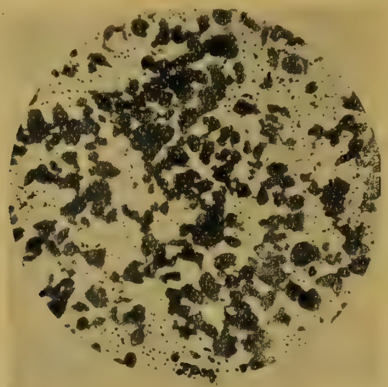


FIG. 86.—Photomicrograph of Belfast Red Sand. Magnified 30 diams. Showing sharp angular grains and fine particles of clayey material.

Assuming a moulding sand to consist of silica cemented together with clay, we should have therefore:—

1. Recent.—The clay contains a large quantity of excess water.
2. Tertiary.—The clay contains little excess water, but the sand retains its plastic character.
3. Secondary.—The clay has lost most of its excess water, the sand has ceased to be plastic, but becomes so on addition of water.
4. Primary.—The clay has lost its water by hydration, and the sand has passed into a sandstone, which even after crushing does not become plastic on addition of water.

GEOGRAPHICAL DISTRIBUTION.

Good foundry sands occur in most parts of the world, and those which occur locally are almost always used. As the sand is required in large quantities and must be of fairly uniform quality, a deposit to be of any use must be of large size, and it must be of fairly uniform composition. Except in special cases, it will not bear the cost of carriage, and therefore will only be used locally. There are a few sands which have such a good reputation that they are sent all over the United Kingdom, such as the sands of Erith and of Belfast. As a rule, however, this is simply because the founders are familiar with their properties, and feel that they can trust them, and so go to the expense of importing and using them rather than either finding local sands suitable for their purpose or making a mixture.

PREPARATION OF SAND.

Sand, as received, is never fit for use. For moulding it must be perfectly uniform, whilst as received it will be far from that; even though the average composition of a sand, cargo after cargo, may be the same, the composition of separate portions will not be uniform. There will be irregularities, perhaps clayey nodules, at any rate some portions will be far more clayey than others; then there may be pebbles or fragments of wood or other material, which must be removed, so that the preparing consists of (1) drying, (2) grinding, (3) sifting.

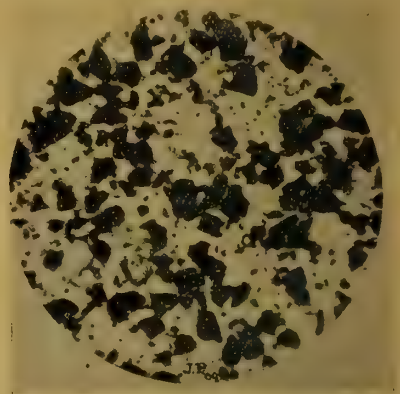


FIG. 87.—Photomicrograph of Silica Sand. Magnified 30 diams. Showing very angular grains, but no "bonding" material.

DRYING.

The sand, as received, will always be moist; the clayey particles will therefore adhere together into plastic masses, and any attempt to separate them must be futile. Drying is often neglected, but unless the sand is dried it is impossible to attain a uniform mixture. All that is necessary is to expel the moisture, not the combined water on which the plasticity of the sand depends, and for this a temperature of about 100 deg. Cen. (212 deg. Fah.) is all that is needed, or even considerably less if a longer time be given.

The sand is best dried on a floor heated beneath by flues, through which the products of combustion from a fire pass; a floor similar to that used for drying bricks is convenient. Even long exposure to the air with constant turning will do a good deal, or exposure to the sun, but heating on a floor is the only efficient method to dry by artificial heat.

PULVERISING.

To a certain extent the friction of the particles during sifting will break down the lumps, and in many foundries all the pulverising the sand gets is breaking down by means of shovels as it is thrown on to the riddles. In most large foundries, however, special pulverising appliances are used.

It is not necessary to describe in detail any of the many appliances that are used. The old-fashioned simple-edge runner is still largely used, in spite of its grinding action, which is obviated in the modification shown in fig. 88; and there are many modern and much more efficient mills, such as the "Griffin" mill, fig. 89, and various forms of impact disintegrators.

SIFTING AND MIXING.

Sifting is still largely done by hand screens, either round riddles held in the hand or inclined screens, against which the sand is thrown by means of a shovel. The coarse material which fails to pass through is crushed with shovels or in a crusher and again put on, and finally the fine material is thoroughly mixed by hand, turning by means of shovels. This is probably as efficient a way of mixing as any, but it is very slow and therefore very costly. The problem is, of course, not only to ensure that the material is sufficiently fine, but also that it is thoroughly mixed. It often happens that other materials have to be added and well mixed in, and this can best be done when the sand is being sifted and mixed, otherwise it needs a separate operation.

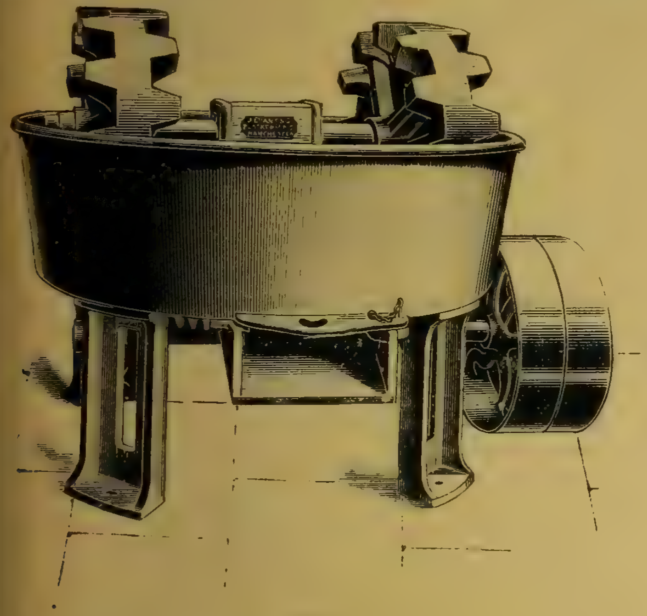


FIG. 88.

A large number of mixing and sifting machines have been devised, and most of them are quite efficient. For a detailed account of them the reader is referred to Bale's "Modern Iron Foundry Practice," Vol. I., chapter VIII., but perhaps the most convenient form is the centrifugal mixer, as shown in fig. 90. This type, as made by Messrs. Evans, has three sets of bar grids, one of which is stationary and attached to the removable side, whilst the other two rotate at about 1,000 revolutions per minute by belt drive. From 3 to 4 H.P. enables the mixer to deal with 2 tons of sand per hour, and the small size weighing 5 cwt. with 18 in. diameter grid takes up only 30 in. by 30 in. of floor space.

FLOOR SAND.

The floor of the foundry is always a layer of sand, in which moulds can be made if necessary, and which can be used for moulding in flasks. As work goes on, this floor sand becomes a most heterogeneous mixture of materials, whilst, however, it still serves its purpose. It consists of sand and burnt sand, *i.e.*, sand from the face of the castings in which the clay has been dehydrated, charcoal and coal dust, parting sand, and other things which may have been accidentally mixed in. It is still plastic, but is not good enough to take the sharp impression and retain its form as is required by a good moulding sand.

FACING SAND.

When the mould is made it is obvious that only a small portion of the sand comes in contact with the pattern and afterwards with the metal, the bulk of the sand serving only as a backing. The backing is made of the "floor sand," but the portion which comes in contact with the pattern is made of a fresh mixture, called in this connection "facing sand," because it forms the face of the mould. It is, of course, the real moulding sand in which the mould is made.

The basis of the facing sand is usually the floor sand or "black sand." This black sand will to some extent have lost its plasticity, because the clay will have been partially burnt, and it may not be sufficiently permeable to allow of the ready escape of the gas displaced from the mould. It is therefore mixed with some fresh sand to give it plasticity. The more clayey or "fatter" the fresh sand is, the less will be required, whilst the leaner it is, the more will be needed. In order to give porosity, coal dust or some other similar material is mixed in. The heat decomposes the coal dust and leaves a more or less porous mass of coke, which helps to make the sand open. The proportion of new carbonaceous matter to be used will vary very much; if new sand be used entirely it may need as much as 10 per cent, but if floor sand is used it may be considerably less. The following mixtures have been given for ordinary facings: New sand, 20 parts by volume; black sand, 20 parts by volume; coal dust, 5 parts by volume. In place of floor sand, sharp or road sand may be taken, and instead of, or with, coal dust, horse dung or other organic matter may be used.

Such mixtures as the following have been recommended: New sand, 20 parts; road sand, 20 parts; horse dung, 2 to 4 parts; coal dust, 5 parts; or new sand, 40 parts; black sand, 20 parts; road sand, 20 parts; coal dust, 9 or 10 parts. The mixtures may be varied infinitely, and as all the constituents may vary very much in composition, no definite proportions can be of any real importance.

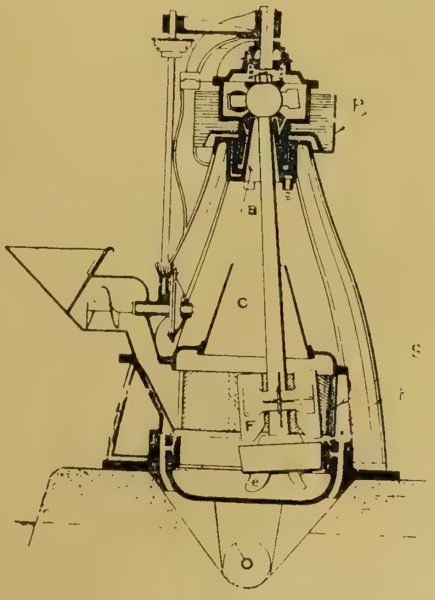


FIG. 89.

CORE SAND.

In making cores, *i.e.*, parts of the mould which are to be almost entirely surrounded by the molten metal, and which may not be very well supported, a sand of great strength is required; such a mixture is usually called core sand. The making of a core requires great care, and the sand must be strong, otherwise it does not differ in any way from ordinary sand. It is often considered as being different, because materials are often intermixed which are not ordinarily used, but which would be available for facing sand of any kind.

Sand Mixtures.

As will be seen from what has been said above, pure sand as it comes from the pit is rarely used, but the founder adds such substances as he may think desirable to modify its properties. He may make these additions in such quantity that the material may become rather an artificial sand mixture than a natural sand. The additions are for the two opposite purposes of (1) giving openness or porosity, and (2) increasing the binding power; and, of course, neither would be needed if a sand exactly suited to the purpose required were obtainable.

In the case of a "fat" sand the addition of some substance to give porosity is absolutely essential. It would seem at first sight that good, clean sea sand, which is almost pure silica, would be a good thing, but the particles of this are so round that it would lack binding power; hence floor sand or burnt sand, *i.e.*, sand in which the clay is dehydrated and has thus lost its plasticity, is used; or road sand—the material worn off granite or macadam roads—which consists mainly of particles of silica, may be used. Powdered coal dust is largely utilised, as mentioned above. This has the advantage that, being solid, it can be rammed hard, but that directly the heat of the metal reaches it it is decomposed, and a more or less porous mass is left; as the hot mould gases contain excess of oxygen, it is burnt away, and thus spaces are left. The coal used must be more or less bituminous; anthracite would probably be of little value.

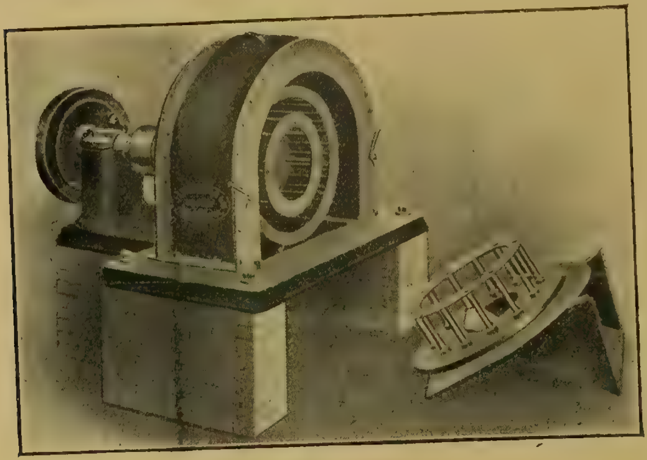


Fig. 90.

The principal binding material used is clay, and by keeping a supply of dry ground clay the founder can increase the strength of his sand very considerably. Clay is not employed for this purpose as much as it might be. Clay has the disadvantage that it shrinks very much on drying. This is not of much importance for green sand moulding, where the mould is used moist, but it is very objectionable in the case of dry sand moulding, where the mould is artificially dried before use. The principal cases of dry sand moulding are the manufacture of cores, and for these, therefore, many other binding materials are used. It must be borne in mind that the use of these binding materials is by no means necessarily restricted to core making, but they may be used in any case where the properties which they impart are required.

All the binding materials except clay are of organic origin, and are therefore charred by heat, thus rendering the sand more porous, and, if judiciously used, they are of great service in the foundry.

Among the most generally used may be mentioned flour of any kind, but preferably wheat flour, which is thoroughly mixed with the dry sand, and the whole is then moistened. Dextrine or British gum (core gum), which is prepared by heating starch with sulphuric acid, starch boiled with water to a fine paste, a more or less gelatinous liquid obtained by boiling oatmeal with water, powdered resin, oils of various kinds, crude paraffins, or linseed or other oil, sugar usually in the form of treacle, and many other materials have been suggested. In many foundries the foreman has some private mixture, which he compounds with great secrecy, but it is almost invariably one of the materials above mentioned. There are also a number of proprietary preparations on the market, which are no doubt good, but are rather costly.

(*To be continued.*)

WORTHINGTON ELECTRICALLY-DRIVEN TWO-STAGE TURBINE PUMP AT TYWARNHAILE MINE, CORNWALL.

A two-stage turbine pump guaranteed to lift 1,000 gallons of water per minute against a natural head of 200 ft., which, together with a vertical, 100-H.P., three-phase, 440-volt, 50-period squirrel cage induction motor, running at a full-load speed of 960 revolutions per minute, is bolted to the channel iron forming the pump frame, constructed by Messrs. Worthington Pump Company Limited, of 153, Queen Victoria Street, London, E.C., has been recently installed for pumping out the water at the Tywarnhaile Mine in Cornwall. The illustration given is a general view of the pump in position for lowering down the mine, and the following description is abstracted from a paper by Mr. W. R. Thomas, manager of the mine, and read before Institution of Mining and Metallurgy:—

The power station contains three $15\frac{1}{2}$ in. by 16 in. three-cylinder, single-acting Westinghouse gas engines operating at 250 revolutions per minute, each having a normal capacity of 130 B.H.P. running on suction gas. The alternators, each 90 k.w. three-phase, 440 volts, 50 period, are direct-coupled to the engines, each set being supplied with a belt-driven 110-volt exciter. The main starting arrangement consists of a small air compressor, direct-driven by a Campbell engine, which is supplied with its own gas producer, thus isolating it from the rest of the plant. A nest of air tanks is fixed opposite each engine, which are, however, interchangeable, and these are kept charged at a pressure of 250 lbs. per square inch. The compressed air is admitted to one cylinder only, and its admission is regulated by a valve operated by a cam fixed on the end of the camshaft outside the crank case.

The gas plant consists of three Dowson producers, each rated at 160 H.P., with coke and sawdust scrubbers. Each producer is fitted with a hand fan for blowing up in case of emergency, but under running conditions a fan driven by a 2 H.P. induction motor supplies the necessary air. These three sets are direct-connected with a 15 in. gas main supplied with the necessary valves for changing over, as and when required. The whole series is therefore interchangeable, and either set of engines can be run off either gas producer.

The gas producers are erected immediately outside the engine room, and the coal is delivered on a platform built at a level with the top of the producer, from which it is fed by a bucket into its feeding hopper. The whole station is supplied with an ample water supply drawn from a concrete tank built at such a level as will give a supply by gravitation. The fuel used consists of washed anthracite pea nuts, $\frac{3}{4}$ in. to $1\frac{1}{6}$ in. in size, imported at Portreath, and carted from there to the mine. The power house is provided with a five-ton hand crane, which will serve any part of the building.

The main pump shaft is situated about 180 ft. from the power house, and the cables are of the 0·2 square inch three-core pattern, lead covered and armoured. The cable supplying curent to the sinking pump motor is mounted on a drum (fixed in a small building near the mouth of the shaft), to which is attached a small hand capstan which permits of it being payed out or taken in easily by manual labour.

Slip rings are attached to the end of the cable, which is securely fastened to the drum, and these in turn are connected to the feeder panel by means of a joint box. The cable from the drum is led through one of the legs of the head gear, direct over a 4½-ft. pulley, down the shaft to a joint box securely attached to the pump frame. The leads are taken from the joint box direct to the vertical motor operating the pump. Thus far no difficulty has been experienced in handling the cable; in fact, the arrangement described has been satisfactory in every way.

An auto-starter is fixed in this building, and the starting and stopping of the pump is therefore done at surface. On the top of the shaft a head gear 25 ft. in height has been erected, together with a large motor-driven capstan of sufficient power to ensure a very easy handling of the pump, together with its 26 ft. suction pipe, and the discharge column with the weight of water therein contained. The capstan is so arranged as to give a speed of 1 ft. per minute in the shaft. A small electric winch has also been erected in the same building alongside the capstan, for the purpose of lowering timbers, ladders, discharge pipes, etc., etc.

Pump in Position for Lowering Down the Mine.

The pump, as has been already mentioned, is of the two-stage turbine type. The motor is provided with an umbrella-shaped top protruding over the sides, which are also totally covered. The object of this is to prevent any moisture getting in, and at the same time to ensure sufficient ventilation. The weight of the motor is taken up with an adjustable ball-thrust bearing, and the impeller shaft is also taken up on a thrust bearing, the two shaftings being connected by coupling held together with a number of small bolts enclosed in rubber washers. The latter thrust bearing is provided with a water-cooled chamber.

Directly above the pump is a throttle valve which governs the discharge, while immediately above this a check valve supports the weight of water contained in the discharge pipe in case of a stoppage. Before starting, the pump is primed with water from the rising main, and the throttle valve is then closed. This latter valve is then opened slowly so as to build up the load gradually. During the unwatering the throttle valve was so regulated as to keep the motor running up to its normal working capacity, and in this way it was found that the reading of the ammeter on the feeder panel could be easily adjusted to the desired number of amperes. The weight of the whole pump is taken up on a specially-made flexible steel-wire rope, which passes over the pulley on the top of the "shear-legs," down around a solid wheel fastened to the pump frame, the "dead" end being made fast to a 3 in. shafting fixed on the top of the head gear. The pump is beautifully balanced, with its suction and rising main, and has been lowered to the 40-fathom level without guides or supports of any kind. The discharge pipes are 10 in. in diameter, and are made of $^3/_{16}$in. lap-welded steel, the flanges riveted on. These have been supplied in 12-ft. lengths, and the joints consist of rubber washers.

As an example of the balancing of the pump, it may be stated that the whole apparatus has been lowered with 200 ft. of piping, from suction to discharge, with a couple of men steading the discharge pipe only.

As regards the cost of maintenance, at the time of writing about 600 gallons per minute are being delivered, from a total depth of 160 ft., with the throttle valve open four rounds out of sixteen rounds for wide open. The total cost of repairs from June 1st to January 7th, inclusive, was 8s. for new packing, and during the whole of this period no difficulty of any kind was experienced with the working of the pump.

During unwatering operations the pump requires the attention of one man on each shift, and particular care should be given to the strainer at the foot of the suction which, during the time that slimy water is being pumped, has a tendency to get its water way practically choked. It is interesting to state that a 26 ft. suction pipe was used, and provided that the strainer was kept resonably clean there was no difficulty in getting the water down to the suction, even when there was a vertical height of 200 ft. from suction to discharge.

The foregoing comprises a brief statement of the plant used, together with the results obtained in unwatering the upper half of an old mine, which has always been considered to be "wet," and which, according to existing records, has experienced constant difficulty and great expense in pumping. It should, perhaps, be stated here that a permanent station pump, of the same design as the sinking pump, will shortly be fixed at the 40-fathom level, on completion of which the unwatering of the second section will immediately be proceeded with. It may be noted that the whole of the plant described has been run by men who have never had any previous experience in either gas engines, gas producers, or electric pumps. Three men are employed in the gas-producer house, one on each shift. The producer generally runs for 48 hours, when a fresh producer is put on, and the former, immediately the charge is free from gas and somewhat cooled down, is subjected to clinkering, when it is again ready for commission.

It has been found necessary to clean out and re-charge the sawdust scrubbers at intervals of about three months. The coke in the coke scrubbers has not yet been changed, and there is reason for believing that this will not be neecessary for at least 12 months from the start. In the writer's opinion it is necessary to pass a sufficient quantity of water through the coke scrubbers to thoroughly wash and cool the gas. It has been noted that when the sawdust scrubber gets warm a good deal of water accumulates in the gas main, and should the engine take any of this over the result is usually a damp sparking plug. The brick linings in the producers are apparently good for a long period. Three such sets of producers, with two in constant use, can be easily looked after by the amount of labour stated.

The engines have thus far run remarkably well, and, practically speaking, have given but little trouble. Their speed remains practically constant, and the governor, therefore, requires but little attention. The consumption of fuel varies in proportion to the amount of load given to the engine, but at anything between three-quarter and full-working load conditions the consumption can, in the author's opinion, be safely taken at from 1 lb. to 1¼ lbs. of coal per horse power per hour.

AN IMPROVED ELECTRICITY METER.

THE electricity meter we are about to describe provides suitable means for indicating the amount due from a consumer to a supply company or authority on account of electric energy supplied, the system on which payment is made being in accordance with the following principle:—

As is well known, there are at present several methods of charging for electric energy supplied to consumers. One of these is known as the maximum demand system, according to which the consumer is required to pay at a fixed rate per kilowatt of his maximum demand plus a fixed rate per kilowatt hour consumed. Thus, for example, these rates might be £7 per annum per kilowatt and one penny per kilowatt hour. With these rates, if the consumer's maximum demand during one quarter were 10 kw. and the energy supplied during this period were 2,000 units or kilowatt hours, the amount due from him would be

$$\tfrac{1}{4} \times £7 \times 10 + 2000 \times £\tfrac{1}{240},$$

that is £17 10s. + £8 6s 8d. or £25 16s. 8d.

This system of charging, although it affords an excellent basis whereby the payments made by any consumer are properly related to the expenses incurred by the supply company or authority in meeting his demand, has nevertheless two disadvantages. These are: (1) Two instruments are necessary, one to record the maximum demand, and the other to record the number of units consumed, both of which instruments must be accurate; (2) consumers are unwilling to adopt the system, owing to a feeling of injustice that their payment will be largely dependent on their requirement in an emergency, which may only occur once or twice in a quarter.

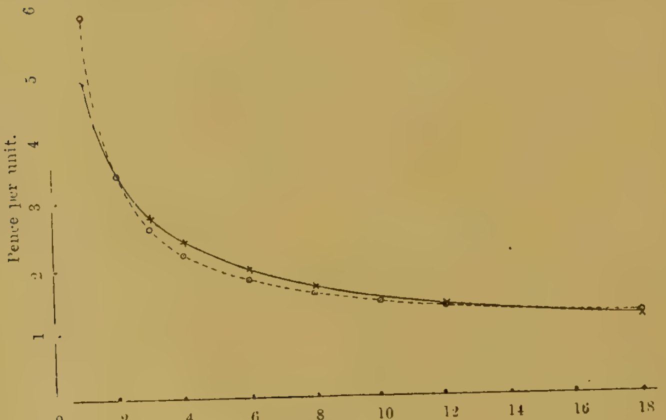


FIG. 1.

The object of the present improvements is to provide a system from which these two disadvantages are eliminated, but in which the essential feature of the maximum demand system is retained, viz., that consumers must pay at a rate depending upon the irregularity of their demand.

In particular, the system consists in charging at a fixed rate per unit multiplied by a variable factor representing the degree of irregularity. The most convenient factor for the present purpose is the ratio of the square root of the mean square of the current (generally known to electricians as the "root mean square current") to the mean current. Put into mathematical language, this ratio is

$$\sqrt{\frac{\int_0^T c^2\,dt}{T}} \quad : \quad \frac{\int_0^T c\,dt}{T}$$

in which C represents the value of the current during any interval of time dt, and T represents the arbitrarily chosen period of time in which this factor is operative, such, for example, as a quarter of a year.

Taking this factor, the amount due from a consumer on account of energy supplied will be

$$a \times \frac{V}{1000} \times \int_0^T c\,dt \times \frac{\sqrt{\dfrac{\int_0^T c^2\,dt}{T}}}{\dfrac{\int_0^T c\,dt}{T}}$$

in which a is the fixed rate per unit, and V the voltage of supply, assumed constant. This expression is equal to

$$\frac{a\,V}{1000} \times T \times \sqrt{\frac{\int_0^T c^2\,dt}{T}}$$

$$\text{or} \qquad a \times \sqrt{\frac{V^2\,T^2}{1,000,000} \times \frac{\int_0^T c^2\,dt}{T}}$$

$$\text{or} \qquad a\sqrt{\frac{V^2\,T}{1,000,000} \times \int_0^T c^2\,dt}$$

In the improved type of electricity meter under consideration the speed of the registering mechanism at any time is proportional to the square of the current. Such an instrument will produce a record proportional to

$$\int_0^T c^2\,dt,$$

and if the registering apparatus is so constructed that it indicates this quantity multiplied by

$$\frac{V^2\,T}{1,000,000},$$

it is then only necessary to take the square root of the meter record for the period of time in question and multiply it by the fixed rate a in order to arrive at the payment due from the consumer.

The invention therefore consists in providing a modified ampere hour meter such that the rate of producing a record shall depend on the square of the current, combined with a registering mechanism that will give an indication in terms of (amperes squared) hours multiplied by the number of hours in any definitely chosen interval multiplied by the square of the voltage of supply and divided by one million.

Such an instrument may be provided with a dial, which shall indicate in any suitable manner the square root of the quantity referred to in the previous paragraph, the mechanism for this dial being such that at the end of each definitely chosen interval the pointer or pointers can be set back to zero.

The description given above is intended to apply to any direct-current supply system. If, however, an alternating-current system is in question the rate of payment will be at a fixed rate per unit registered, the registration of the meter being produced in precisely the same way as already described, the only modification necessary in the construction of the meter being that the iron portions of the magnetic circuits in which there is an alternating magnetic field must be suitably laminated.

If the supply is a single-phase system, no modification of the above description is necessary; if, however, the supply is a polyphase system, a suitable constant must be introduced into the multiplier for converting the number of revolutions of the meter into the required reading on the registering dials. For example, if the supply is three-phase, the amperes-squared hours must be multiplied by

$$\frac{3\,V^2\,T}{1,000,000} \text{ instead of } \frac{V^2\,T}{1,000,000},$$

as explained above, V in this case representing the voltage between phases and the current actuating the meter being the current in one of the phases. Suitable constants for other polyphase systems are known to experts.

Fig. 1 of our illustrations shows two curves demonstrating that the essential feature of the maximum demand system is inherent in the system proposed. Fig. 2 shows diagrammatically a meter constructed in accordance with the above improvements. Fig 3 shows in one form how the various dials indicating the record of the meter may be arranged, and fig. 4 refers to a constructional detail applicable to a special form of meter constructed on the described principle.

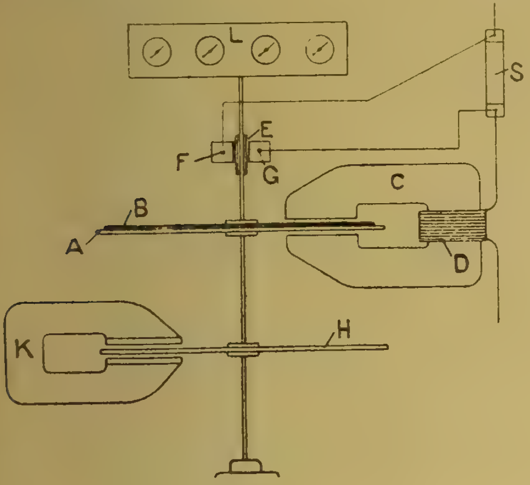


Fig. 2.

Referring to fig. 1, in this figure two curves are shown, of which each represents the price per unit actually delivered as depending upon the number of hours per day during which the supply, supposed uniform during that time, is maintained. The curve shown by the dotted line refers to the maximum demand system in which payment is made at the rate of £7 10s. 0d. per annum per kilowatt of maximum demand plus one penny per unit. The curve shown by the full line refers to the system described in this invention in which the rate of payment is one penny per unit multiplied by the ratio of the root mean square current to the mean current. On comparing these curves it will be seen that there is close agreement throughout the entire range from 18 hours per day to one hour per day, and it is therefore clear that the system proposed herein possesses the same feature as the maximum demand system, namely, that the actual price per unit is graduated so as to take account of the irregularity of the demand. It will be seen, however, on consideration, that the two systems do not give the same result in the case when an unusually large demand occurs once or twice a quarter. This may be illustrated by means of the following example:

Suppose that a consumer's load is a uniform demand of 10 kilowatts for six hours per day, but that for two hours during a quarter the actual demand is 20 kilowatts. On the maximum demand system the quarterly payment would be: $\frac{1}{4} \times 20 \times 7 \times 240 + (91 \times 6 - 2) \times 10 + 2 \times 20$ pence; that is, 13,880 pence. On the other system the payment would be:

$$\sqrt{91 \times 24} \times \sqrt{10^2 \times (91 \times 6 - 2) + 20^2 \times 2} \text{ pence}$$
$$= 11{,}000 \text{ pence}$$

In other words, the consumer has to pay in the one case for the extra units £17 11s. 8d., and in the other case 6s. 8d. It is thus clear that the objection urged against the maximum demand system by the consumer cannot be urged against the system proposed herein. It will also be clear from the foregoing and from the subsequent description of the apparatus required to carry out this invention that the other objection is also met, in that only one instrument of a simple description is required for any installation.

Fig. 2 shows more or less diagrammatically one form in which an instrument may be constructed on the principles described above. The particular form is a modification of the well-known disc type of electricity meter. A disc or armature A of insulating material is fixed to the spindle through the centre. On the disc are a number of coils of insulated wire B arranged as in the ordinary disc type of meter and connected up to a commutator E fixed to the spindle. Bearing on this commutator are two brushes F and G. Another disc or armature H of suitable material, such as aluminium, is attached to the same spindle so that it can rotate between the poles of a permanent magnet K. Another magnet C of soft iron is arranged so that its poles are above and below the disc A. This magnet is excited by means of a coil D of insulated wire, through which flows the current from the supply mains. In circuit with the coil D is a shunt S, from the terminals of which connections are made to the brushes F and G. On the passage of any current from the supply mains the magnet C is excited and a current flows through the coils on the disc A, such current being proportional to the main current. The iron core and the other parts of the electro-magnet are made of a sufficient cross section to ensure that with the maximum current to be dealt with the magneto-motive force required for the iron part of the magnetic circuit is negligible in comparison with that required for the air gap. It will be seen therefore that the torque tending to make the discs rotate is proportional to the square of the main current, and, as the retarding torque, due to the permanent magnet K and the disc H, is proportional to the speed of rotation neglecting friction, it follows that the speed of rotation is proportional to the square of the main current. Registering gear is provided, as indicated in the diagram by the letter L, whereby the number of revolutions in any given time is indicated in any convenient manner. Under these circumstances the record produced by the instrument will be in terms of amperes-squared hours.

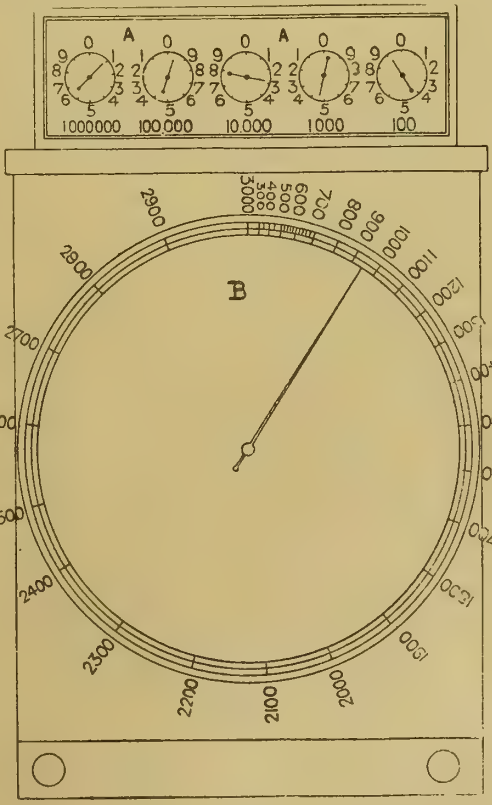


Fig. 3

Fig. 3 shows the exterior appearance of one form of meter constructed on the principles described, in which the dials for indicating the record proportional to the number of revolutions are shown, and also a single dial for indicating the record proportional to the square root of the number of revolutions.

It will be seen that the upper dials A A are of the usual kind arranged for reading up to ten million, and that the single large dial B is graduated to read up to 3,000. The needles of the upper dials and that of the large dial are connected by ordinary toothed or worm gearing to that part of the meter, the movement of which is to be recorded or indicated. The scales on the upper dials are all uniform, and the record is therefore proportional to the movement of the meter. The scale of the large dial, on the other hand, is such that the reading is proportional to the square root of the angular movement of the needle, and the indication is therefore in terms of the square root of the movement of the meter; that is to say, it is proportional to the payment to be made. Mechanism is provided so that this needle can be replaced in the zero position at the end of every quarter, when the meter reading is taken. Any suitable mechanism can be used for this purpose, such, for example, as is contained in stop watches.

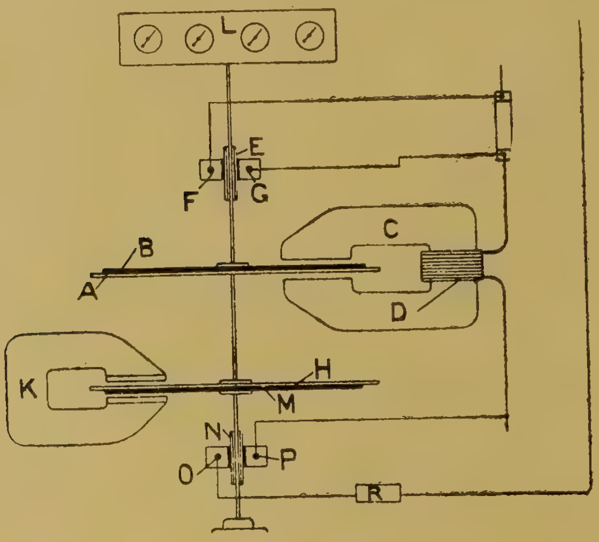


Fig. 4.

These dials might be used for a meter intended for a normal maximum supply of 10 kilowatts, readings to be taken every quarter or three months. One complete revolution of the pointer on the large dial would correspond to a demand of 10 kilowatts for about 12 hours per day throughout the quarter, and the graduation should therefore be sufficient to act as an indication to the consumer of his liability at the end of the quarter. A more exact statement is obtained by taking the square root of the difference of the two readings on the upper dials at the beginning and end of the quarter.

An improvement in the construction of a meter of the form shown in fig. 2 is illustrated in fig. 4. It may be necessary in such a meter to take special precautions to neutralise friction, as the propelling force, which varies as the square of the current passing, may be very small for small values of the current. For this purpose a set of coils is provided on the disc H, which rotates between the poles of the permanent magnet K. These coils are connected up in the usual way to a commutator N on the spindle, and two brushes O and P bear upon this commutator. These two brushes are connected in a suitable manner to the supply mains, a resistance R being connected if required in circuit in one of the connections, so as to keep the current in the coils M down to a suitable value. The supply voltage being constant, there will be a constant current in the coils M, and therefore a constant propelling force due to this current and the magnet K, and, with suitable design, this force can be made to counterbalance the retarding force due to the friction of the mechanism, brushes, etc. This device is obviously only applicable to direct-current systems.

The above improvements have been patented by Messrs. Siemens Brothers Dynamo Works Ltd., of Caxton House, Toothill Street, Westminster, S.W., in conjunction with Mr. Francis Sydall.

THE VANDERVELL SYSTEM OF MOTOR CAR LIGHTING.

The manufacture of automobiles has recently made rapid advance, and the method of lighting has kept pace with these improvements, necessity having undoubtedly dictated many of the improvements in lighting, for, obviously, as the speed of the cars increased, lamps of greater power became necesssary in order to ensure safety in driving. The infinite superiority of electric lighting over all other forms is at once obvious; convenience of control and cleanliness, entire absence of smell, smoke, dirt or heat, are only a few of its many advantages.

Messrs. Vandervell commenced to study the question of motor car lighting in 1900, and continued their experiments until, in 1902, they standardised a successful set of side and tail lamps. In 1903 the firm placed the first electric headlight upon the market, which proved as successful as the set of side and tail lamps previously introduced. The one and only drawback—if it could be considered such—was the inconvenience of having to charge the battery supplying the current more or less frequently. To overcome this Mr. C. A. Vandervell, in 1904, invented a variable speed dynamo to automatically charge the battery; this was the first of its kind, and several of these machines are even now still running satisfactorily. Since then the design and manufacture of the lamps, as well as the self-contained dynamo lighting system, has been continuously improved.

An ordinary dynamo is acknowledged to be one of the most reliable pieces of mechanism in existence, but, in its simplest form, it is not suitable for application to motor car lighting owing to the very wide variations in engine speed. If, therefore, a variable speed dynamo could be produced having no more working parts than an ordinary dynamo, with no extra windings or resistances to waste current, no extra brushes to cause friction, in fact, no moving part but the armature, only the usual windings and number of brushes, then the utmost simplicity is reached, and this is exactly the ideal which Messrs. Vandervell have endeavoured to attain.

By making use of the magnetic actions and reactions that occur between the armature and field magnets, the output is kept absolutely constant at all speeds of the engine, as will be described later. It is a well-known fact that if a dynamo be supplied with current from an accumulator it will run as a motor, and that the current taken will be proportionate to the load; and in the case of such a machine being connected by chain or gear to an engine, it will, as a matter of course, endeavour to revolve the engine, and the current taken will be excessive. This was one of the problems that the inventors had to face in doing away with every form of automatic cut-out, and which problem they claim to have successfully solved.

The Vandervell patent dynamo, which is shown in fig. 1, has a simple free-wheel clutch of the roller type interposed between the driving spindle and the armature, so that when the engine is stopped, or run too slowly for the dynamo to charge the accumulators, the armature can, for the moment, revolve freely, or "motorise," thus over-running the driving spindle. This device is illustrated in fig. 2, which shows the armature (with bearings complete) and the free wheel clutch. The design of the machine, moreover, is such that only an exceptionally small current, viz., zero to $1\frac{1}{2}$ amperes, will be taken from the battery, the maximum being $1\frac{1}{2}$ amperes when the engine is stopped. This free wheel device thus renders it impossible for an excessive current to be discharged from the battery through the dynamo.

The free wheel clutch is arranged upon the axle of the dynamo (which is shunt wound) through which the driving effort is transmitted; or an equivalent friction clutch may be used, the operative function of which is controlled by centrifugal force through the medium of frictional devices, so that when the driving speed falls below a predetermined amount, the centrifugally-controlled devices release the driving effort and allow the dynamo to run away as a motor from its driving mechanism. The only necessary elements of this system are a dynamo with special driving gear and a switch board for controlling the current supply to the various circuits, thus avoiding the use of any independent automatic switch gear to safeguard the dynamo from being injured by current from the batteries when the prime mover reduces its speed or is stopped altogether. When the apparatus is in operation, and the speed of the prime mover drops below the critical speed, the clutch is forced out of engagement, and the dynamo is permitted, as already mentioned, to run as a motor driven by energy from the secondary battery. In a similar way, if a self-releasing clutch be employed the dynamo becomes a motor which over-runs the driving pulley

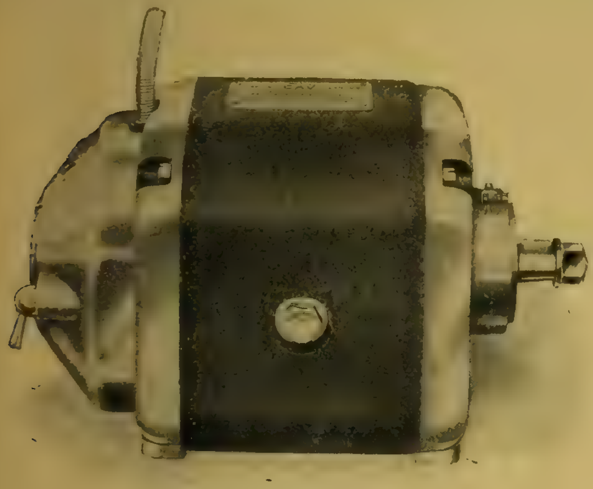


Fig. 1.

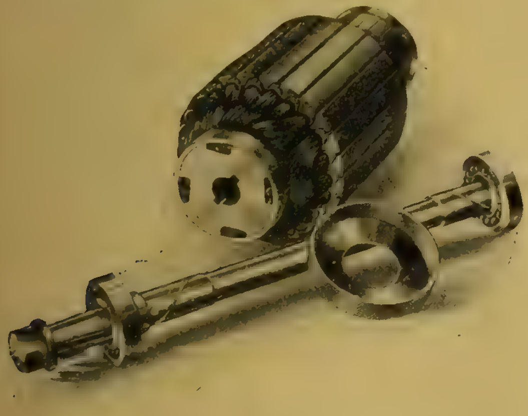


Fig. 2.

When no secondary battery is included in the system the arrangement can be utilised in the same way as a booster to a generating plant, and also in the case of any form of generating system in which the dynamo is liable under certain conditions to run as a motor, the function of the device being the same in all these cases, viz., to prevent a rush of current from the mains through the armature of the generator.

Briefly, it will be seen that the pith of the system consists of a device disposed between the source of power and the dynamo shaft, adapted when the speed has dropped below a critical point to allow the dynamo to over-run the prime mover as a motor driven from the secondary batteries, and thus prevent any excessive discharge of current through the dynamo armature during the non-generating period without the use of electrical cut-out devices.

The convenience of being able to switch the dynamo out of action when the accumulators are fully charged will be readily seen, and is one not possessed by several of the systems of motor-car lighting in use at the present time.

A great advantage which the free wheel system is claimed to possess over the cut-out system, is the fact that there are no extra contacts which are liable to get out of order, and the dynamo charges immediately the voltage rises above the battery voltage. With a cut-out the dynamo voltage rises very considerably before it "cuts in," and relies on a reverse current and the tension of a spring to "cut out."

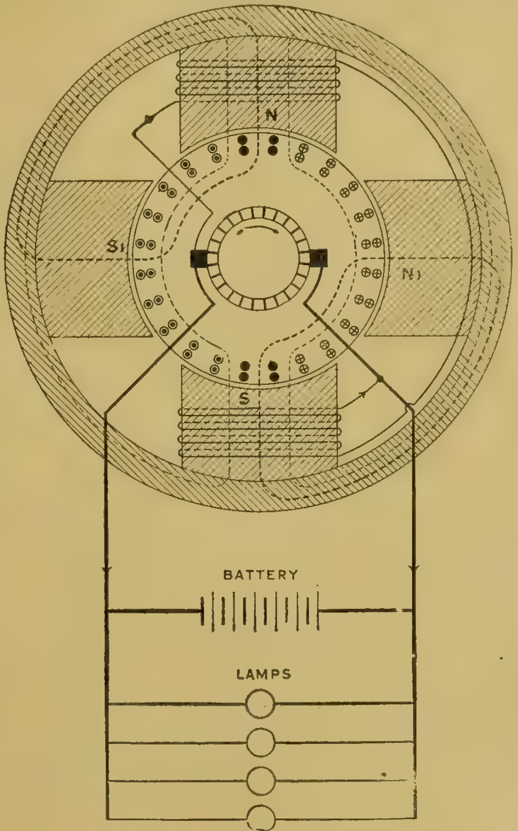


Fig. 3.

Although it might appear at first sight a wasteful plan to take current at any time from the accumulator, consideration, however, will show that this is not so, but, on the contrary, quite the reverse, for whilst an ordinary cut-out is taking current through its shunt and series coils the whole of the time, in the case of the free-wheel system it only happens for a few moments occasionally, and even then the consumption of current is infinitesimal.

Fig. 3 shows a diagram of the system. There are in the machine two ordinary poles N_1, S_1, and two subsidiary poles N, S, the latter being excited by the windings which are supplied with current from the working mains of the machine.

The magnetic flux excited by these windings passes, when not distorted, diametrically through the armature from one subsidiary pole to the other subsidiary pole, and, dividing right and left, finds return paths through the frame of the machine, as shown by the thin dotted lines.

The two ordinary poles have no winding upon them of any kind. Magnetism is excited in them by the reaction of the armature, not of the whole armature, but the reaction due to currents generated in certain short-circuited coils, namely, the coils which are for the time being short-circuited by the brushes that are collecting the current at the commutator. The position of these coils is shown by four black dots.

The operation of the machine is as follows: The brushes, being set in in the usual neutral position with respect to the ordinary poles N_1, S_1, the coils which they short circuit in the act of commutation are the coils which for the time being are not in any neutral magnetic zone, as in the case of an ordinary dynamo, but are in an active zone where they are cutting the magnetic lines of the field due to the "subsidiary" poles N, S. Hence, during the period of short circuit, they will be the seat of short circuit currents. These short-circuit currents cross-magnetise the armature and tend to set up a magnetic flux at right angles to the flux of the subsidiary poles, and this cross-magnetising effect is greatly augmented by the presence of unwound "ordinary" poles.

The result is that the previously-existing flux is distorted, and instead of traversing the armature diametrically from one subsidiary pole to the other, now turns aside, passing only quadrantally through the armature, breaking up into two quadrantal paths, each of which include only one quadrant of the frame, as shown by thick dotted lines.

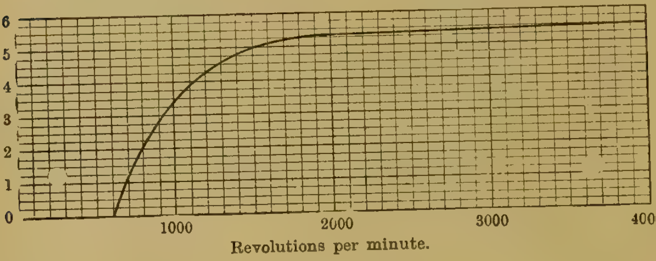


FIG. 4.

This change from the directly transverse flux to the quadrantal flux is accomplished gradually as the speed of revolution begins to increase.

But now another action begins, for, in addition to such short-circuit currents (which are confined to a few coils) the whole of the windings of the armature are now generating the working current which the brushes are collecting and sending to the battery or lamps.

This working current in the windings of the whole armature exercises a magnetising reaction which tends to directly oppose the magnetism of the subsidiary poles, and thus reduce the initial flux, and since these demagnetising reactions increase with the speed they will counteract the tendency of the generated electro-motive force to rise as the speed rises, so that the output remains constant.

The output curves of the various models, showing the exceptional steadiness of the charge over a very wide range of speed, are shown in figs. 4, 5, and 6.

Five standard models are made by the firm, which they claim cover all possible requirements. Type "C" is designed for taxi-cab work. It commences to charge at about 600 revolutions per minute, and has a maximum output of five amperes at any speed above 1,500 revolutions per minute, and is suitable for running in conjunction with a four-volt battery. It should be geared to run at about one and a half to double engine speed. Type "D" is intended for small cars where very powerful headlights are unnecessary, but at the same time where a really good driving light is required. It commences to charge at about 600 revolutions per minute, and the maximum output is five amperes at any speed above 1,500 revolutions per minute, and is suitable for running in conjunction with a six-volt battery. Fig. 4 gives the output curve for both the C and D type of machines. Type "E" is suitable for the average touring car, and is undoubtedly the most useful model. It commences its charge at about 600 revolutions per minute, and has a maximum output of five amperes at all speeds over 1,500 revolutions per minute, and is suitable for running in conjunction with a 12-volt battery. It should normally be geared to run at about double-engine speed, but for exceptionally high-speed engines it may be geared to run from one to one and a half times engine speed, according to the normal speed of the engine. Fig. 5 is the firm's output curve for this type of machine. Type "F" is a little larger than Type "E," but is designed to give the same output at a little over half the speed. It commences charging at about 375 revolutions per minute, and gives a maximum current of six amperes at any speed above 1,000 revolutions per minute, and is suitable for running with a 12-volt battery. It is intended for use where a direct drive at engine speed is obtainable, as, for instance, when there is a position available under the bonnet to drive the machine like a magneto. The output curve shown in fig. 6 applies to this machine. The firm also make another machine, Type G, which has the same dimensions and weight as Type "F,' but is designed to give a larger output and to run at about double-engine speed. Its maximum output is 10 amperes at all speeds over 1,500 revolutions per minute, for working in conjunction with a 12-volt battery. It is intended for very large cars, motor omnibuses, commercial vehicles, etc. This type has a very wide field of usefulness owing to its greater output.

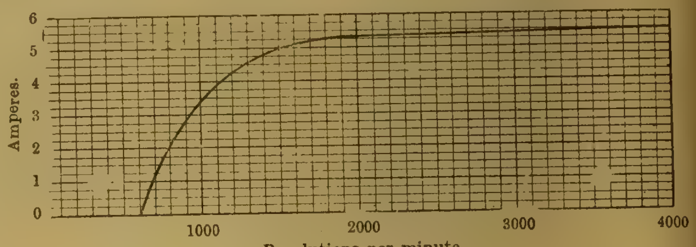


FIG. 5.

The selection of a suitable dynamo is obviously an important matter, and as the uses to which cars are now put differ very widely, it is as well to consider the following points:—Taking the case of a small car, having a "comfortable" speed of about 20 to 25 miles per hour, there is really no object in fitting a headlight with which one can read at 300 yards range, and the Type "D" dynamo, with a set of side and tail lamps, and a pair of 7½ in. headights, would be ample; but, of course, on small cars which are capable of comparatively high speeds, the Type "E" machine would be preferable, in fact, necessary. For open touring cars, where it may be

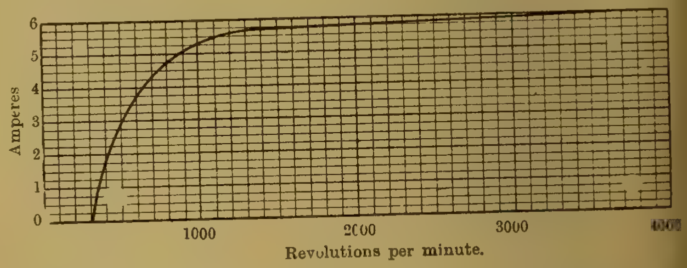


FIG. 6.

assumed that the maximum lamp load does not exceed about eight amperes, the Type "E" machine will provide sufficient current, always assuming that the car has a fair proportion of daylight running so as to keep up the reserve in the battery. Where it is necessary or desirable to drive direct (at engine speed) of course, the Type "F" machine is the most suitable model to select, unless the engine is of an exceptionally high-speed type. In the case of very large covered cars which have much night work and very little daylight running, also omnibuses or commercial vehicles having illuminated signs or advertisements, the Type "G" machine is obviously the one to be recommended, as it has a much larger output.

Fig. 7.

As regards the best position for the dynamo and most suitable method of driving; under the bonnet on a small bracket is the best place for the dynamo, the bracket being bolted to either a portion of the engine or the chassis frame. In such cases the dynamo may be belt or chain driven from any suitable revolving part of the engine, such as the main shaft, fan spindle, etc., or in some instances it may be gear driven or coupled direct, where suitable provision is made. Where there is no available accommodation under the bonnet, the dynamo can be supported by a bracket fixed to the inside of the chassis frame beneath the footboards, and a drive taken from the clutch shaft, a special cradle in aluminium alloy being provided. Where a position and drive for the dynamo cannot be obtained as above suggested, it should be supported upon a bracket or cradle fixed to the inside of the chassis frame, in such a position as will enable a drive being taken from the cardan shaft as close up to the universal joint—near the gear box—as possible.

As regards the most advantageous method of drive, when the dynamo is placed under the bonnet and no provision is made to drive direct or by means of gear wheels, it is quite a simple matter to fit the necessary chain wheel or pulley to the engine or other projecting shaft for a chain or belt drive respectively. When, however, the dynamo is placed under the body of the car, the driving pulley must be split in halves, so that it can be easily fitted to either the clutch or cardan shaft, thus making it unnecessary to dismantle any part of the car.

This driving pulley consists of an inner cast-iron boss, split in halves, upon the outside of which is mounted in a deep groove either the chain wheel or pulley, which are also split in halves. They are assembled so that the joint in the chain wheel or pulley is at right angles to the joint in the cast-iron boss. Four tapered-steel bolts pass through the boss and the chain wheel or pulley. When these bolts are tightened the two halves of the boss are drawn together, thus securely gripping the shaft upon which they are mounted, but at the same time the portions forming the wheel or pulley are held rigidly in their correct position.

With respect to batteries for use with dynamos it is essential that batteries of abnormal capacity, such as are necessitated by the use of dynamos giving an excessive amount of current at certain speeds, should be strictly avoided, not only because of the fact that a much larger battery has to be carried than the lighting justifies, but it also shortens the life of the battery when the charging current is continually varied between such wide limits. The use of ordinary ignition batteries is not to be recommended, as it is absolutely necessary—for this class of work—that batteries of special design and construction should be used. Owing to the fact that the Vandervell dynamo supplies such a steady charging current over a great range of speed, it is only necessary to employ a comparatively small battery, but which—under the circumstances referred to—will be working under ideal conditions, and thus ensure a long life.

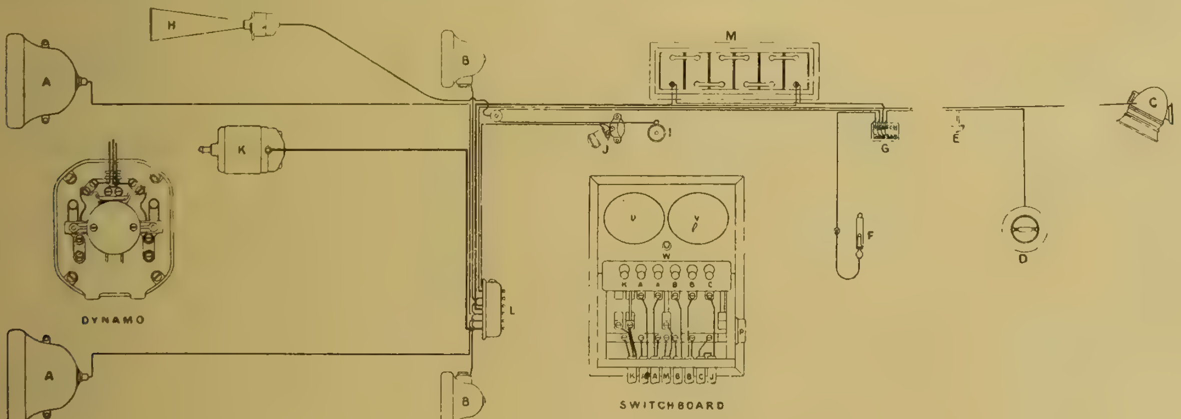


Fig. 8.

The position in which it should be fixed is quite optional, but the makers recommend the footboard of the car as the most convenient and accessible one. The Vandervell batteries are held in crates provided with handles, and the containing cases are of special construction so that the battery can be easily removed either from the top or side, thus enabling instant inspection. These special batteries are made up in various capacities and voltages to suit different requirements.

The firm have designed a special switchboard to overcome the many difficulties which formerly arose when arranging for the proper control of a car-lighting system. By its use all joints in the wiring system are avoided, the special cables running from each component direct to separate terminals on the board. The instruments are placed at such an angle that they can be easily read from the driver's seat. It will be noted that the ordinary commercial form of "tumbler" house-lighting switch has been eliminated. Although extremely small and neat, the switch board contains all the switches and instruments that can possibly be required to meet the utmost refinement of control, there being separate switches for the dynamo, headlights (right and left), sidelights (right and left), and tail-light, also a plug fitting for an inspection lamp, etc.

The arrangement of these switches are shown in the diagrammatical views figs. 8, 9, and 10.

An important feature is that there are no hidden connections, every conductor and terminal being made instantly visible and accessible by simply sliding off the front of the board. There is only one fuse of the spring-clip pattern, which is provided to guard against any possible damage to the dynamo in the event of it being run—accidentally—when the battery is disconnected. This fuse is placed in the dynamo field circuit, and therefore only carries a small current. To insert a new fuse, it is only necessary to remove the fuse carrier and place a single strand of tin fuse wire between the clips and replace the fuse carrier.

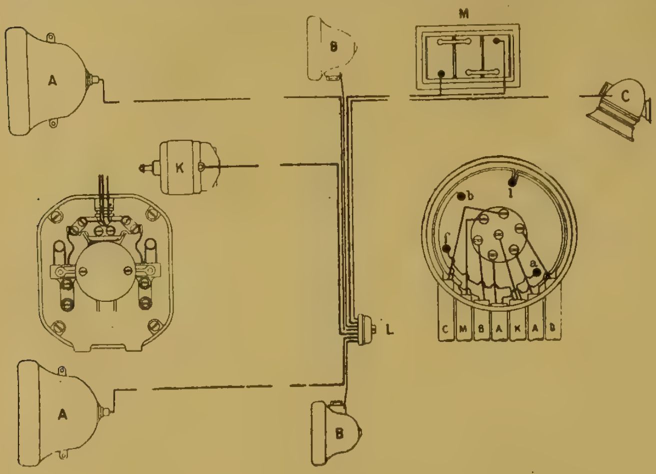


Fig. 9.

For taxi-cab work, where it is necessary to make the control as automatic as possible, a rotary controlling switch of the pattern shown in fig. 7 is used. This switch, which is in reality a miniature switch board, provides positions for charging (lamps off), alternative positions for lights on with the engine running, or stopped, and, of course, an "off" position. Care should be taken when the lights are left on with the engine stopped to see that the switch is pointing to the "Lights on, engine stopped" position, otherwise the dynamo, if "free-wheeling," is naturally taking a small current in addition to the lights. With this switch the lights are "all on" or "all off," but it forms an effective and cheap means of control for use where the refinements of the complete switchboard are not required. In the case of an interior light being fitted, a separate switch would usually be provided inside the body.

To anyone who has not studied the question, the wiring of a car seems a simple matter, but in reality, if properly carried out, it has hitherto been a more difficult and costly job than one would imagine. To begin with, it is most essential that the cables should be thoroughly protected and fixed in such a manner that they are impervious to oil or water, and at the same time so protected that they will successfully withstand mechanical contact without injury to the insulation. The cables should also be fitted so that the accessibility of the working parts of the car is in no way impaired. Hitherto the only satisfactory way to obtain this end was to run the cables through copper tubing, having watertight junction boxes. This method involved a great deal of labour in bending and fitting the tubes, but even then the installation could not be finished off in a really neat and satisfactory manner such as one would expect upon an up-to-date high-grade car. Messrs. Vandervell have produced, after many experiments, a flexible armoured cable, which is very easily and neatly fitted to the car, and yet, when fixed, successfully withstands all the adverse conditions to which it can possibly be subjected. A special form of insulation is adopted in which rubber plays no part, and the conductors are protected by an outer covering of armour consisting of a single wire of a special section wound spirally instead of the usual method of braided wire or other forms of armouring composed of several strands of wire, the difficulty with which lay in the fact that the ends became unwound or frayed out, and in many other respects was found quite unsuitable.

Owing to its construction, the armouring of this cable has no tendency whatever to unwind even if cut, and just a spot of solder at the end will hold it permanently in place. The section of the wire forming the armouring is such that it will withstand practically any amount of mechanical friction it is at all likely to be called upon to undergo. It has been designed with the object of eliminating all soldered joints, which have hitherto formed a very undesirable feature of most wiring systems.

A terminal block is fixed to the frame of chassis, where interior lights form part of the lighting scheme, such as with limousines and similar type bodies. By merely releasing the conductors at the terminals, the body may be removed without in any way disturbing the wiring system. Although in such cases this fitting will undoubtedly prove a great convenience and is included in the wiring diagram, its adoption, of course, is quite optional.

Lighting from Batteries Only.—For those who have special facilities for charging accumulators, and do not use the car for very long or extended tours, or who do not care to go to the expense of having a dynamo outfit installed, lighting from batteries may be used. In connection with this form of installation, a special battery to facilitate the handling of the cells for charging purposes is employed. The outer box or containing case is intended to be a fixture, and preferably painted to match the coach work, or it can be supplied in polished teak. The battery itself can be instantly removed *en bloc* for recharging and replaced with a spare set. When one considers the number of car miles that can normally be run upon a battery of quite modest dimensions and weight, it will be seen that the attention required—even where batteries only are used—is simply nothing as compared with acetylene and oil.

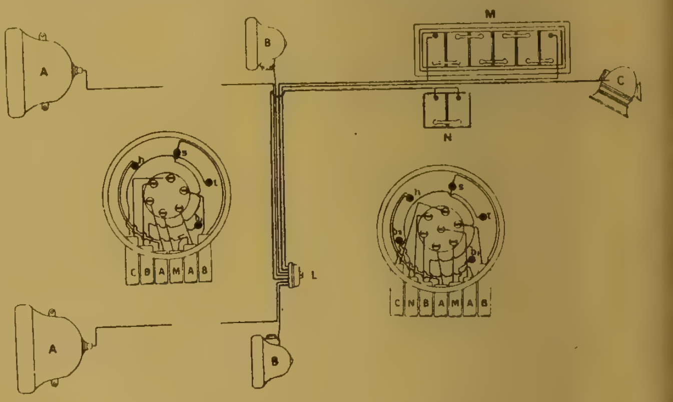


Fig. 10.

A standard type of battery gives 12 volts, 33 ampere hours (actual), and weighs about 36 lbs. It will run two head lights for 10 hours, or two head lights, two side lights, and a tail light for seven hours continuously.

The diagrams shown in figs. 8, 9, and 10 show respectively a system for larger car lighting, with complete arrrangement of lamps and accessories, a system of lamps for small cars, and a system of lighting without dynamos.

Referring to fig. 8, A indicates the head lamps, B the side lamps, C the tail lamp, D the interior light, E the interior light switch, F the cigar lighter, G the chassis terminal board, H the electric horn, I the horn push, J the dashboard light and tail lamp indicator, K the dynamo, L the switchboard, M the battery, P the inspection lamp plug, U the voltmeter, V the ammeter, and W the battery voltmeter push.

Referring to fig. 9, A indicates the head lamps, B the side lamps, C the tail lamp, K the dynamo, L the rotary controlling switch, and M the six-volt battery. The standard switchboard with instruments complete, as shown in fig. 8, can be substituted for the rotary controlling switch L.

Referring to fig. 10, A are the head lamps, B the side lamps, C the tail lamp, L the rotary controlling switch, M an 8 or 12 volt battery, and N a 4-volt battery.

THE FRICTION OF BALL BEARINGS.

(Concluded from page 454.)

Figs. 21, 22, and 23 show a type of ball bearing invented by a Swedish engineer, Mr. Sven Wingquist, which are manufactured by The Shefko Ball Bearing Co. Ltd., Lower Regent Street, London, S.W. These bearings are known as the "Skefko" S.K.F. ball bearings, and the general construction will be understood from the illustrations.

The diagram (fig. 21) clearly shows the construction of the "Skefko" patented type of radial bearings. The outer ball race is machined and ground to a radius struck from the centre of the bearing. The inner race is provided with two grooves, each having a radius slightly larger than the radius of the balls employed.

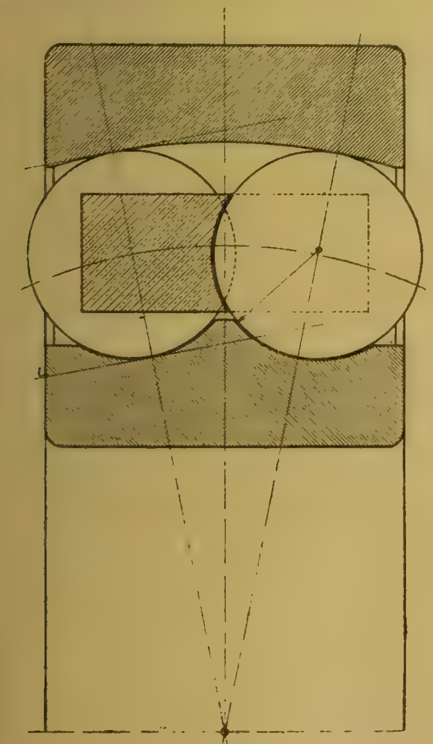
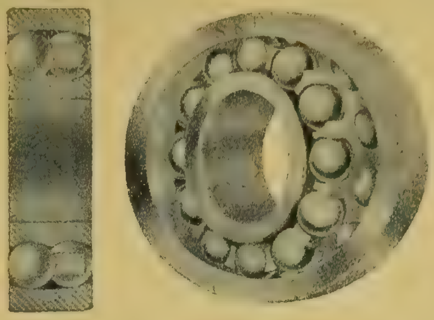


Fig. 21.

The balls are retained in position by a phosphor-bronze cage (figs. 22 and 23) having a series of recesses into which they are sprung by a slight pressure of the fingers, and from which they can be as easily removed when desired. This cage "floats" between the ball races, and is practically frictionless, its duty being simply to retain the balls in position, and each ball in its correct relation to its neighbour.

It will be obvious that when assembled, the balls, together with their dividing cage and inner races, form a kind of disc equal in diameter to the diameter of the outer ball race, in which it is free to revolve without being able to fall out, the whole constituting in fact an almost perfect ball and socket joint.

Though at first glance the diagram may appear deceptive, an analysis of the stresses due to the load will clearly demonstrate that an equilibrium of forces is established without any tendency to bring the balls together, or create unbalanced pressure on the races. The tangents of each ball at its points of contact with the races are parallel, and lines drawn through the contact points of all the balls meet at the centre of the shaft. By the adoption of a larger radius on the outer race a practically equal bearing surface is obtained on both races, thus equalising the wear and prolonging the life of the bearing.



Figs. 22 and 23.

Should it be required to take the bearing apart, two adjacent balls can very readily be removed on either side, diametrically opposite to each other; it will then be found quite easy to withdraw the centre portion complete with the remaining balls and cage from the outer ball race. To replace, this operation must be repeated in the inverse order.

It cannot be too strongly recommended, where phenomena appear that the user does not understand, or has had no experience of, that he should apply to a firm of experts in ball bearings, and what is still more important, he should have confidence in their advice. A plain bearing, for instance, will jamb if the lubrication fails. This is not the case with a ball bearing. If the lubrication fails the balls and races will wear, and the bearing will emit considerable noise. The user then often comes to the conclusion that the balls and races are too soft, and will have no confidence in the real reasons given him as to the cause. If the races or balls begin to chip, this can nearly always be ascribed to overloading. If the chipping does not appear in the middle of the race, but at the sides, it can be taken at once that the ball bearing has had to stand end thrust. Overloading arises not only from the calculated load being excessive, but often also through the bad fitting of the housing, made up of two pieces, in which the outer ring is fitted, causing this to be distorted and pressed on to the balls, or else the shaft may be much thicker than the inner ring, so that it stretches too much and jambs the balls.

It is impossible here to treat of all the phenomena that may occur. Mature experience is necessary to deal with these correctly, and where the user has not acquired this, he should obtain the advice of the manufacturers of bearings and be guided thereby.

South Wales Miners' Ballot.—The result of the ballot of the South Wales and Monmouthshire colliery workmen as to whether they would grant support by levy to the Cambrian Combine workmen, or demand a stoppage of the whole coalfield, has resulted as follows: For a levy, 76,978; for a stoppage, 44,868; majority in favour of levy, 32,110.

BERGMANN STEAM TURBINES.

OUR illustrations show two installations at the Brussels Exhibition by Messrs. The Bergmann Electric Works, for whom Messrs. the Adnil Electric Co. Ltd., of Adnil Building, Artillery Lane, London, E.C., are the sole agents in this country. Fig. 1 depicts a Bergmann steam turbine of 10,000 H.P., 1,500 revolutions per minute, 10,000 volts, three-phase; fig. 2, a Bergmann steam turbine, 2,500 H.P., 1,500 revolutions per minute, 180 lbs. sup., 500 deg. Fah., three-phase, 2,500 volts; which provide the lighting for the exhibits.

The Bergmann steam turbine is of the pure action type, *i.e.*, a turbne in which the pressure on both sides of the revolving blades is equal, and in consequence of which the clearance between the moving parts and the casing may be made as large as desired without this having an adverse influence on the steam consumption.

The turbine is divided into six to ten pressure steps or stages, inside which the moving blades revolve. The principle of the so-called velocity steps has been adopted in the first stage, this permitting high steam velocities and also high drops of heat to be economically used, but at the usual peripheral speeds of action.

The principal advantages claimed for the Bergmann turbine may be briefly summarised as follows—The body of the turbine is not exposed to high pressures and high temperatures, in consequence of the transformation of a high drop of heat (drop of pressure) in the first guide blades. It is thus possible to adopt the most economical initial steam pressure and degree of heat to suit each case. The sealing of the turbine from the air and steps presents considerably less difficulty than with turbines or other makes. There is a large clearance between the stationary and revolving part, so that danger of fouling is excluded. The number of stages is small, although the same moderate peripheral speeds of the ordinary action turbine are adhered to. The turbine is short and the different parts to be lifted, especially the rotor, very light. There is no axial thrust and thus the many complicated devices used to compensate the balance in other systems can be entirely dispensed with. High steam economy, simplicity in operation and low cost for attendance, and, finally, absence of vibration.

As regards the turbines, even right up to the largest units, these consist of one single cast-iron cylinder split horizontally. The end plate on the high pressure side is made in the larger sizes of cast steel in one piece. Between each rotating element a guide disc is situated, at the periphery of which are the nickel-steel guides or distributing blades, these latter converting the pressure of the steam into velocity and determining the direction of the steam. These guide discs are also split horizontally, this arrangement facilitating erection and permitting the turbine to be quckly dismantled for inspection purposes. The guide discs enclose the turbine shaft, but are separated from same by sealing rings of the labyrinth type made of a special soft metal. There is thus a small clearance between the rotor shaft and the guide discs, so that under ordinary conditions no friction can take place involving wear of the rings and possibly heating up of the parts.

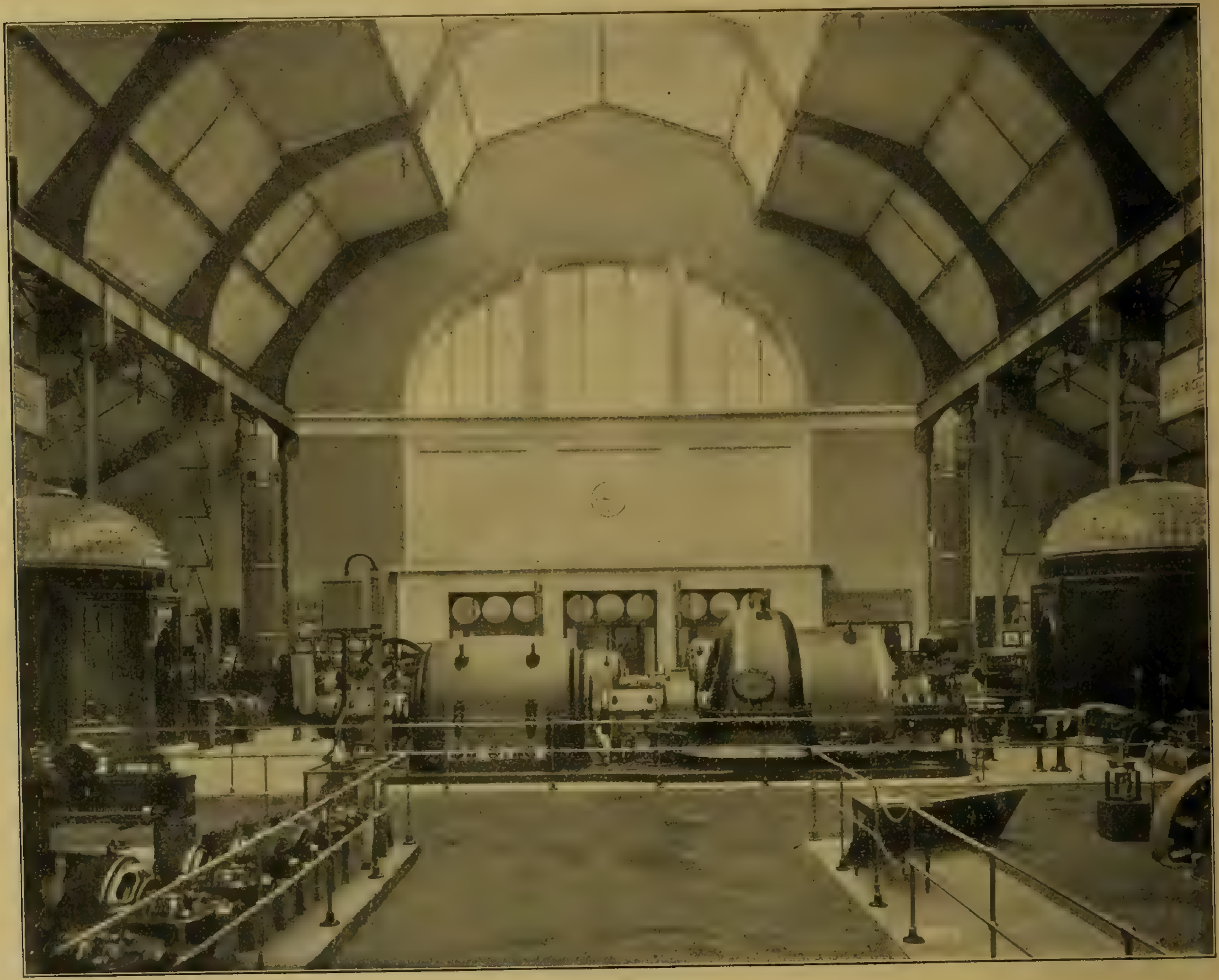


FIG. 1.—"BERGMANN" STEAM TURBINE, 10,000 H.P.

The turbine is sealed from the air by a labyrinth construction to which high pressure steam is admitted at certain parts. As the pressure in these glands is thus higher than that of the atmosphere, no air can enter on the condenser side, and thus a high vacuum is maintained independently of the condition of the sealing devices.

The revolving discs are massive and are made throughout of specially selected Siemens-Martin steel, and each disc is subjected to a searching examination after having been machined, and, if the material is not perfect in every respect, is at once rejected.

The moving blades are securely attached to the circumference of the discs, but the first revolving or velocity discs differ from the pressure discs following. In the former the higher velocity of the steam necessitates a special shape of the blades. These blades are inserted in a groove of a dovetail section turned into the circumference of the metal disc, and are so securely held that under no circumstances can they become detached or work loose. The first disc is thus massive and heavy, but on account of the lower steam velocities at which the remainder of the pressure stages work, it is possible to use a lighter construction and also lighter blades of equal thickness throughout. These blades are fastened by means of two rivets to the massive steel disc, this method of fastening the blades having been found after careful and lengthy tests to be absolutely reliable, and to allow of even the largest blades standing, without injury, stresses twenty times in excess of the normal. The revolving blades are further provided with a shrouding which is twice riveted to each blade tip, to better guide the stem. The material for the moving elements is subject to stringent tests before being machined and assembled, and after completion, each wheel is tested at the speed of twice the normal.

The wheels are supported by a nickel steel shaft of such liberal dimensions as to preclude the possiblity of vibration. The bearing supporting the shaft are water-cooled and are lubricated by oil under pressure. The bearing liners are made of special metal suitable for such high speeds, and the wear on the bearings is reduced to an absolute minimum, as with forced lubrication the whole weight of the rotor is carried on a film of oil. Such provision is made, however, that no oil can enter into the body of the turbine, the bearings being entirely separated from the turbine, and the condensed water is thus entirely free from oil and can be used again for feeding the boilers.

The smaller units have three bearings only, the turbine and generator shafts being coupled together by means of a rigid coupling. Larger units are provided with four bearings, two for the turbine and two for the generator; in this case a flexible coupling joining up both shafts. This coupling consists of a number of thin steel rods of great flexibility, thus compensating for any slight error in alignment and ensuring smooth running for both parts. Oil under pressure is used for actuating the governing devices.

The governor is driven in a similar way to the oil pump, by means of a worm on the turbine shaft, and, in the first instance, influences, through a system of levers, a slide valve, which, according to its position, allows the oil to pass by different paths. The oil then reaches the top or bottom of a cylinder and imparts motion to its piston. The lever of this piston being rigidly connected to the throttle valve, the latter concides with the motions imparted to the piston by the oil.

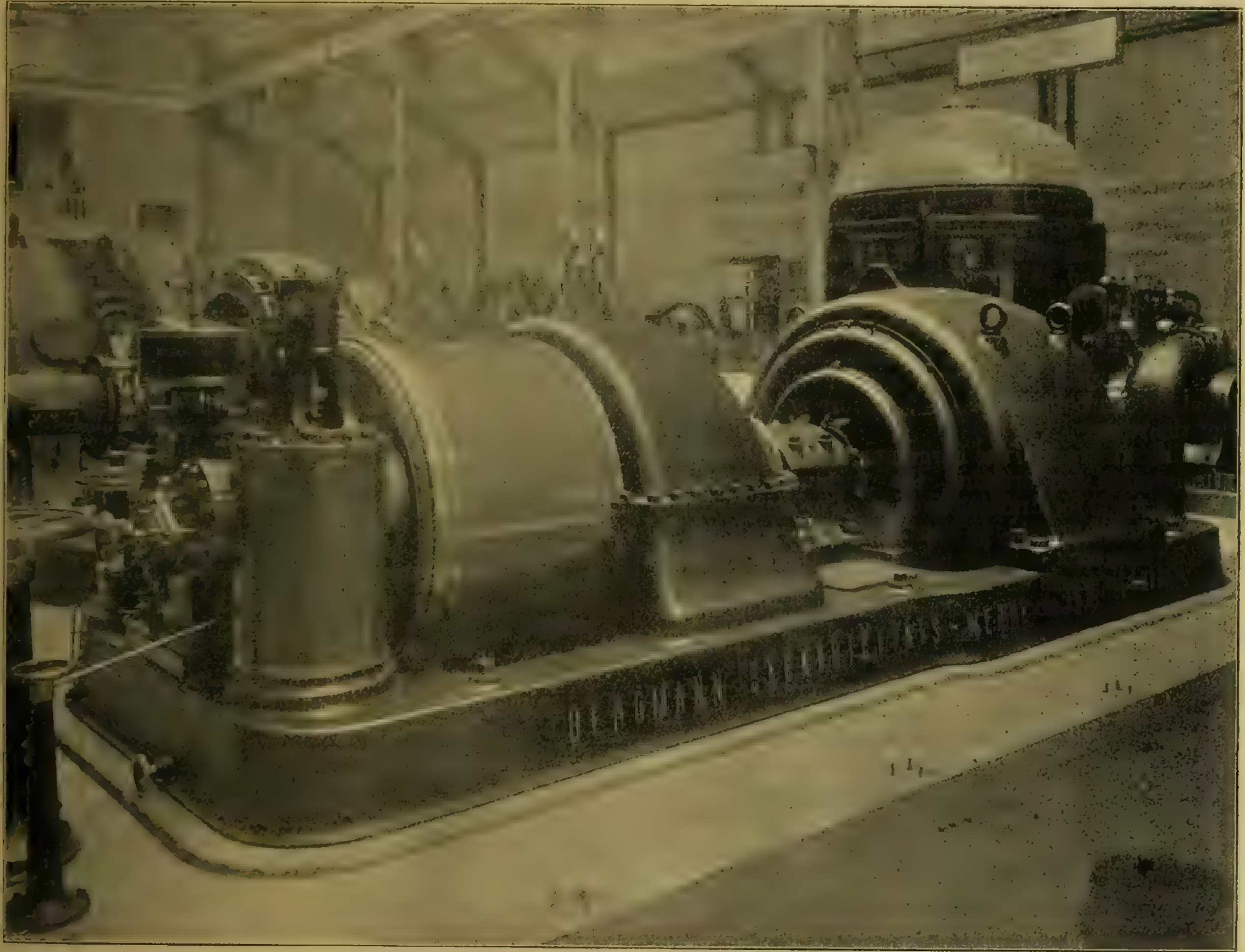


FIG. 2.—"BERGMANN" ELECTRICAL WORKS STEAM TURBINE, 2,500 H.P.

The governor has a high degree of accuracy, and even if full load is suddenly thrown off, the speed only rises by a few per cent. Each governor is provided with a device which enables the speed to be adjusted by 4 to 5 (five) per cent. All methods of governing depending upon the throttling of steam consumption rise to a disproportionately high figure. To remedy this defect the Bergmann turbines are provided with a second method of governing. This is effected by guiding the first guide blades into several groups and providing a hand-operated valve for each group. With this arrangement it is thus possible to open or close these nozzles and so adjust them that the most favourable steam consumption corresponding to different loads is obtainable

Each turbine is provided with a safety device which automatically cuts off the steam supply, should the normal speed be exceeded by 10 per cent. This device is fixed direct to the main shaft, gearing of any description being avoided in order to ensure absolute reliability of operation under all conditions. In such critical cases, this safety device does not actuate the throttle valve, but the main stop valve which is then closed and cuts off the steam supply entirely. To prevent any shock on the sudden release of the valve the movement is damped by means of a dash-pot. This safety device acts entirely independently by the will of the driver, and the main stop valve cannot be opened until this safety valve is in its correct working position. If desired, this device can further be so arranged that it also acts if, for some reason or other, the forced lubrication of the bearings should fail.

At the admission end of the turbine, there is a thrust bearing, but of small dimensions, so it has not to take up any axial thrust, but only serves to ensure accurate alignment of the rotor.

A prominent feature of the Bergmann turbine is, further, the arrangement for draining the turbine. Although provision is made for draining each stage or compartment, it has been found possible to accomplish this by a special design with one cock only for four stages, this doing away with the delicate parts which otherwise would be necessary. There are three of these cocks which are mechanically interlocked in such a way that only a slight pressure on the handle of a lever suffices to operate them.

The exhaust outlet of these turbines is of especially liberal dimensions in order to reduce the losses in steam pressure between the last wheel and the condenser to a minimum. The vacuum is responsible to a high degree for the steam consumption of a turbine, and by thus dimensioning the outlet so liberally it has been possible to derive the greatest benefit at the last discs from the high vacuum produced by modern condensers.

The overload capacity of the turbine is determined by the overload capacity of the electric generators, these latter being capable of withstanding an overload of 25 per cent for half an hour.

THREE-PHASE TURBO-GENERATORS.

The outputs and speeds of the Bergmann turbines are as below :—

3000 Revolutions per Minute.

Electric Output..	KW	200	300	400	550	750	1000	1250	1500
	KVA	250	350	500	650	900	1200	1500	1800
Output at the turbine shaft	PS	300	450	600	800	1100	1500	1900	2250

1500 Revolutions per Minute.

Electric Output..	KW	550	750	1000	1250	1500	1750
		2000	2500	3000	3500	4000	—
	KVA	650	900	1200	1500	1800	2100
		2400	3000	3600	4000	4800	—
Output at the turbine shaft	PS	800	1100	1500	1900	2250	2600
		3000	3600	4500	5250	6000	—

Exhaust steam turbines are built for the same outputs as the high-pressure turbines and do not differ materially in their general design from these, but with the exception that the velocity stage is omitted.

In consequence of the lager specific volume and the larger quantities of steam required by exhaust steam turbines as compared to high pressure turbines, the governor and valve often assume considerable proportions.

The three-phase turbo-generators are of the revolving field type, with stationary armature, and a series of patents protect the more important features of their design.

The shaft with the inductor consists of one massive piece of Siemens-Martin steel. The slots into which the field windings are laid are milled out of the solid metal, and the poles thus obtained form an integral part of the core and are not added and attached afterwards as in other designs. This is a most important feature, ensuring, as it does, the continual satisfactory and smooth running of these high-speed machines. The slots are distributed equally over the circumference of the inductor, but differ in their width. By this arrangement a current curve of sine form is obtained.

The field windings are secured in their slots by means of bronze wedges, and the projecting ends of the windings are protected and securely held in position by bronze caps.

The stationary armature is built up of soft iron stampings securely bolted to the cast-iron housing. The armature coils are laid in nearly totally-enclosed and highly-insulated slots. Special care has been taken to secure perfect mechanical rigidity and stability of the end connections. On short circuits the end connections attract one another and are, in consequence, subjected to severe mechanical strains, which might lead to dangerous movements of the conductors if not securely held in position.

These generators are totally enclosed and are carefully ventilated. The inductor acts as a fan, and draws in air from below and expels same through an opening underneath the housing after it has passed through the inductor and stator. As the air is drawn past and through the windings, this method of ventilation is very effective and keeps the temperature down to normal limits. The direct-connected exciter is attached to the outer bearing, the armature being mounted on an extension of the generator shaft.

These generators are rated to give their full output continuously without excessive heating, and can carry overloads of 25 per cent for half an hour without injury.

NOTICES OF MEETINGS, &c.

October 14th.—COVENTRY ENGINEERING SOCIETY. Paper on "Engineering in H.M. Navy," by Admiral Bacon, C.N.O., D.S.O.

INSTITUTION OF MARINE ENGINEERS. Bohemian concert, on the invitation of the Junior Section.

MANCHESTER SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS. Conversazione to be held at the Manchester Whitworth Institute, at 7-30 p.m.

October 15th.—INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS. Home District Meeting to be held at Guilford.

October 17th.—INSTITUTION OF MARINE ENGINEERS. Meeting at 58, Romford Road, Sratford, London, E. Paper on "Cylinder Condensation," by Mr. W. F. H. Northcott.

October 21st.—INSTITUTION OF MECHANICAL ENGINEERS. General Meeting to be held in the Institute House, Storey's Gate, St. James's Park, at 8 p.m. A paper on the "Standardisation of Locomotives in India, 1910," will be read by Mr. Cyril Hitchcock.

October 22nd.—THE MANCHESTER ASSOCIATION OF ENGINEERS. Paper by Mr. D. Wilson, on "Water Tube Boilers."

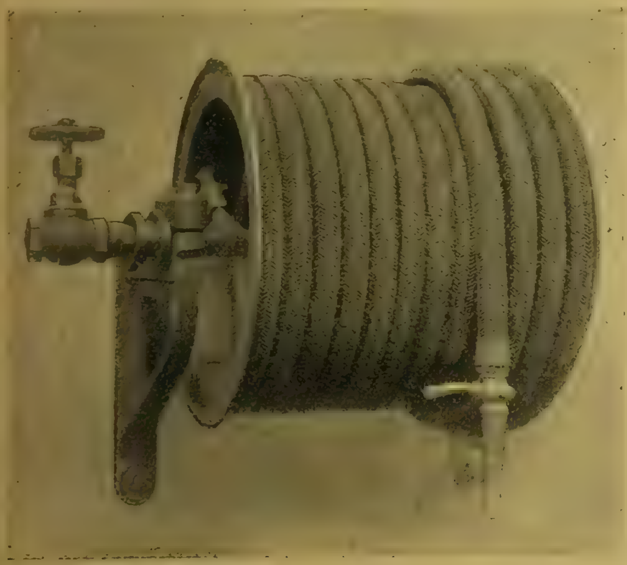
SOUVENIR.—We have received from Mr. F. W. Bridge a copy of the souvenir of the fourth International Printing, Stationery, and Allied Trades Exhibition which was held at the Agricultural Hall from May 25th to June 9th of this year.

A NEW FORM OF HOSE AND REEL.

Our illustration depicts a new form of hose and reel recently brought out by Messrs. Jackson and Brother, of Wharf Foundry, Bolton. The hose is an entirely new departure. The outer protective covering is formed of whipcord, which is tightly laid on in a special manner by machinery designed for the purpose. The whipcord is saturated with a waterproofing and non-inflammable material, and forms a remarkably strong and lasting type of hose, possessing many advantages over those of the armoured patterns.

The reel is well designed and strongly constructed, and is made in various sizes capable of holding from 60 ft. to 120 yards of hose.

The hose is tested to 600 lbs., and is intended to be kept under pressure, so as to be always ready for immediate use. A pressure of 160 lbs. per square inch is quite usual in some of the cases where this hose is installed. This feature of keeping the hose under a full pressure of water is most important, the water supply being available at a moment's notice, all that is required being to unwind or draw the hose from the reel and open the nozzle cock. The wheel valve is sealed in the open position, so that it cannot be closed without the knowledge of those interested. The gland is packed to stand high pressures, and forms a convenient brake when the hose is being unwound.



New Form of Hose and Reel.

This hose and reel should find a place in factories, shops, etc., and might with advantage be specified by insurance companies; indeed, we understand that one or two companies have already done so, and are moreover so confident in its good qualities that they are prepared to give a 10 per cent to 15 per cent allowance on premiums where in use.

The apparatus can be handled with certainty by anyone, no previous practice or skill being necessary to run out the hose and get a full-pressure jet into play at once—a feature which will be readily appreciated by those who are familiar with the handling of the usual collapsible fire hose.

Oil Motors.—Oil motors continue to gain in favour for the propulsion of vessels of considerable size. A vessel of 960 tons displacement has been launched at Ancona for the Ravenna-Trieste-Fiume service. She is to have Sulzer-Diesel motors, and her designed speed is 12 knots. The East Asiatic Co., of Copenhagen, following the example of the Hamburg-American Line, have ordered a large passenger and cargo steamer, which is to be propelled by Diesel engines.

HIGH-SPEED TOOLS AND MACHINES TO FIT THEM.*

(Concluded from page 432.)

The stepped cone is rapidly becoming obsolete, except in the case of small machines. The obvious disadvantages of this method of changing speed are the trouble, and, in the case of boys, the danger of throwing a heavy high-speed belt from one step to another, and the variation in power available from the different belt speeds.

The gears which are always in mesh should have helical teeth to ensure quiet and smooth running and to prevent chatter. The pinions should be hardened, and, of course, all wheels should be made either of forged steel or steel castings. It is of great importance to cut the teeth of gear wheels to a considerable degree of accuracy. Some idea of what vibration may be set up by inaccurate teeth is given by the following instance. Two teeth having broken out of a gear wheel on a large lathe they were replaced as a temporary measure by pegs filed to shape according to the usual millwright method. The result was apparently satisfactory on low speeds, but a very unpleasant vibration was set up at higher speeds. A diagram plotted from the movement of the ammeter needle showed a considerable wave of current at low speeds. This wave took place after the peg teeth had passed out of gear, and was evidently due to the power required to regain velocity which had been lost when the peg teeth were in gear. Anyone who has had to cut gears for motor-cars knows how much noise and vibration may be set up by a very slight inaccuracy in the pitch or form of the teeth.

Worm and worm wheels should never be used unless hardened. The author has seen the teeth of a cast-iron worm wheel 7 ft. in diameter almost entirely worn away in a few days; the introduction of high-speed steel has meant the replacing of many worm and worm-wheel drives by spur-gear drives. All feed arrangements must be amply strong, as in certain cases the side pressure is equal to the vertical pressure on the tool.

Very powerful machines are now built for taking heavy cuts. The beds are made very wide to give ample support and bearing surface for the saddle, and the spindles are made of what appears to be excessive strength, but it is most important to have ample bearing surface and an absolutely rigid spindle to prevent chatter. A general rule is to make the diameter of the front bearing half the height of the centre. Thus, 6 in., 12 in., and 14 in. centre lathes would have respectively 3 in., 6 in., and 7 in. front bearings. There should always be a hole through the spindle, as this is required for the bolt for drawing up expanding chucks or for supporting the end of a boring bar. The tailstocks should be very massive and clamped to the bed by two bolts in the case of the smaller sizes, and three bolts for larger sizes; the diameter of the barrel should be one-third the height of centres.

Turret lathes have been greatly strengthened, and one capable of dealing with bar up to 2¼ in. in diameter can reduce a bar from 2¼ in. to 1 in. diameter at a traverse of 11⅜ in. per minute with an expenditure of 20·7 H.P., when using the latest form of high-speed tool steel (Class C). The ordinary steadies were found quite useless at this high duty, and a roller steady has been introduced with excellent results. Such a machine fitted with a roller steady averages an output at least 33 per cent greater than the output of the older machines designed for the use of ordinary high-speed steel, and at least 110 per cent more than the pre-high-speed tool machines, so that the extra cost of the modern machines is small compared to the saving. Of course, such cuts as given above are not often required, so that a provision of 10 H.P. is quite sufficient for all ordinary purposes. Taking the production from one of these machines built in 1900 as the unit, the following figures giving the cost per unit of production are obtained:—1900 machine, £112 10s.; 1905 machine, £83 12s.; 1910 machine, £71 4s. These figures would vary with the class of work; on some work the gain would be more, on other work less.

Great attention is now paid to making drilling machines so stiff that very little deflection of the saddle takes place. One maker provides a double-girder jib with a space left between the two girders for the saddle. The saddle is supported by the girders on each side of the spindle, so that there is no twisting movement round the horizontal axis of the jib. Change-speed gear boxes or variable-speed motors are generally provided, allowing from 12 H.P. to 15 H.P. for the larger sizes. Such machines are capable of drilling inch holes at a rate of travel of 5 in. a minute, and to drill 100 inch holes in an hour through plates an inch in thickness is ordinary practice. Really fast drilling cannot be done on old jib drilling machines, as the jibs spring and twist, causing the drills to break, and in many cases the arrangement for feeding and withdrawing the spindle are most unsatisfactory, but still high-speed drills can be used to considerable advantage in some of the best makes of pre-high-speed drilling machines by increasing the belt speed. But running the drill at a high speed and a fine feed entails considerable loss of power.

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* Abstract of a paper by Mr. H. I. Brackenbury, read at the Birmingham Meeting of the Institution of Mechanical Engineers in July last.

The power allowed for milling machines has been greatly increased within the last few years, but it is very doubtful if milling machines should be used, except in special cases, for heavy roughing work, as the power required to remove material with a milling cutter is very large as compared to tools of the lathe type. The milling cutter may be compared to a lathe tool with a very long cutting edge removing a thin wide chip, which requires far more power than a tool with a short cutting edge removing a thin narrow chip. The actual consumption of power to remove a pound of material with a milling cutter is about double that required by a lathe tool.

A great advance has been made in the cutting speed of planing machines, and naturally with the increase in cutting speed came a desire for a quicker return stroke. Heavy planing machines now have a return-stroke speed of 90 ft. per minute, and lighter machines are made with a return stroke up to 180 ft. a minute, the shock at the reverse being absorbed by recoil springs. Various devices are now made which can be fitted to pre-high-speed planing machines, by means of which the above results may be obtained at a moderate expenditure of money, and the results are most satisfactory.

METAL MARKETS.

SEPTEMBER.

Pig Iron.—The pig iron market for last month was disappointing. An improvement is generally expected in this month, but this year such improvement has failed as yet to arrive, and traders are much inclined to be pessimistic. Probably this is to be attributed to the labour troubles, poor reports from the United States, and the prospect of dearer money. Altogether the outlook does not seem very encouraging. The shipments from the Tees to September 29th are 100,197 tons, as against 100,066 tons for August, and 16,883 tons at September 30th last year. The highest and lowest daily settlement prices for the month were as follows: At Glasgow, Scotch, 55s. 7½d. and 55s. 3d.; Cleveland, 49s. 7½d. and 49s. 3d.; hematite, 66s. 3d. and 65s. 1½d. In London, Cleveland, 49s. 7½d. and 49s. 3d. Rubio ore is still 20s. per ton delivered at wharf, Tees or Tyne. Coke was firmer in price, 16s. per ton, delivered equal to Middlesbrough, being the regular quotation. At the end of the month Messrs. Connal and Co., the warrant store keepers, had in stock at Middlesbrough 474,156 tons of Cleveland pig iron, composed of 430,702 tons of No. 3 Cleveland, 36,513 tons of other kinds of iron deliverable as standard, and 6,941 tons of other kinds of iron not deliverable as standard.

Manufactured Iron and Steel.—On the whole producers of manufactured iron did fairly well, having a greater number of orders booked than has hitherto been the case this year; in fact, they are in a better position than they have been for some two years past. The improvement has not, however, been such as to warrant manufacturers to advance their prices. At the end of the month steel and iron ship plates were quoted at £6 10s., less 2½ per cent; iron ship angles, £7; steel ship angles, £6 2s. 6d.; steel bars, £6 5s.; iron bars, £7; black and galvanised sheets, £7 5s. and £11 10s. respectively f.o.b. for 24 gauge, less 4 per cent; steel hoops, £6 12s. 6d.; steel strips, £6 10s.; and steel joists, £6 2s. 6d., less 2½ per cent. The manufacturers of cast-iron pipes and wire have booked fair orders.

Copper.—The business done in manufactured copper has been a steady one. The highest and lowest daily settlement prices for the month were £55 12s. 6d. and £55 2s. 6d. The prices quoted at the beginning and the end of the month were £55 10s. and £55 8s. 9d. cash. A shrinkage of 2,704 tons is shown by the statistics just issued in the visible supply during the second half of September.

Tin.—The market for this metal, which showed a downward tendency towards the middle of the past month, at the end was a shade firmer. The highest and lowest quotations for the month were respectively £166 and £157 15s. cash. The prices quoted at the beginning and end of the month were: the former £162 10s. and the latter £157 15s.

Lead.—The prices of both the soft foreign and the English varieties of this metal have remained fairly firm during the month and show an upward tendency. The highest and lowest quotations for soft foreign were £12 16s. 3d. and £12 10s., whilst those for English were £13 2s. 6d. and £12 16s. 3d. The prices at the beginning and end of the month were: For soft foreign £12 11s. 3d. and £12 16s. 3d., and for English £12 17s. 6d. and £13 2s. 6d. respectively.

Spelter.—The price of this metal, g.o.b.'s, is firm. The highest and lowest quotations during the month were £23 10s. and £22 13s. 9d. The price at the beginning of the month was £22 13s. 9d. and that at the end of the month was £23 10s. Specials were quoted at £24.

LAUNCHES AND TRIAL TRIPS.

Strathan.—The new steel screw steamer Strathan, the third of four vessels ordered by Messrs. Burrell and Son, Glasgow, from Messrs. Archibald M'Millan and Son, Dumbarton, has run trials on the Clyde, attaining a speed of 12½ knots. The machinery, which was supplied by Messrs. David Rowan and Co., Glasgow, worked in a very satisfactory manner.

Walbrook.—The twin-screw tug boat Walbrook, built by Messrs. Ferguson Brothers, Port Glasgow, for the Port of London Authority, ran speed trials on the measured mile, and afterwards towing trials at Port Glasgow. Both tests were considerably in excess of the contract. The vessel is preparing for her voyage in Port Glasgow Harbour.

Rotorua.—The Rotorua, built by Dennys, of Dumbarton, for the Union Co., of New Zealand's passenger service, has just ran her trials on the Clyde. A speed of 15·77 knots was developed, being three-quarters of a knot more than the guarantee. The Rotorua will carry first, second, and third-class passengers. She has insulated holds, and will carry 105,000 carcases of mutton. She is 484 ft. long and is the largest and fastest vessel in the company's fleet.

Lorca.—The new screw steamer Lorca, built by Messrs. John Readhead and Sons Ltd., West Docks, South Shields, to the order of the English and American Shipping Co. Ltd., of which the managers are Messrs. C. T. Bowring and Co. Ltd., London, was taken to sea on her official trial trip on September 29th. The vessel is of the improved single-deck type, with large holds clear of beams and other obstructions in stowing cargo, and is of the following dimensions: Length overall, 376 ft.; breadth, 51 ft.; depth moulded, 27 ft. 8½ in. She carries a large cargo on a light draught of water. The engines and boilers have also been constructed by Messrs. John Readhead and Sons Ltd., the cylinders being 25½ in., 42 in., and 69 in. diameter, by 48 in. stroke, with three boilers of 180 lbs. pressure. The vessel is built to Lloyd's highest class, and to their special survey. Satisfactory results were obtained at the trials.

Drumcraig.—Messrs. Russell and Co., Port Glasgow, launched on October 1st the screw steamer Drumcraig, of 5,000 tons gross, which they have built to the order of Messrs. Joseph Chadwick and Son, Liverpool. She is 410 ft. in length, 52 ft. 3 in. in breadth, and 28 ft. 3 in. in moulded depth. The machinery, consisting of engines with cylinders 27 in., 44 in., and 73 in. in diameter respectively, and a stroke of 48 in., will be supplied by Messrs. David Rowan and Co., Glasgow.

Howick Hall.—Messrs. William Hamilton and Co., Port Glasgow, launched on October 1st a screw steamer, which they have built for the New York and South American Line, managed by Messrs. C. G. Dunn and Co., Liverpool. The principal dimensions of the vessel are: Length, 413 ft.; breadth, 51 ft. 6 in.; depth, 29 ft. 7 in. to upper deck. She is fitted with appliances for the rapid handling of very heavy cargoes, including lifting gear for weights up to 35 tons. The steamer will be fitted by Messrs. David Rowan and Co., Glasgow, with machinery, consisting of triple-expansion engines having cylinders 27½ in., 45 in., and 75 in. diameter respectively, and a stroke of 51 in., four single-ended boilers, 14 ft. 6 in. diameter by 11 ft. 6 in. in length, and designed for a working pressure of 180 lbs. The vessel is classed with Lloyd's Register for their highest class longitudinal framing.

Driebergen.—The official trial trip of the new steel screw steamer Driebergen took place at Hartlepool Bay on Saturday, October 1st. She was built to the order of Messrs. Furness, Withy, and Co. Ltd., West Hartlepool, for Mr. J. A. A. van Meel, of Rotterdam, by Messrs. Irvine's Shipbuilding and Dry Docks Co. Ltd. at the Harbour Dockyard, West Hartlepool, and her dimensions are: 289 ft. 6 in. by 40 ft. 2 in. by 20 ft. 6½ in. The propelling machinery and boilers have been supplied and fitted by Messrs. Richardson, Westgarth, and Co. Ltd., Hartlepool. The sizes of the cylinders are 20½ in., 33 in., 54 in., by a 36 in. stroke, and steam is supplied by two large single-ended boilers working at 180 lbs. pressure per square inch. The vessel's performance was very satisfactory. The engines worked exceedingly well, a speed of 11 knots being attained.

Bore.—The Campbeltown Shipbuilding Co. launched recently a steel screw steamer named Bore, built to the order of the Svea Co., Stockholm. The vessel, which is about 2,000 tons dead weight, is of the well deck type. After the launch the steamer left in tow for the Clyde. The vessel will be engined by Messrs. J. G. Kincaid and Co., Greenock.

NAVAL NOTES.

H.M.S. Bristol.—The speed trials of H.M.S. Bristol, the last of the second-class protected cruisers of the "town" class, completed under the 1909-10 estimates, have proved very satisfactory. The vessel was built at Clydebank by Messrs. John Brown and Co., and provided with the Curtis type of turbine, invented in America, but perfected by Messrs. John Brown and Co. In four out of six runs on the measured mile the Bristol has touched 27 knots an hour, which establishes a record for war vessels other than torpedo boats, and beats the Newcastle ship Inflexible, which formerly attained the highest speed.

Lyra.—On October 4th the torpedo-boat destroyer Lyra was launched from Messrs. J. I. Thornycroft and Co.'s yard at Woolston. The vessel has a displacement of 730 tons, and is fitted with Parsons turbines, of sufficient power to give her a maintained speed of 27 knots.

Neptune.—The new Dreadnought battleship Neptune, which completed her official gun trials in the Channel recently returned to Portsmouth Harbour and reported a satisfactory result. The concussion was terrific when the broadsides were fired from her ten 12-in. guns, and minor damage was done on board, although every preparation had been made to prevent it. The new super-imposed turrets or barbettes worked quite up to expectations, and the guns' crews in the lower turrets withstood the test of concussion well. The trials were carried out under the supervision of the officers of the Gunnery School at Portsmouth. The Neptune is now to be prepared for commission, and it is understood that she will relieve the Dreadnought as flagship of the first division of the home fleet.

TRADE NOTES.

The Admiralty have placed the orders for the turbine machinery of the battleships to be built at Devonport and Portsmouth. One ship is to be supplied with machinery by Messrs. The Parsons Marine Steam Turbine Co. Ltd., and the other by Messrs. Hawthorn, Leslie, and Co.

The **Fairfield Shipbuilding and Engineering Co. Ltd.**, Govan, have received from the Union Steamship Co., of New Zealand an order for a large passenger steamer for the Pacific service.

We are informed that **Messrs. The Bolton Lubricating Co.** have purchased the business patents and works of Messrs. Robt. Wood and Co. Ltd.

Messrs. Easton, Greig, and Co., shipowners, Glasgow, have placed an order for a steamer of 6,400 tons dead-weight capacity with **Messrs. A. Rodger and Co.,** Port Glasgow.

Messrs. Glen and Co., Glasgow, have contracted through the Shipping Agency Ltd. with Messrs. A. Vuijk and Zonen, Capelle a. d. Ysel for the construction of a steamer to carry about 2,000 tons dead weight on a draught of 16 ft., dimensions 240 ft. 9 in. by 35 ft. 2 in. by 16 ft. 5 in., with engines 17 in., $28\frac{1}{2}$ in., and 46 in., by 36 in. stroke, by Mr. G. T. Grey, South Shields.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 6th October, 1910.

Belfast.—*Second class:* W. McNeilly, J. S. Hay.

Cardiff.—*First class:* W. C. A. Aggett, F. H. Rowney, W. E. A. Thomas, F. Cooke. *Second class:* E. Brice, C. D. James, T. N. Lloyd, A. Powell, W. H. Thomas.

Glasgow.—*First class:* R. McG. McMurrick, D. C. McMillan, W. Reid. *Second class:* G. B. Baird, J. Borland, W. Murray, D. Smith, M. Teasdale.

Leith.—*First class:* R. Auchterlonie, D. Taylor, J. S. Cramond, D. C. Petrie. *Second class:* C. M. Macnee, D. W. Urquhart.

Liverpool.—*First class:* R. Stevenson, W. R. Hornby, E. B. Askew, W. Kneale, R. H. Shaw. *Second class:* S. W. H. Griffiths, B. S. Sumner, F. G. Woodward.

London.—*First class:* A. M. Wilson, H. H. Cox. *Second class:* W. H. Fraser, W. D. Revington.

North Shields.—*First class:* C. H. Clark, D. D. Donkin, E. Pickering, C. R. R. Moller. *Second class:* M. E. Mail, S. Simeonidis.

Southampton.—*First class:* W. B. E. J. Abraham.

CORRESPONDENCE.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only; and if accompanied by sketches, these should be neatly drawn, and forwarded on a roll, to prevent creasing. We cannot undertake to return rejected communications, or to reply to inquiries by letter. In all cases letters must be accompanied with the name and address of the writer.

We do not hold ourselves responsible for the opinions of our Correspondents.

MANUFACTURERS WANTED.

To the Editor of "The Practical Engineer."

Sir,—Will you kindly supply us with the names of firms who would be able to manufacture completely a small patented metal adjustable pencil holder? It would be nickel-plated and would have certain wording stamped upon its side.

We shall also be extremely obliged if you would get us names of firms who could take on the manufacture of small die cast parts.

Thanking you in anticipation of this favour.—Yours, etc.,

M.O.A.S.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2277. **Keying, Shrinking, etc.**—Can anyone give some reliable figures comparing keying, shrinking on, and hydraulic pressing of wheels, etc., on shafts as regards cost, time of fitting, reliability, general convenience; indicating also limits and limitations of each method?—Miner.

Answer.—Keying is by far the most commonly employed means of securing wheels, collars, etc., to shafts (whether the key be in the ordinary form of a rectangular sectioned bar, bedding to half its depth in each of the pieces coupled, or having merely a frictional grip, or in the allied form of one or more set screws, which may penetrate into or merely grip the surface of the inner piece). Though the keying-on of shafts needs no such special plant as is needed by the alternative methods considered below, it is a slow process, and one needing much skill, to bed a key properly in its keyway; imperfect fitting involves high local stresses and liability to slacken during running (permitting rocking of the parts connected, or even complete disconnection). On the whole, keying is a reliable means of connection, and very generally applicable and convenient. In cases where an outer piece has to be placed far on to a long shaft, keyed attachment is alone feasible in most cases.

Shrinking-on gives, perhaps, the fiercest grip and the most permanent connection that can well be obtained between two mechanically distinct pieces. Parts that have to rotate at high speeds are commonly shrunk on to the parts that drive them; steel shrink rings are placed on turbo-commutators to prevent centrifugal bursting of the latter; steel cylinders are shrunk on to inner cylinders in certain methods of heavy gun manufacture. In each instance the application illustrates the enormous forces called into play by the contraction of the outer piece on the inner part. It necessarily follows that the outer part is very heavily stressed, and owing to the magnitude of these stresses, which are more or less unknown, and which are liable to be very local and to cause distortion, shrinking-on is to be performed with care and under proper supervision. The outer part is usually bored to a diameter smaller than that of the inner part by about one-thousandth of the latter. This method of attachment needs considerable skill, since any errors in the relative adjustments of the parts cannot be rectified once the outer part has cooled. The boring and turning of the fitting surfaces is carried out by machine tools, and, providing a suitable heating furnace is available, the method is convenient where a permanent connection is required. Under such conditions it is not unduly costly in time and labour.

Pressing-on gives a connection more permanent than that afforded by keys, but, in general, a less powerful grip than is secured by shrinking-on. Nevertheless, a wheel or similar part once pressed on to its shaft should never be removed till it or its shaft is worn out, since subsequent pressings-on would give much reduced grip, and would probably need to be supplemented by keys. The stresses set up are more uniform and less intense than is the case with shrunk-on parts, though the excess diameter of the inner part regulates the frictional grip of the outer part much as before. This excess should be such that the total axial pressure required to force the parts together lies within the limits shown in fig. 1 for shafts of various diameters. Providing these pressures actually are needed to force on the wheel, etc. (a point which must be carefully checked by gauge reading), it may safely be assumed that no smaller pressure will shift the parts under working conditions. It should be noted that pressed (or shrunk) on parts will withstand axial pressures as satisfactorily as they will resist peripheral forces, whereas keys should not be depended upon to take up axial thrust. It is a somewhat slow, but not costly, operation to press wheels on to their shafts, and in most cases where keys do not give a sufficiently permanent and powerful connection pressing-on will suffice, though to obtain a more powerful grip, and in cases where parts will not "stand up" to the lateral pressure of an hydraulic press, shrinking-on is preferable. A suitable hydraulic press is very costly, and is available in relatively few works, so that pressed-on parts have usually to be sent away for removal.—C. T.

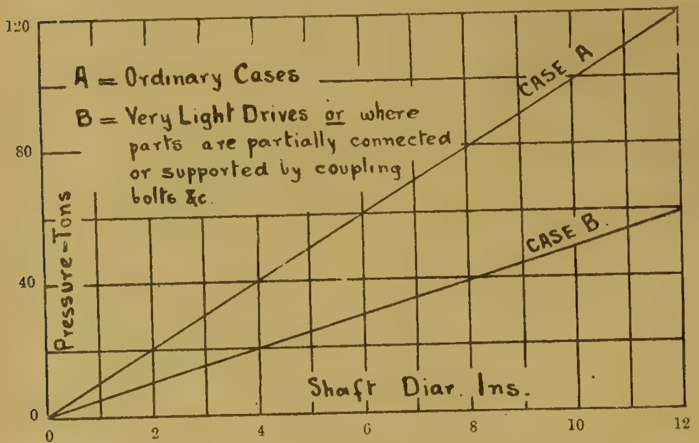

Fig. 1.

2282. Safety Valve Design.—Will any reader give the main points to take into consideration in safety valve design? How is the area of the valve determined? Also outline the design of a spiral spring type valve for a 6 ft. Lancashire boiler, 150 lbs. pressure.—K. T.

2283. Cost of Power Supply.—Compare the cost of power supply by steam, oil, and gas engines, and by electric motors. Analyse costs as far as possible in the various cases and state very clearly any factors which cannot be reduced to £ s. d.—City.

[This information could be obtained from reports of exhaustive tests already made, and given in proceedings of various societies; much information can also be obtained from *The Practical Engineer* Pocket Book.—Ed.]

2284 Oil Fuel Apparatus for Boiler.—Should be glad if any reader will give name and maker, or any information respecting above.—Boiler.

[These particulars are given in *The Practical Engineer* Pocket Book.—Ed.]

2285. Wrought-iron Chimney.—I shall be obliged if some reader will assist me with particulars to design a self-supporting wrought-iron chimney, 6 ft. dia. by 120 ft. high. Diameter at bottom and diameter bed-plate? Weight in concrete foundation? Number and stress in holding down bolts, thickness of plates, etc.? Would it be necessary to line with fire-brick, and if so, to what height? What factor safety is usually allowed in such chimneys? If chimney is not self-supporting, what difference could be made in above particulars when using guy ropes and ground anchors? How many guy ropes? Complete information in this will be of much assistance.—Worker.

MISCELLANEA.

Change of Address.—Messrs. The Stirling Boiler Co. Ltd. have removed from 25 to 58, Victoria Street, London, S.W.

Change of Address.—Messrs. The British Welding Co. Ltd. have removed from 25 to 58, Victoria Street, S.W.

The Admiralty have invited the Thames Ironworks Co. to submit a tender for another battleship of the Dreadnought type, as set out in the naval vote for the 1910-11 programme. The Thames Ironworks Co. are at present completing the contract for the Thunderer, which, it is hoped, will be ready for launching in December. Already the placing of contracts in this part of the country has had an appreciable effect upon the industrial condition of the Thames side, and has meant an increased weekly wages bill of between £5,000 and £6,000. The firm have already sent in tenders for one or two of the armoured cruisers and for torpedo boats in the 1910-11 programme. The contracts for the armoured cruisers are to be placed within a week or so.

Fire at Messrs. Vickers, Sons, and Maxim Works.—On the 8th October a fire was discovered in the joiners' shop in the shipbuilding department of Messrs. Vickers, Sons, and Maxim's naval construction yard at Barrow-in-Furness. The flames spread quickly, and a few minutes after the first discovery the whole place was a mass of flames. The shop is about 250 ft. long by some 80 ft. or 90 ft. wide. It contained a large quantity of all descriptions of wood and many fixtures and articles in course of construction for use aboard ships building in the yard. A large wooden water cooler was completely destroyed. The polishing department was burnt out, together with the engine and ship-tracing departments. The total damage is estimated at £30,000.

Aviation Schools.—On the grounds of the London Aerodrome Co., near Hendon, an informal inauguration took place on Saturday of the aviation school which M. Blériot proposes to found in this country. The site, which provides for a course of from two to three miles, has been acquired for the purpose of offering facilities for instruction in flying and aeronautical science, and, when properly cleared, should prove an excellent and convenient aerodrome for the Metropolis. At present there is shed accommodation for eight machines, one of the sheds being that from which M. Paulhan started on his London to Manchester flight. Three of the sheds have been taken by an aeronautical syndicate, which is also founding a school; two by M. Blériot, and the others are vailable for the purposes of the Aerodrome Co.

Commercial Motor Users' Association.—The Commercial Motor Users' Association has now moved into its new offices on the ground floor at 112, Piccadilly, London, W., where reading, writing, and smoking rooms are available for the use of members; the new telephone number and telegraphic address are 4610, Mayfair, and "Usamobile, London," respectively. Mr. Fred. G. Bristow, A.C.I.S., who for several years acted as assistant secretary, succeeds Mr. Rees Jeffreys (now the secretary of the newly-constituted Road Board) as secretary of the association. The committee anticipate that the membership roll will be materially increased in the near future now that the advantages of the associate scheme of the R.A.C. are offered to members without extra subscription, in addition to the benefits already conferred by membership of the association. Members are entitled to free legal defence in respect of either private or commercial motors.

Sheffield and Steel Production.—Alderman Senior, Master of the Cutlers' Company, addressing the members, deplored the lack of funds which crippled the efforts of the company to prevent false marking of steel goods. Within recent years they had spent nearly £2,000 for the protection of the word "Sheffield" abroad. Action had been taken in Egypt, Canada, France, and Germany, and action was being taken in the United States. He did not think that, as a large manufacturing city, Sheffield was holding its own as it might do, and this might be partly because they were allowing other nations to trade on the name of Sheffield. He urged that a fighting fund was needed, and suggested that local manufacturers should give donations or subscribe to such a fund, which should be used solely for the protection of the word "Sheffield." He criticised the statement made at the meeting of the Iron and Steel Institute at Buxton last week, that in a large measure the electric furnace would do the work of the old Sheffield crucible method of melting, and would produce satisfactory tool steel. A great number of similar statements were made when the Bessemer process was invented. Then it was said that the best crucible cast steel trade was doomed, and such prophecies had been indulged in scores of times since, but the trade had increased by leaps and bounds, and continued to flourish. The firms who stocked the best irons were the firms who were doing the best and the largest business. The best markets which Sheffield had for best tool steel were in Germany and America, notwithstanding the knowledge of science and the protective tariffs of the people of Germany and the United States. That was due to the fact that Sheffield made the best tool steel before chemistry was known in the steel trade. Ever since electric steel had been made commercially large quantities of it had been sent to Sheffield for testing and experimental purposes, and practical Sheffield steel manufacturers who had tried it came to the conclusion that it would never do for tool steel purposes.

PATENTEES' CHRONICLE

OF

Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

OCTOBER 3rd, 1910.

22806 Tobacco pipe filler. Livesey.
22807 Lifting appliance. Johnson.
22808 Gas fire fittings. Thornton.
22809 Carriage door lock. Powell.
22810 Fireplaces. Johnson.
22811 Clothes drying closet. Longsdon.
22812 Puzzle. Pye.
22813 Game. Pye.
22814 Weaving mechanism. Metcalfe.
22815 Internal-combustion engine. Plowright.
22816 Hat linings. Mymms.
22817 Valves. Cochran.
22818 Spiral rail tracks. Sturgess.
22819 Spinning mules. Moulding.
22820 W.C. seats. Brooks.
22821 Spirit levels. Salisbury.
22822 Stopper. Cowburn.
22823 Spinning mechanism. Starkie.
22824 Yarn shade card. Stannard.
22825 Cycles, etc. Osborne.
22826 Game. Davidson.
22827 Preventing pit accidents. Adam.
22828 Toilet paper holder. Boonzaier.
22829 Non-skid apparatus. Sagel.
22830 Cigar, etc., holder. Bare.
22831 Holder for powder paper, etc. Macrae.
22832 Nickel-silver plating powder. Hamilton.
22833 Amusement. Andrews.
22834 Fuel briquette manf. Zimmer.
22835 Fuel briquette manf. Zimmer.
22836 Pneumatic wheel. Sobofewski.
22837 Chucks. Scott.
22838 *Wrenches. Paul.
22839 *Preserving chambers. Mederer.
22840 *Lifting granular material. Sfaello. Sfaello.
22841 *Arc lamp.
22842 *Electric switch. Schattner.
22843 *Tobacco pipe extinguisher. Parker.
22844 *Airships. Nowotnick.
22845 Pneumatic tyres. Emery.
22846 Pneumatic tyres. Nash.
22847 Drawing device. Roos.
22848 *Conveying apparatus. Cowley.
22849 Boot manf. Denne.
22850 Shirt collars. Wright.
22851 *Fertiliser. Coates.
22852 *Metallic filament lamps.
22853 Handle-bar control device. Brown.
22854 Cycle saddle. Barnett.
22855 Game. Affleck.
22856 *Furnace. Curran.
22857 *Lubrication system. Bosch.
22858 *Cleaning fibrous material. Liebscher
22859 Boots, etc. Spurin.
22860 *Hoes. Bilsland.
22861 *Liquid mixer. Still.
22862 *Distilling device for oils. Still.
22863 *Cooler for condensing liquids. Still.
22864 Glazing pottery. Lovatt.
22865 Spring wheel construction. Brown.
22866 *Utilisation of glass panes. Obrist.
22867 Peat handling device. Testrup.
22868 *Device for packing powder. Paraskovich.
22869 Treating textile plants. McInerny.
22870 *Wheel. Pierson.
22871 Cans. Goodchild.
22872 Rotary engine. Crofton.
22873 Fanlight opener. Ford.
22874 Loose-leaf binder. King.
22875 Wheel tyres. Stephens.
22876 Dry dyeing device. Ransford.
22877 Lime water supply to steam boilers. Sands.
22878 Delivery of compressed liquids. Lawson.
22879 Windows. Hahn.
22880 *Strong room. Homan.
22881 Auto robes. Chandlee.
22882 Valve. Downs.
22883 Wall beading. Steiner.

OCTOBER 4th, 1910.

22884 Sketching easel. Roberts.
22885 Internal-combustion engine. Pearce.
22886 *Steam engine. Davidson.
22887 *Steam engine. Davidson.
22888 *Battery. Schmidt.
22889 Dust extractor. Buckley.
22890 Motor car. Craig.
22891 Gas burner. Prosser.
22892 Pipe joint. Barker.
22893 Internal-combustion engine. Goodman.
22894 Golf ball. Bayley.
22895 Price ticket manf. Sullton.
22896 Football case. Scrivner.
22897 Brake. Dyson.
22898 Looms. Bradford.
22899 Tobacco pipes. Grant.
22900 Mill. Clemesha.
22901 Hats. Mymms.
22902 Telemotor. MacTaggart.
22903 Window fastening. Mascoad.
22904 Conveyor. Paterson.
22905 Clippers. Terry.
22906 Hose clip. Potter.
22907 *Coke oven. Fabry.
22908 Distillation of coal. Beilly.
22909 Corking machines. Plunkett.
22910 Screens. Baxter.
22911 Hair comb. McGhee.
22912 Gear. Stockwell.
22913 Rain water gutter. Allen.
22914 *Superheater. Weddigen.
22915 *Relating to snake jets. Eddy.
22916 Stage trace. Harrison.
22917 Furniture castors. Collins.
22918 *Cutting out comminution device. Alexander.
22919 *Cutting out comminution device. Alexander.
22920 *Water controlling device. Alexander.
22921 *Water heating. Alexander.
22922 *Feed water heaters. Alexander.
22923 *Water purification. Alexander.
22924 *Costing fluid metals. Doehler.
22925 Wheels. Schofield.
22926 Door latches. Day.
22927 Fire escape. Bonnaud.
22928 Aerating device. Garrett.
22929 Wheel. Sturgess.
22930 *Pasting machinery. Stocker.
22931 *Stop cocks. Ellwood.
22932 *Cigar holder. Darst.
22933 *Window shades. Smith.
22934 *Pump. Schou.
22935 Aeroplanes. Pollard.
22936 Adjustable die. Owen.
22937 *Measuring device. Pappano.
22938 *Trusses. Knox.
22939 *Bookkeeping device. Johanson.
22940 *Photo apparatus. Lake.
22941 *Heater. Palmer.
22942 Resistance contact device. Brown.
22943 *Clothes drying device. Henrici.
22944 *Washing device. Edwin.
22945 *Reversing mechanism. Henrici.
22946 *Reversing mechanism. Henrici.
22947 *Washing machine. Henrici.
22948 Wheels. Williams.
22949 *Glasses. Blanchard.
22950 *Bottle stoppering. Langlois.
22951 Gas burner. Zechrall.
22952 Motor cycle. Buch.
22953 Internal-csombustion engine. Kingston.
22954 Electrical device. Simpson.
22955 Clip. Hunt.
22956 Hooks. English.
22957 Non-puncturable tyre. Terry.
22958 Separating device. Schrey.
22959 *Telephone system. Neuhold.
22960 Cycle brake. McGuise.
22961 *Viscosity meter. Baldus.
22962 *Cardboard box. Murrell.
22963 Closet pan. Zelzer.
22964 *Gearing device. Cake.
22965 Spherometers. Aldis.
22966 Boot heels. Peake.
22967 *Dental instrument. Toomey.
22968 Wheels. Moreau.
22969 *Turbine. Parsons.
22970 Collar fastening. Zimmer.
22971 *Gas lamp. Specht.
22972 *Washing machine. Boult.
22973 *Concentration of ores. Greenway.
22974 Stocking suspenders. Ward.
22975 *Gymnastic apparatus. Brechbuhl.
22976 *Type casting. Degener.
22977 Boot, etc., sole, etc., guard. Luxmore.
22978 Mudguard stay. Hooker.
22979 Hammock. Edwards.

OCTOBER 5th, 1910.

22980 Submarine. Grant.
22981 Window wedge. Downes.
22982 Steam traps. Coulthard.
22983 Brakes. Moffett.
22984 Flour purifiers. Samuelson.
22985 Ladies' hatpin. Williams.
22986 Dust apparatus. Green.
22987 Single rail vehicles. Kearney.
22988 Fishing rod. Carswell.
22989 Fishing reels. Carswell.
22990 Boot, etc., warmer. Williamson.
22991 Timber drawing machine. Williams.
22992 Motor lighting. Culverwell.
22993 Waterproofing apparatus. Oliver.
22994 Searchlight. Aulsebrook.
22995 Coupling. Houlding.
22996 Looms. Hollingworth.
22997 *Coke, etc., crusher. Guest.
22998 Electric instrument. Lawes.
22999 Weaving device. Redman.
23000 Gas, etc., taps. Barralet.
23001 Alarms. Birch.
23002 Garden rake. Dixon.
23003 Forks. Townley.
23004 Gas meter. Seaton.
23005 Electric fittings. Etchells.
23006 Electric lamp holder. Townley.
23007 Inflators. Amphlet.
23008 Gas burner. Sherburn.
23009 Eyeglasses. Grimes.
23010 Saw socket. Yarrow.
23011 Clothes props. Robinson.
23012 *Spectacle cases. Willmott.
23013 *Chain fastening device, etc. Jenkins.
23014 *Valve gear. Melling.
23015 *Railway terminals. Irving.
23016 Boots, etc. Barker.
23017 Whip. Mogren.
23018 *Ball valve. Liebert.
23019 Roller skates. Evans.
23020 Saucepan lid, etc., handling device. Martyn.
23021 Meat safe. Ferguson.
23022 Gas stoves. Charters.
23023 Bedstead. Scriven.
23024 Shirt cuffs. Sternberg.
23025 Motor steering. Quinn.
23026 Iron ore, etc., excavating. Whitaker.
23027 Puzzles. Hough.
23028 *Steam valve. Heide.
23029 *Potato, etc., cutter. Wirckop.
23030 *Ignition device. Baltrusch.
23031 Frames. Strain.
23032 Cinematograph machine. Hansen.
23033 Gas stoves. White.
23034 Aviation device. Batty.
23035 Electric conductors. Green.
23036 Burners. Kelly.
23037 Cinder sifter. Whitaker.
23038 Shuttle peg. Brook.
23039 Gas controlling device. Sperryn.
23040 Gas production. Marken.
23041 Aerial vehicles. Hardie.
23042 Light projecting apparatus. Henwood.
23043 Cycle wheels. Hardingham.
23044 *Electric signals. Arnold.
23045 Relating to gas vapours. Phillips.
23046 Separating nitrogen and ammonia. Phillips.
23047 Liquid delivery. Phillips.
23048 Flying machine. Hardwick.
23049 *Electric ignition. Bosch.
23050 *Carburetter. Pelterie.
23051 *Glass manf. McMullin.
23052 Dye manf. Johnson.

23053 Displaying samples, etc. Bronssaid.
23054 *Roller lever. Yoxall.
23055 Nasal inhaler. Helot.
23056 *Drawing sheets. Elwres.
23057 *Tyres. Puschmann.
23058 *Photo apparatus. Ives.
23059 Artificial teeth. Bécheraz.
23060 *Weighing machine. Boyer.
23061 *Price indicator. Boyer.
23062 Ellipsographs. Arnold.
23063 Mattresses. Arnold.
23064 Road repairs. Nathan.
23065 Electric fittings. Turner.
23066 Electric meter. Martin.
23067 Cape cart hood. Rucker.
23068 *Stoker. McLaren.
23069 *Pumps. Adolfsson.
23070 Screw propeller. Schüler.
23071 Aviators' garments. Deissner.
23072 Gas cocks. Feeny.
23073 Grinders, etc. Boult.
23074 *Hair treatment. Rougat.
23075 *Suspension springs for vehicles. Jacquet.
23076 *Milk pails. Herbold.
23077 Sterilising liquid. Helbronner.
23078 Sterilising liquids. Helbronner.
23079 Brake. Oppermann.
23080 Calorific value of fuel. Verity.

OCTOBER 6th, 1910.

23081 *Axle box. Hinds.
23082 Potato washing. Horsburgh.
23083 Lever propulsion. Parks.
23084 Advertising device. Johnston.
23085 Gas lamps. Hatton.
23087 Toy. Sparkes.
23088 Cash tills. Gledhill.
23089 Rail bolts. Dobbie.
23090 Tyre manf. Mortier.
23091 Snow ploughs. Crawford.
23092 Cottage. Slade.
23093 Signals. Starlick.
23094 Bolt rifle. Proctor.
23095 Guns. Wallace.
23096 *Fans. Keith.
23097 Grocers' basket. Passant.
23098 Pulleys. Hallows.
23099 *Pulleys. Leach.
23100 Variable rope drives. Leach.
23101 Pit cages. Barclay.
23102 Collar supports. Goode.
23103 Match box. Barratt.
23104 Foot and ankle support. Davies.
23055 Pendants. Turner.
23106 Looms. Hollingsworth.
23107 Looms. Hollingsworth.
23108 Railway carriages. Berry.
23109 Wheels. Doddrell.
23110 Razor. Savage.
23111 Speed gear. Boody.
23112 Lathering rubber. King.
23113 Steam heated kilns. Bothwell.
23114 Internal-combustion engine. Reeves.
23115 *Sink outlet. Peters.
23116 Golf club. Harrower.
23117 *Soap manf. Janousck.
23118 Acetyelene gas generation. Bernhard.
23119 Fountain pen. Davis.
23120 Door, etc., fastening. Morey.
23121 *Lamps. Schröter.
23122 *Electric motor. Oerlikon.
23123 Treatment of feed water. Haythorpe.
23124 Controlling flow of liquids. Summers.
23125 *Separating device. Tanne.
23126 *Engine. Minne.
23127 Printing machine. Waite.
23128 Aerial machine. Lorenzen.
23129 Push carts. Headley.
23130 Safety pin. Weight.
23131 Friction clutch. Wilson.
23132 Button. Talbot.
23133 *Glow lamp. Siot.
23134 *Tub. Grass.
23135 Bottle filling device. Miller.
23136 Chains. Morris.
23137 Valves. Brookes.
23138 *Screens. Späth.
23139 Speed gear. Buch.
23140 Wheels. Cooper.
23141 Lamps. Potter.
23142 *Screws. Lakhovsky.
23143 *Fireproof structures. Wilson.
23144 Brackets. Bigwood.
23145 *Gunpowder. Claessen.
23146 *Bottle manf. Guillemot.
23147 Cutting tool. Ashton.
23148 *Vegetable extracts. Anderson.
23149 Alarm. Elieson.
23150 *Blowers. Gibson.
23151 *Sash fastener. Smith.
23152 Liquid flow regulator. Normandy.
23153 Electric cable. Dagnall.
23154 Boxes, etc. King.
23155 Looms. Radcliffe.
23156 Stair rod eyes. Hudson.
23157 *Potassium persulphate manf. Pietzsch.
23158 *Hydrogen peroxide manf. Pietzsch.
23159 Coin counter. Wiberg.
23160 Flax straw preparing machine. Stewart.
23161 Tin opener. Roughley.
23162 Screws, etc. Gordon.
23163 Stereoscopic, etc., effects. Fulton.
23164 *Grates. Schwellenbach.
23165 Wearing apparel. Cohen.
23166 Toys. Hansen.
23167 *Fountain holder. Fries.
23168 *Lamp. Nier.
23169 Reversing gear. Attwood.
23170 *Milking machine. Loquist.
23171 Utilisation of slag. Thompson.
23172 Draught preventers. Minton.
23173 Buffers. Dunne.
23174 *Motors. Dassenay.
23175 Wood paving blocks. Phillips.
23176 Photo apparatus. Pearson.
23177 Treatment of ores. MacIvor.
23178 Telescope. Newitt.
23179 *Gas supplying apparatus. Edgar.
23180 Determining strain, etc., in structures. William.
23181 Carriage door opener. Sketon.
23182 Cycles. Evenden.
23183 Seats. Faulkner.
23184 Photo retouching. Hollosy.
23185 Coupling chains. Bagnall.

OCTOBER 7th, 1910.

23186 Pipes. Dittmar.
23187 Pumps. McRobbie.
23188 Signalling device. McCoubney.
23189 Barrels. Walker.
23190 Tyres. Priestley.
23191 *Ladies' hat. Costello.
23192 Firebars. Shutt.
23193 Gauges. Ellis.
23194 Sand valve. Gibbs.
23195 Bath. Franklin.
23196 Turbine. Lake.
23197 Aerial railway. Hamilton.
23198 Latches, etc. Harries.
23199 Efficiency recorder for lifts. Barry.
23200 Looms. Walker.
23201 Governor for engines. Sutherst.
23202 Cigar pouch. Jennens.
23203 Propeller. McKay.
23204 Brush holder. Hall.
23205 Match delivery apparatus. Burks.
23206 Yarn winding. Johnson.
23207 Cloth strengthening. Chapman
23208 Pump. Smith.
23209 *Fanlight. Tonks.
23210 Machine tool. Barton.
23211 *Gas burner. Wilson.
23212 Extending light rims. Edgington.
23213 Bottle stoppers. Bayley.
23214 *Mud removing. Evershed.
23215 Separating water and peat, etc. Burnett.
23216 *Securing device. Terry.
23217 *Piston. Putois.
23218 Waterproof bag. Etches.
23219 Driving band manf. Sankey.
23220 Thread cleaner. Eckersley.
23221 Looms. White.
23222 *Electric lamp. Lüdecke.
23223 *Firegrates. Edwards.
23224 Cheese wine. Brown.
23225 Massage appliance. Ray.
23226 Winding yarn. Leach.
23227 Valves. Markham.
23228 Door lock. Jones.
23229 Washing machine. Parker.
23230 *Speed gear. Richardson.
23231 *Speed gear. Powell.
23232 Turbines. Ricci.
23233 Gauge for water. Prigmore.
23234 Envelope opener. Fayers.
23235 Pump. Price.
23236 Potato diggers. Knowles.
23237 *Leather softening. Farrar.
23238 Showcards. Hewett.
23239 Advertising cards. Hewett.
23240 Boot trees. Warner.
23241 *Ignition device. Sussex.
23242 Wireless telegraphy. Fleming.
23243 Envelope. Dunton.
23244 Re-inforcing papers for filing. Greathed.
23245 *Cycle rims. Sangster.
23246 Tyres. Burnett.
23247 Bearings. Maitland.
23248 Aerated water manf. Lloyd.
23249 Boot. Vandyk.
23250 Treatment of ores. Dick.
23251 *Pump. Bosch.
23252 *Acid manf. Peitzsch.
23253 *Mills. Lake.
23254 *Projectiles. Lake.
23255 *Firearms. Mauser.
23256 *Furnace stoker. Seyboth.
23257 Valve. Richardson.
23258 Culinary contrivance. Stocken.
23259 *Furnace. Haensel.
23260 *Treatment of ores. Mitchell.
23261 Telescopic shoots. Wrightson.
23262 *Drying device. Würth.
23263 Wheels. Lemarchand.
23264 Games. Treadwell.
23265 *Boilers. Schwab.
23266 Ships. Chamberlain.
23267 Kettles, etc. Chamberlain.
23268 Building slabs. Heaton.
23269 *Gas lighting device. Rousset.
23270 Aeronautical machine. Clarkson.
23271 Drawing blocks, etc. Steller.
23272 *Case hardening furnace. Zeugin.
23273 Veil holding frame. Peniston.
23274 Fluid apparatus. Hele-Shaw.
23275 Tin cans. Griffin.
23276 *Advertisement. Peaucellier.
23277 *Door locks. Töpfer.
23278 *Window frames. Kopplinger.
23279 Girths, etc. Ash.
23280 *Cycles. O'Neill.
23281 *Sheet feeding device. Heide.
23282 *Sheet feeding device. Heide.
23283 *Sheet feeding device. Heide.
23284 Carburetter. Doudney.

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23285 Aerial navigation. Statter.
23286 Railway switch levers. Williams.
23287 Motor plough. Charlton.
23288 Concrete mortar. Owens.
23289 *Pipe manf. Wienburg.
23290 Lamps. Johnston.
23291 Drains. Lawrence.
23292 Fire extinguisher. Baden-Powell.
23293 *Food. Gillbanks.
23294 Ship's rudder. Webster.
23295 Electrical device. Clarke.
23296 Sewing machine. Bell.
23297 Sewing machine. Bell.
23298 Motors. Wilson.
23299 Picklers. Taylor.
23300 Internal-combustion motor. Beech.
23301 Ashpans. Ure.
23302 Marking device. Town.
23303 Aeroplanes. Burga.
23304 Cycle saddle rainproof cover. Arthur.
23305 Manipulating hot hollow articles. Purnis.
23306 Spanner. Riddleston.
23307 Lamps. Sherwood.
23308 Looms. Yates.
23309 Collars. Atkinson.
23310 Valve gearing. Stewart.
23311 *Garments. Horwood.
23312 Looms. Kay.
23313 Looms. Kay.
23314 *Electric current regulators. Poole.
23315 *Tobacco pipe. Heywood.
23316 Spinning mules. Crowther.
23317 Carding engine. Haddock.
23318 Washer cutter. Coffey.
23319 Loading, etc., device. Maiden.
23320 *Yarn treatment. Hathaway.
23321 *Yarn treatment. Hathaway.
23322 Watch manf. Hardwick.
23323 Mudguards. Shrapnel.
23324 Flying machine. Olsson.
23325 *Boot upper manf. Boyd.
23326 Motor car screens. Challinor.
23327 Music cabinets.
23328 *Penholder. Fairbrother.
23329 Game, etc. Turrey.
23330 Boot heels. Mathews.
23331 *Ore roasting furnace. Harris.
23332 Electric lamp manf. Hoge.
23333 *Lime kilns. Mathon.
23334 *Wheels. Juhasz.
23335 Haulage clips. Bennett.
23336 Wheels. Ruddicom.
23337 Badges. Bannister.
23338 Sparking plug. Lodge.
23339 *Wheels. Barrean.
23340 *Explosion motors. Barrean.
23341 *Valveless motor. Barrean.
23342 Boring machine. McGoath.
23343 *Tyre cover instruments. Kendrick.
23344 Railway spikes. Westmacott.
23345 Stage management. Bruckner.
23346 *Automatic grab. Laudi.
23347 Heel protector. Barnes.
23348 Compression of gases. Hoat.
23349 Pipes. Campbell.
23350 Golf club bags. Bromphy.
23351 *Fishing reels. Crichton.
23352 Locks. Bowl.
23353 Tyres. Willes.
23354 *Cement. Colletas.
23355 Illumination device. Pinching.
23356 Hinge joints. Wall.
23357 *Propulsion of ships. Wahlen.
23358 *Military implement. Drossopouls.
23359 *Treating aluminium. Rumpler.
23360 *Hats. Alezina.
23361 Spinning frames. Boyd.
23362 Shock absorber. Spicer.
23363 *Articles of clothing. Bailly and Co.
23364 Transporters. Hughes.
23365 *Applying capsulus to bottles. Lassen.
23366 *Eyeglasses. Newbold.
23367 *Eyeglasses. Newbold.
23368 *Treatment of acid tar. Thaarup.
23369 Lamp lighter's torches. Schwabacher.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to November 14th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

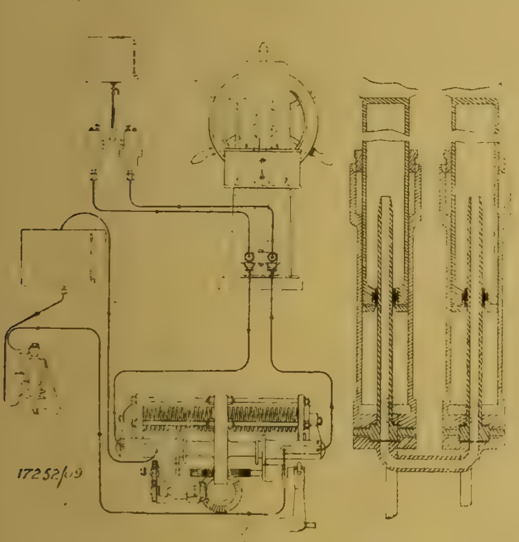
Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

3260 Hamilton: Vacuum cleaners. [Post-dated August 9th, 1909.] 15656 Filippi: Propellers and the like. [Date applied for under International Convention, April 6th, 1909.] 15682 Thomas and Thomas: Electric collectors for maintaining connection between stationary and moving conductors. 15841 Dockree: Preserving and protecting cinematograph films. [Post-dated January 7th, 1910.]

17252 Thompson: Motor and steering telemotors. [Post-dated January 19th, 1910.]

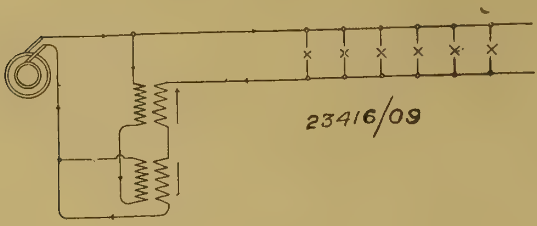
It consists in providing motors and steering telemotors with means for automatically permitting the springs to set the cross bar in mid position when the rams are in mid position.



18045 Kay: Photographic cameras to obtain sky and cloud effects. 18124 Goodson and Burnett: Mechanism for use in connection with calculating machines and the like. 18583 Venner and Griesbach: Electric mechanism for writing and colour-changing signs. [Post-dated March 11th, 1910.] 19803 Dockree, Holmes, and Houghtons Ltd.: Reflexed cameras. [Post-dated December 31st, 1909.] 19949 Imer: Reflectors with closed globe suitable for illuminating purposes. 20012 Piper: Acetylene generators. 20040 Lake (European Brake Shoe Co.): Method of casting metals. 20089 Macpherson and Heys: Soap and the manf. thereof. 20108 Potter: Aeroplanes. 20128 Rheinische Metallwaaren und-Maschinenfabrik: Hydraulic brakes for guns having a recoiling barrel. [Date applied for under International Convention, February 9th, 1909. Application for Patent of Addition to 289, 1907.] 20155 White: Vacuum cleaning apparatus. 20217 Drexler: Manf. of hollow concrete blocks, floors, and ceilings. 20221 Hurst and Bridger: Bottle, jar, and like stoppers. [Cognate Applications. 28282, 1909, and 2532, 1910.] 20231 Wimperis and Elphinstone: Instruments for measuring acclerations, gradients, inclinations, and the like. 20232 Evans: Aeronautical apparatus. 20237 Simpson: Manf. and purification of coke or other fuel and with apparatus therefor. 20355 Jack: Priming of mine or other pumps. [Cognate Application. 25282, 1909.] 20365 Jensen: Drain pipe cutting machines. 20392 Sefton-Jones (Lloyd): Method of and means for making coiled wire fabric. 20394 Marks (Green): Variable diameter brace bits for boring wood. 20401 Chemische Fabrik Griesheim Elektron: Manf. of sulphuric acid. [Date applied for under International Convention, September 21st, 1908.] 20435 Shaw: High voltage ceiling rose with a detachable plug connection independent of the cover and base. 20444 Johnson: Bridge for boiler furnaces. 20458 Notcutt: Abrasive files. 20486 Lucas: Acetylene gas burners. 20487 Osborn and Osborn: Production of lines on cycle frames and other bodies. 20496 Bowell: Electric clocks and like mechanisms. 20573 Moor: Apparatus for digging and separating potatoes and other analogous purposes. [Cognate Application. 5828, 1910.] 20575 Planes Ltd., and Thompson: Flying machines. 20578 Boult (United Shoe Machinery Co.): Machines for use in conforming uppers to lasts. [Application for Patent of Addition to 16589, 1908.] 20592 Tully: Retort furnaces for the destructive distillation of coal. 20628 Tonkin: Internal-combustion engines using liquid fuel. 20639 Berry: Electrically-heated apparatus. 20662 Waterhouse, Phillips, and Phillips: Certain kinds of metallic bedsteads and cots. 20723 Dunne: Underframes for aeroplanes and like machines. 20792 Smythe: Golf clubs. 20815 Siemens Bros. Dynamo Works, and Lydall: Electricity meters. 20827 Akt.-Ges. Brown, Boveri, and Cie.: Dynamo electric machinery for starting purposes. [Date applied for under International Convention, January 22nd, 1909.] 20877 Higginbottom: Mechanically-propelled heavier than air flying machines. [Cognate Application. 8663, 1910.] 20927 Sloper: Non-slipping surfaces for elastic tyres and other elastic goods. 20944 Berard, Berard, and Beland: Building motion of spinning, twisting, and winding machines. 20972 Carpenter: Speed regulators for motor cars and the like. 21000 Boult (United Shoe Machinery Co.): Pulling-over and like machines. 21012 Eaton-Shore: Lubrication of bearings. 21016 Humphrey: Water heaters. [Date applied for under International Convention, December 26th, 1908.] 21017 Humphrey: Water heaters. [Date applied for under International Convention, January 15th, 1909.] 21031 Hermann: Manf. of artificial stone slabs or plates and the like. [Date applied for under International Convention, May 8th, 1909.] 21205 Liney: Means for pulling up or raising floor boards and the like. 21251 Smith: Machine for manufacturing wire or like bonds used in ferro-concrete and like constructions. 21297 Sonnenthal and Bamford: Drilling, boring, and similar machines. 21441 Chambers: Method of controlling electrical qualities by means of sound waves and apparatus therefor. [Cognate Application. 27663, 1909.] 21471 Mitchell: Apparatus for operating railway and tramway points and the like. 21499 Hollingworth (Crompton and Knowles Loom Works): Means for effecting weft replenishment in automatic weft-replenishing looms. 21551 Cayless: Barrows. 21569 Trethan and Bachmayr: Compound chair, bed, stretcher, and table. 21573 Torrance, Torrance, Torrance, and Torrance and Sons Ltd.: Multiple roller mills. 21598 Whittaker, and C. Whittaker and Co.: Brick-making machines. 21607 Sharpe and Sharpe: Domestic boiler. 21619 Vinten: Artificial bait. 21629 Welin: Gear for securing ships' boats. 21711 Pownall: Apparatus for cooling water for condensing and other purposes. 21732 Deakin: Aeronautical apparatus. 21864 Aked: Knee grip for motor cycles. 21952 Hahn: Yarn-mercerising machine. 22113 Park: Golf clubs. [Cognate Application. 26800, 1909.] 22243 Sabine: Machine for lining sanitary pipes with rings of jointing material. 22422 Kinney: Rotary motors and pumps. 22714 Johnson (Badische Anilin and Soda Fabrik): Manf. of halogen derivatives of the indigo series and of intermediate products. 22750 McNaught: Combined sliding bolt and lock fastenings. 22759 Ferguson and Ferguson: Driving and reversing gear for engine shafting. 22801 Halasz: Paper-adjusting devices for writing machines. 22865 Johns: Windows with double-hung sashes. [Request under Section 19 of the Act not granted.] 22916 Fletcher: Autographic recording device. 22970 Cook: Method of glazing greenhouses, garden lights and frames, portable buildings, and the like. 22997 Kent: Apparatus for generating heat by electric currents. 23028 Morrish: Fittings for venetian blinds. 23036 Conore: Machine for decorticating and similarly treating plant fibres. [Date applied for under International Convention, October 31st, 1908.] 23094 Turner: Anti-skidding devices, more especially applicable to motor road vehicles. 23360 Sigurdsson: Type-casting and composing machines. [Date applied for under International Convention, October 31st, 1908.] 23377 Webb, Brettell, and Adamson: Ventilation and purification of ships' holds or chambers.

23416 British Thomson-Houston Co. (General Electric Co.): Voltage regulation of alternating-current circuits.

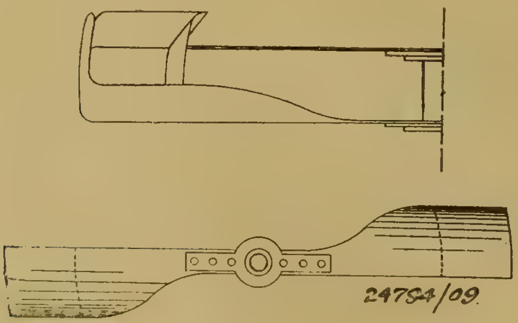
Relates to voltage regulation of alternating-current circuits, and the object is to provide simple and efficient means for compounding the voltage of the circuit with varying load, and consists in employing two transformers having their primaries connected in series with each other and in shunt to the source of voltage for the circuit and their secondaries connected in series with each other and with the load. The cores of the two transformers are so proportioned that one is saturated and the other unsaturated. The relative connections of the two transformers are reversed, so that their secondary voltages are in opposition, the secondary voltage of the first transformer opposing the voltage of the source in the load circuit, and the secondary voltage of the second transformer assisting the voltage of the source. At no load the secondary voltages are equal and opposite. As the circuit is loaded the load current flowing through the transformer secondaries cannot affect the magnetisation of the saturated transformer, but increases the magnetisation of the unsaturated transformer, and therefore increases the secondary voltage, which is in a direction to add to the voltage to the source, so as to increase the voltage supplied to the load.



23477 Royle: Motion-multiplying gear for hydraulic lifts. 23564 Whiting: Automatic small arms. 23607 James Keiller and Son Ltd., and Boyd: Packages used for the marketing of sweets and the like. 23649 British Thomson-Houston Co. (General Electric Co.): Electric transformers. 23664 Vorwerk: Means for securing interchangeable heels, heel pieces, soles, and the like to boots, shoes, and the like. 23713 Baumann: Flying machines. 24219 J. Stone and Co., Jakeman and Wells: Manholes, surface boxes, or the like and covers therefor. 24283 Williams: Advertising signs. 24296 Watson, Lightfoot, and Shortill: Life-saving mechanism for trams and like cars. 24315 Holt and Maryon-Wilson: Aerial machines. 24503 Nathan: Method of and burner for consuming crude and other combustible oils. [Date applied for under International Convention, October 31st, 1908.] 24545 Bamford and Bamford: Swath turners or hay collectors. 24574 Brinton and Hood: Jacquard needles. 24643 Wineberg: Brush cleaner for clothes, hair, paint, and like brushes.

24794 Hamilton: Propeller.

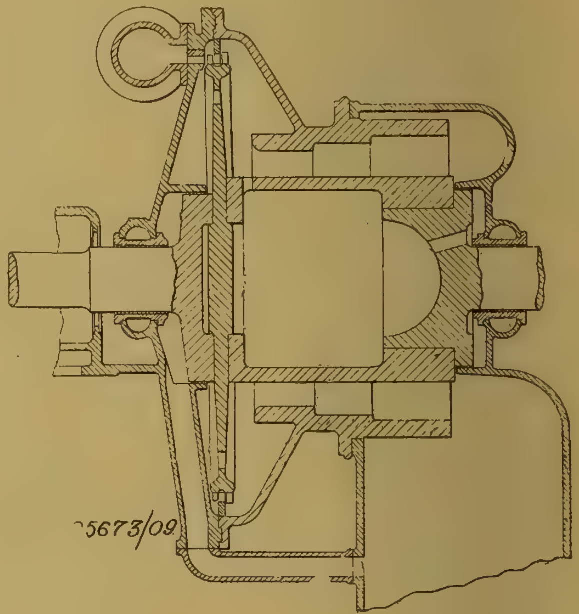
Relates to propellers used for the propulsion of aeroplanes, and has for its object an improved construction designed to reduce slip as far as possible. The propeller is constructed of two or more blades projecting radially from a central boss or hub in the usual manner and each curved in cross section to a suitable pitch or contour. Projecting at right angles from the concave or convex surface or both of each of these blades are two segmental planes arranged concentrically and opposite to one another and one of which is coincident with the end of the blade and the other is situated at a suitable distance therefrom. These planes are of a depth approximately equal to the distance they are placed apart and they carry on their outer free ends a plane curved to correspond with the curvature of that part of the blade which is beneath it. A structure somewhat resembling an open-ended box is so formed on each blade of the propeller on either or both sides thereof of such a character that the air passing through it when the propeller is in use is compressed without the production of interfering eddy currents.



24803 Baldwin: Pneumatic tyres for bicycles and motor vehicles for the prevention of skidding. 24925 Jenkins: Paper and like stoppers or lids for vessels. 25010 Champ: Reel frames for machines for making wire netting. 25026 Fisher: Life-saving apparatus for use at sea. 25178 King: Cowl for chimneys and the like. 25273 Tudor Accumulator Co. (Accumulatoren Fabrik Akt.-Ges.): Electric storage battery separators. 25282. *See* 20355, 1909. 25594 Thomas: Transmission of power. [Post-dated January 15th, 1910.] 25595 Buckley: Curtain pole holder.

25673 Willans and Robinson Ltd., and Izod: Combined impulse and reaction turbines.

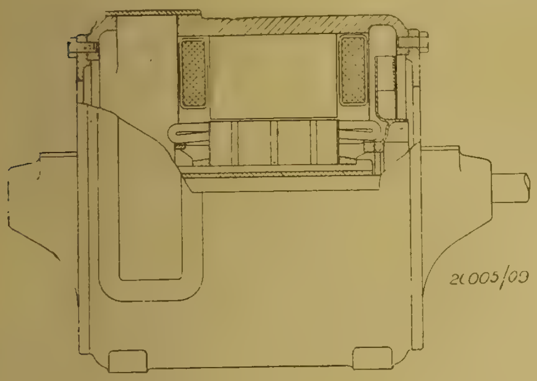
The revolving portion of the turbine is as shown formed at each end with a cylindrical piston projecting from it. Each piston fits around its circumference to the interior of a cylinder forming part of the fixed outer casing. The cylinder at the high-pressure end of the turbine is connected by a pipe leading from it to the exhaust passage, whilst the other cylinder at the low-pressure end is supplied with steam through a passage and through the hollow interior of the reaction drum to which steam is admitted near the first row of the reaction blading, this steam being preferably not above atmospheric pressure. By employing two pistons, one at each end of the reaction drum, one acted on by vacuum and the other by pressure, their diameter and consequently the peripheral speed of their packing is considerably less than when a single piston at one end is used as heretofore.



25700 Lockwood: Domestic fireplaces and the like. 25742 Onken: Speed indicators for motor cars and the like. 25966 Sippel: Foldable stretcher.

26005 Mavor, and Mavor and Coulson Ltd.: Ventilation of electric motors.

Various methods have from time to time been devised for the better ventilation of electric motors of the protected type having an armature with radial ventilating passages of which many forms are known. Among these methods may be particularly mentioned one in which a fan of the propeller type—that is to say, one in which the air is delivered parallel to the axis and of a diameter approximately equal to the internal diameter of the motor shell, is used to draw air from the outside and to deliver it over the whole surface of the motor winding on the armature and magnets. This method is found to be disadvantageous because the action of the fan does not co-operate with the natural action of the ventilating current of air through the radial passages of the armature of the machine. Eddy currents are therefore caused and the cooling effect is inferior. According to the present invention, in order to overcome such objection and secure improved results, a modified arrangement is employed embodying two fans of radial type arranged at one end of the motor, one fan by exhausting action supplementing the natural action of the ventilating current of air through the radial passages of the armature and the other fan forcing air through the stator between the field magnets.

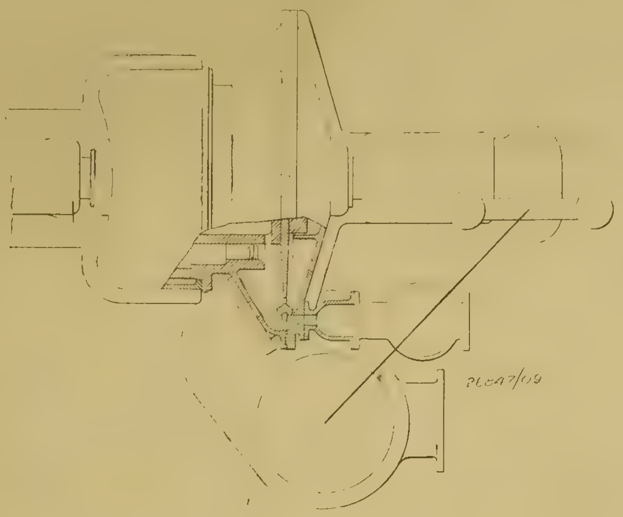


26040 Nance: Process of tanning. 26224 Gilmore: Means for playing games. 26248 Waters: Lid for manholes in tanks, boilers, steam generators, and the like. 26259 De Frece: Device for facilitating the distribution of tickets for places of amusement and the like. 26288 Widdison: Method of and means for fixing advertising cards and the like in tramcars and other places. 26344 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new acid wool dyestuffs. [Application for Patent of Addition to 7820, 1909.] 26587 Auto-Carriers Ltd., and Weller: Three-wheeled motor vehicles. 26671 Davis: Device for extracting thorns, flints, and the like from tyres. 26800. *See* 22113, 1909. 26804 Williams: Changeable sign for advertising purposes and the like.

26847 Willans and Robinson Ltd., and Izod: Combined impulse and reaction turbines.

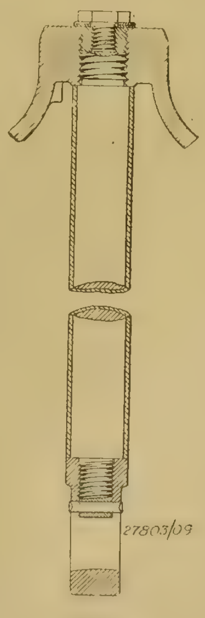
A combined impulse and reaction turbine is constructed in the manner shown in the illustration so as to be capable of being worked with steam from two sources of supply, viz., low-pressure (or exhaust) steam supply to the reaction (or drum) portion of the turbine from the low-pressure source of supply and high-pressure steam from high-pressure source of supply to high-pressure nozzles delivering steam to the impulse blades on the impulse wheel. The impulse wheel is made of larger diameter than the end of the drum or reaction portion of the turbine which is adjacent to it. The portion of the outer casing within which the impulse wheel is enclosed is similarly made of larger diameter than the portion of the casing which surrounds this end of the drum. The high-pressure nozzles for delivering steam to the impulse blades of the impulse wheel pass through one side of the enlarged portion of the casing which surrounds the outer portion of this wheel, whilst an inlet for low-pressure steam is made through the opposite side of this portion of the casing. The steam passage leading to this low-pressure steam inlet is led back alongside of the high-pressure steam passage and a cut-off valve is arranged in each in such a position that both may be operated by the movement of one lever extending from the main governor of the turbine. Cut-off valves are provided in the high-pressure and low-pressure steam passages to allow of the turbine being operated either by high-pressure steam alone or by low-pressure steam alone or by a combination of high-pressure and low-pressure stea...

26858 Stewart and Stewart: Gas producers and the method of working the same. 26865 Sands: Self-igniting match boxes. 26917 Fredenstein: Inspection apertures for padded rooms. 26974 Walker, Swift, and Hulme: Nosebags for horses and the like animals. [Post-dated March 10th, 1910.] 27079 Fischer: Device for attaching leather tips to billiard cues. 27090 De Lareinty-Tholozan: Explosion turbines. [Date applied for under International Convention, December 11th, 1908.] 27213 Koepe: Means for threading thin-walled tubes. 27251 Lion: Carburetting apparatus for internal-combustion engines. 27636 Brown, and Brown and Barlow Ltd.: Carburetters such as are used on internal-combustion engines. 27663. *See* 21441, 1909. 27697 Taylor: Portable buildings and other structures. 27698 Schmid, and Merian and Luthy: Machine for brushing boots and shoes. [Date applied for under International Convention, November 27th, 1908.] 27714 Fabri: Treatment of mineral and like oils for lighting, motor fuel, and similar purposes.



27803 Gresham: Vacuum brake apparatus for railway and like vehicles. [Request under Section 19 of the Act not granted.]

Consists in providing in combination with the piston rod of vacuum brake apparatus in which the piston rod is provided with a sleeve or liner and is adapted to screw into the piston, a locking screw to lock the piston rod to the piston to prevent unauthorised removal of the rod.

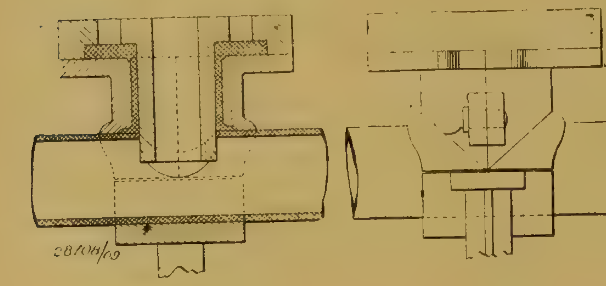


Another feature consists in the provision of a combined locking and jointing device for the piston rod connection with its piston.

27960 Lake (Hite): Manf. of coal briquettes. 27965 Egle: Hydraulic presses. 27973 Bostock: Copying lathes. 28122 Carlton: Water gauges for locomotive and stationary steam boilers. 28218 Nieser and Poleschowsky: Atmospheric gas burners. 28282. *See* 20221, 1909. 28397 Lynas: Internally-heated laundry irons. 28442 William Newman and Sons Ltd., and Newman: Double-acting door hinges. 28531 Fletcher and Sershall: Swivel couplings for connecting inflating pumps to tyre or the like valves. 28592 Lake (Submarine Signal Co.): Submarine signalling apparatus. 28667 Shaw: Shuttle-relief motion for looms for weaving. 28684 Rex Motor Manufacturing Co., and Sarginson: Spring forks of cycles, motor cycles, and the like. [Cognate Application. 326, 1910.]

28708 Metal Jointing Co., and Harden: Means for enabling a branch to be cast upon a lead or similar pipe *in situ*.

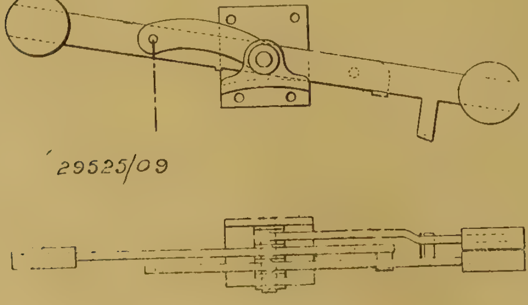
The object of this invention is to provide means for enabling a branch to be cast upon an existing lead or similar pipe *in situ*, and it consists in an improved form of knock-down mould adapted to be applied to the pipe so as to permit of the branch being formed simply by filling the mould with molten lead, a suitable flux being preferably used for the purpose of ensuring a proper union of the new with the old part at the joint between them.


28708/09

28985 Gordon: Device on which to place clothes for drying or airing in laundries, kitchens, and like places. 29079 Prince: Brake-operating mechanism for motor vehicles and the like. 29108 Burroughes: Cushions for billiard tables and the like. 29130 Whitcomb: Pulley rims and like surfaces for increasing the frictional efficiency of the same. [Date applied for under International Convention, December 26th, 1908.] 29139 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new derivatives of the anthraquinone series. 29262 Fenn: Blank feed mechanism for needle-forming machines. 29315 Kopal: Coin-freed locks for caretakers. 29365 Buderus'sche Eisenwerke: Apparatus for atomising liquid slag. [Date applied for under International Convention, December 28th, 1908.] 29484 Bowden Brake Co., and Lamplugh: Brakes for velocipedes.

29525 Williams, Williams, and Williams: Railway signalling.

Relates to improved apparatus for controlling and simplifying the movements of semaphore and like signals. A signal post is fixed to a bracket on which is mounted a horizontal pin. In the case of a calling-on and a home signal both signals are operated by one wire from the signal cabin by mounting on the horizontal pin three parallel levers. A calling-on, a home, and a distant signal are operated by two wires from the cabin. In this case there are two additional levers mounted alongside the others and similarly fulcrumed. The one is the lever to which is attached the wire for the distant signal, the other has attached to it the distant signal operating rod. The latter lever has two projecting flanges or feet, the one passing under the distant wire lever, and the other passing under the home rod lever, so that when the home signal wire is pulled the calling-on signal comes off during the first portion and the home signal is pushed off during the second portion of the travel. The lever for operating the distant ram is then free to be operated. The distant wire lever when moved by the pull of the wire does not move the distant signal which is only free to move when the control is released by the movement of the home and calling-on signals.


29525/09

29700 Grimes: Eyeglasses. 29755 Caldecott: Settling tanks for separating liquid from crushed ore products and other granular materials. 29802 Zepler and Zepler: Repair bands for pneumatic and similar tyres. 29931 Pickford: Carding engines. 29973 Cook: Card to be used as a toy and for advertising purposes. 30095 Ludw. Loewe and Co., Akt.-Ges., Millington, and Munthe: Apparatus for slitting screws. 30133 Rhodes, Rhodes, and Sanjebord Publicity Co.: Street and other advertisement display apparatus. 30259 Stephenson and Duerden: Kilns for burning bricks and tiles. 30390 Holste: Bleaching starch. 30420 Gelin: Safety razors. [Date applied for under International Convention, January 4th, 1909.] 30598 Holzwarth and Junghans: Gas turbine plant. [Date applied for under International Convention, August 9th, 1909.]

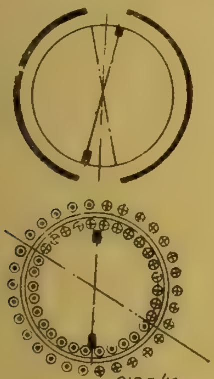
1910.

47 Coventry (Doherty): Apparatus for burning cement. 131 Sutcliffe: Snow ploughs. 239 Evered and Co., and Poole: Lubricators or grease cups. 271 Bennett: Method of renovating or repairing staircases, steps, and the like. 326. *See* 28684, 1909.] 343 Reichel: Regenerators for coke ovens. 364 Dimmock: Golf balls. 379 Wrbka: Vehicle wheels with detachable tyres. 754 Neumann: Method of manufacturing cocoa powder. [Date applied for under International Convention, March 15th, 1909.] 932 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of colouring matter lakes. 950 Soc. Besnard, Marie et Antoine: Gas or oil stoves. [Date applied for under International Convention, July 26th, 1909.] 1150 Morton: Pin point protectors. 1196 Cay: Forming a metal pile shoe for reinforced piles or sheet piles of concrete and such like material. 1275 Aronson: Wrenches. [Application for Patent of Addition to No. 22886, 1909.] 1290 Sattler: Machines for covering wire, thread cores, cords, flexible conductors, electric cables, and the like. [Date applied for under International Convention, January 19th, 1909.] 1293 Poll and Bennett: Clip for carrying watches. 1487 Hoffman: Ladies' hatpin, point protector, and hatpin retainer. 1529 Bair: Climbing devices for pipes and the like, particularly for use as fire escapes. 1593 Schulzke: Toy or game appliance. 1842 Pockett: Means for reducing the shocks and slipping to which horses and the like are subjected when negotiating hard and slippery surfaces. 1944 Stoker and Gilchrist: Rope grips. [Post-dated March 16th, 1910.] 2006 Tucker: Method of and means for securing skirts, petticoats, and the like in position. 2040 Lutz: Pedals for cycles and the like. 2176 Lord: Sliding and folding partitions. 2233 Vogel: Automatically closing funnels for liquid. 2308 Platts: Packing for securing fluid-tight joints. 2370 Ingle: Locking devices for the cages of lifts or elevators. 2375 Rogers: Wheels for vehicles. 2421 Paul: Presses for corrugating roofing paper, felt, and like materials. 2519 Justice (Veeder Manufacturing Co.): Counting apparatus. 2532. *See* 20221, 1909. 2663 Sheehy: Means for operating railway points. 2885 Wright: Apparatus for displaying advertisements, information sheets, and the like. 2953 Neubauer: Spindle bearings for spinning machines. 2986 Simon: Air pumps, more particularly applicable for inflating pneumatic tyres. 3150 Whitelaw: Historical and educational puzzle. 3197 Summers: Coking processes. [Date applied for under International Convention, February 9th, 1909.] 3455 Bell and Bell: Sewing machines. 3569 Shearer: Combs: 3607 Bissell: Power-transmitting mechanism. 3760 Carlson: Motor vehicles. [Date applied for under International Convention, May 25th, 1909.] 4197 Stahn: Device for opening the wrappers of prismatic packages. [Date applied for under International Convention, March 6th, 1909.] 4296 Sweeny and Grindle: Feed-water heaters for steam boilers. 4441 Balfour: Fastenings for doors and the like. 4473 Fabry: Process to recover ammonium sulphate direct from coke oven

or retort gas. 4565 Koscielsky and Krudener-Struve: Peat-disintegrating machine. 4804 Rosenberg: Electro-magnetic vibrator for local application to the person. [Application for Patent of Addition to 4133, 1909.] 4983 Lederer: Boot trees. 5020 Kestner: Apparatus for concentrating liquids. 5046 Mackenzie (National Papeterie Co.): Paper boxes. 5121 Rau: Surface condensers. [Date applied for under International Convention, March 26th, 1909.] 5124 Newton: Wood or metal sills for windows, specially applicable to casement windows. 5190 Weckesser: Mixing machines for concrete, plaster, and the like. [Date applied for under International Convention, October 7th, 1909.] 5273 Wolfarth and Zimmermann: Compressed air cushions for vehicles. [Application for Patent of Addition to 13,652, 1909.] 5294 , Telecheff: Small arms. 5345 Lamson Paragon Supply Co., and Evans: Paper-perforating devices for use with files for documents and other papers. 5349 Brenken and Boddecker: Belt fastenings. 5368 Campbell and Robinson: Fittings for lamp globes, shades, and the like. 5369 Roman: Electroplating apparatus. 5448 Woll: Art of teasing or picking curled hair. 5582 Pushee: Manf. of brushes. [Date applied for under International Convention, March 11th, 1909.] 5669 Lan-Davis: Time exposure valves for photographic shutters and the like. 5828. *See* 20573, 1909. 5935 Haddan (C. M. B. Wrench Co.): Ratchet wrenches.

6124 Siemens Bros. Dynamo Works (Siemens Schuckertwerke Ges.): Alternating-current commutator electric motors.

> In an alternating-current electric motor having a short chord rotor winding connected to a commutator and brushes in the manner referred to which is started up as a repulsion motor, the torque producing magnetic field being excited by rotor ampere turns, short circuiting the rotor winding and making electrically inoperative the commutator and brushes under normal running conditions in such a manner that the motor then operates as an induction motor.



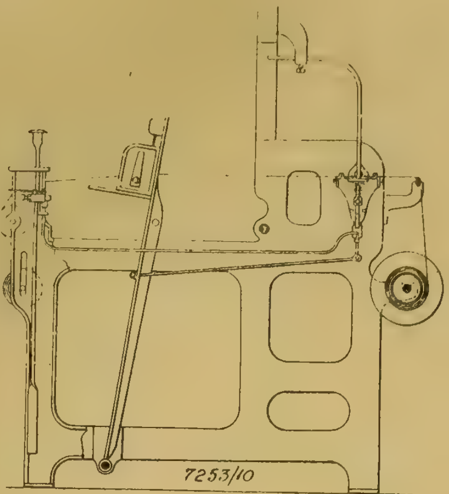
6124/10

6208 Ruegg: Jacking apparatus for railway cars. [Date applied for under International Convention, March 12th, 1909.] 6252 Lord: Chimney pot. 6290 Muller: Combined apparatus for ice-making, cooling victuals, and aerating liquids. 6351 Imray (Soc. of Chemical Industry in Basle): Manf. of brominated vat dyestuffs. 6393 Guttmann: Plaster for medical purposes. [Date applied for under International Convention, April 5th, 1909.] 6485 Wilm: Process for improving alloys. 6731 Wendler: Methods of and apparatus for manufacturing wire-strengthened paper, pasteboard, and the like. 7097 Sandeman: Combined overshoe or boot and legging. 7128 Johnson: Shaving paste.

7253 Smith and Smith: Warp stop motion of looms for weaving.

> This invention relates to certain improvements in stopping looms automatically on the breakage of a warp thread and liberation of one of a series of slotted detector plates adapted to be supported by two, or by four warp threads, or on the breakage of a warp thread supporting an ordinary drop bar, and comprises detectors supported by warp threads, a reciprocating device adapted to be stopped on the dropping of a detector, means for admitting compressed air to a sliding cylinder attached to the starting handle of loom in combination with a displacing arm secured to the reciprocating lay beam.

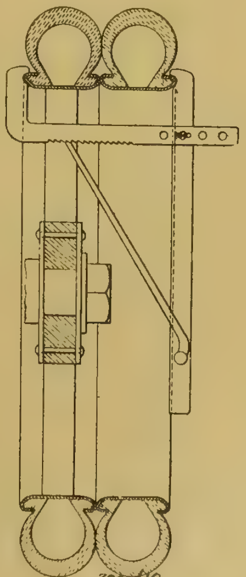
7335 Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gas: Clockwork movements. [Date applied for under International Convention, July 9th, 1909.] 7540 Vogel: Calculating machines. 7552 Parkinson: Pneumatic conveyers. 7603 Walter: Toys. 7649 Wolski: Hydraulic rock drills. 7803 Brenken and Boddecker: Saw guides for sawing machines. 7897 Floyd and Williams: Appliance for securing hats to the head.



7253/10

7907 Squires: Means for facilitating the attachment of spare rims to motor vehicle wheels. [Cognate Application. 10876, 1910.]

> Relates to improvements in means for facilitating the attachment of spare rims to motor vehicle wheels, and comprises the combination of a pair of pivoted members which form a simple lever vice or clamp whereby the spare and permanent rims can be gripped and expeditiously drawn together and held whilst the usual attachment devices for the spare rim are being secured in position.

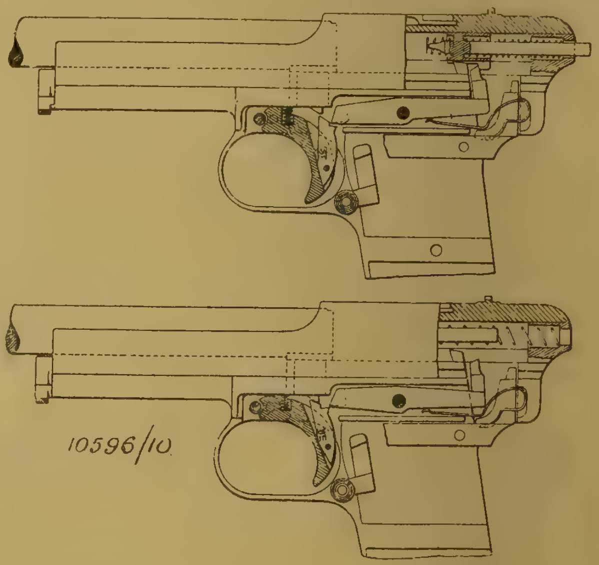


7907/10

8102 Dalmar: Device for cleaning the smoke tubes of marine and other boilers by suction. 8228 Neuhold: Automatic telephone exchanges. [Date applied for under International Convention, June 10th, 1909.] 8279 Bench: Variable-throw cranks for bicycles and the like. 8287 Beckert: Means for adjustably supporting window blinds. [Date applied for under International Convention, April 6th, 1909.] 8310 Newton (R. Hoe and Co.): Ink-feeding mechanism for printing machines. 8339 Marks (Blumberg and Rindskopf): Process for the preparation of aldehyde sulph-oxylates. 8350 Rodd: Lunch trays. 8445 Powner: Automatic safety gates for hoists. 8459 Schaefer: Device for cleaning and lubricating gun barrels. [Date applied for under International Convention, April 8th, 1909.] 8529 Luchsinger-Caballero: Daylight photographic developing tanks and the like. [Date applied for under International Convention, April 9th, 1909. Application for Patent of Addition to 24085, 1909.] 8621 Allgemeine Elektricitats-Ges.: Control of alternating electric current induction motors. [Date applied for under International Convention, April 10th, 1909.] 8624 Srosloff: Time pieces. 8629 Destefani: Devices for burning paraffin wax or the like for illuminating or other purposes. 8630 Smith: Holders for flowers and the like. 8663. *See* 20877, 1909. 8734 Dieffenbach and Moldenhauer: Manf. of hydrogen. [Date applied for under International Convention, January 10th, 1910.] 9089 Maschinenbau-Anstalt Humboldt: Rotary drying drums. [Date applied for under International Convention, April 24th, 1909.] 9251 Clarke: Device for stiffening collars, belts, bodices, and the like. 9351 Finley, Glaspy, and Piper: Metallic railroad ties. 9406 Richardson: Manf. and treatment of steel. [Date applied for under Rule 13, June 5th, 1909.] 9506 Draper and Hilton: Cranking device for internal-combustion engines. 9539 Rabinsohn: Devices for producing or transmitting electric current waves and oscillations. 9582 Coan and Marx: Boot trees or stretchers. 9758 Goldman: Conveyer. 9876 Briault: Apparatus for raising vehicles. [Date applied for under International Convention, April 24th, 1909.] 9886 Domec: Centrifugal crushing or breaking machines. 9898 Moy and Bastie: Cinematograph projectors, cameras, and the like machines. 10072 De Jersey: Paper-bag making machines by mechanism for inserting card or like bottoms. 10135 Wittenberg: Mouthpiece for tobacco pipes and cigarette holders. 10141 Hare: Vacuum cleaner nozzles. 10148 Ionides: Carburetters for internal-combustion engines. 10187 Ransford (Oddur Manufacturing Co.): Type-casting machines. 10193 Uellner: Clamps for fixing the covers of tyres to the wheels of motor vehicles. 10331 Bloxam (Chemische Fabrik Griesheim Elektron): Manf. of yellow disazo dyestuffs. 10440 Lake (Winchester Repeating Arms Co.): Repeating firearms. 10461 Von Horlacher: Combined tobacco pouch, pipe case, and pipe filler. [Date applied for under International Convention, September 30th, 1909.] 10478 Ern: Safety razors. 10485 Loewenthal: Fencing droppers. [Date applied for under International Convention, May 4th, 1909.]

10596 Mauser: Firing mechanism for automatic pistols. [Date applied for under International Convention, December 24th, 1908. Originally included in 28707, 1909.]

Relates to a recoil loading pistol having a fixed barrel and a breech block guided on the body and of the type in which the sear is formed as a bell crank lever, one end acting as a sear engaging the firing pin and the other end co-operating with a spring catch carried by the trigger to allow the firing pin to be cocked even if the trigger be held in its rearmost position, and comprises a new arrangement of the trigger mechanism for this type of weapon, the sear of which is mounted at the side of the magazine and above the upper part of the detachable magazine in the upper part of the body, and consists of a bell crank lever pivoted at the centre of its horizontal part, the upwardly projecting arm of which forms the sear proper, while the detent lever for holding and releasing the sear is pivoted to the trigger.



10596/10

10655 Walker: Pneumatic tyre for road vehicles. [Date applied for under International Convention, May 12th, 1909.] 10714 Warrick: Apparatus for advertising purposes. 10801 Penin: Speaking tubes. [Date applied for under International Convention, March 10th, 1910.] 10819 Anglo-American Oil Co., and Powell: Receptacles for petrol or the like. 10840 Randle and Smith: Egg poachers. 10876. *See* 7907, 1910. 10914 Firm of Geb. Sulzer: Two-stroke cycle internal-combustion engines. [Date applied for under International Convention, May 29th, 1909.] 10954 Wertheim: Apparatus for displaying signs or advertisements. 11213 Vickers and Sinclair: Process of manufacturing beef and like brawn. 11335 Meyer: Ploughs. [Application for Patent of Addition to 10394, 1909.] 11458 Laviolette: Process for the manf. of parabolic lenses having a central cavity for searchlights or projectors. [Date applied for under International Convention, May 14th, 1909.] 11496 British American Tobacco Co., and Robbins: Cigarette-packing machines. 11705 Carlsen and Michaelson: Combined starting device and carrier for spinning tops. [Date applied for under International Convention, May 12th, 1909.] 11779 McNeill: Aeroplanes. 11916 Henrichsen and Hemmingsen: Milking appliances. [Application for Patent of Addition to 25185, 1908.] 11945 Hopf: File handles. 12018 Gush: Supporting attachments for nosebags for feeding horses and similar animals. 12054 Soc. H. Vinot et Cie. and Lefebvre: Elastic wheels for vehicles. 12119 Friedl: Mounting photographs or other prints. 12178 Hartley: Looms for weaving pile fabric. 12223 Priem: Paper bags and method of making same. 12232 Lake (Winchester Repeating Arms Co.): Small arms. 12244 Brown: Brakes for machinery. 12311 Lucas: Tool for effecting the closure of fuel economiser lids and the like. 12548 Hayden: Developing tanks for photographic films. 12691 Rice: Starting and reversing mechanism for gas engines. [Date applied for under International Convention, October 28th, 1909.] 12905 Short, Short, and Short: Wheeled carriage for flying machines. 13039 Callow and Callow: Moulding or like treatment of dough. [Date applied for under Rule 13, December 6th, 1909.] 13468 Knight: Tyres for motor and other vehicles. 13574 Hamley: Saw-cut picture puzzles. 13316 Peraux: Tyre levers. 14346 Hofmann and Hofmann: Folding canopy top for automobiles. 14556 Trow, and Trow's Patents Ltd.: Hinges for doors, casement windows, and other hinged structures. 14581 Abram Lyle and Sons Ltd., and Lyle: Means for closing tins. 14592 Graham and Murison: Envelopes. 15318 Hofermann: Disinfecting device for telephone apparatus. [Date applied for under International Convention, January 27th, 1910.] 15399 Degener, and General Composing Co. Ges.: Matrices for matrix-setting and type-line casting machines. [Date applied for under International Convention, February 23rd, 1910.] 15728 Dorschel: Stoppers for preventing refilling of bottles. 15855 Van Berkel: Meat clamp for meat-slicing machines. 15915 Birkin and Sands: Lace, and the method of making the same. 15933 Russell and Hutson: Holders for electric incandescent lamps. 16035 English: Talking machines. [Date applied for under International Convention, July 10th, 1909.] 16344 Hanbury: Toast rack. 16382 Black: Apparatus for testing the eye sight. 17295 Morrison: Pedestal spittoons for dental purposes. 17471 Goodson and Burnett: Calculating machines [Date applied for under Rule 13, August 5th, 1909.] 17733 Viette: Combined visible indicator and luminous signal-indicating apparatus. [Date applied for under International Convention, August 26th, 1909.] 17809 Carl Zeiss: Mixtures disengaging oxygen when heated. [Date applied for under International Convention, July 29th, 1909.] 18184 Mertens: Machine for printing lengths of material (textile fabrics, paper, or the like). [Date applied for under International Convention, August 2nd, 1909.] 18459 Hodgkinson: Rotary motors. [Date applied for under International Convention, September 1st, 1909.]

COMPLETE SPECIFICATIONS OPEN TO PUBLIC INSPECTION BEFORE ACCEPTANCE, UNDER THE PATENTS ACT, 1907.

1909.

30393 Wilzin: Process for the manf. of metal forks and spoons.

1910.

6899 Huessener, Schaefer, and Henss: Method and apparatus of extracting tar from hot distillation gases by means of tar gas water or both. 7707 Gavan: Convertible beds. 10041 Malachowski: Manf. of electric glow lamps. 12747 Firm Paul Schmidt and Desgraz Technical Bureau Ges.: Process and device for the operation of gas furnaces for heating, scaling, and hardening purposes. 14925 Hartmann Braun Akt.-Ges.: High frequency resonance measuring instruments. 15164 Thomson: Resisters of electric furnaces. 15165 Thomson: Revoluble or oscillatory electric furnaces. 15166 Fitzgerald: Electric furnaces. 15167 Thomson: Electric furnaces. 15168 Thomson: Electric furnaces. 15169 Thomson: Electric furnaces. 17893 Barton: Governing apparatus. 18429 Hodgkinson: Fluid-pressure motor plants. 18691 Bourbeau: Cylinders for explosion engines. 19022 Mathot: Regeneration gas producers. 19086 Gaara: Steering devices for aeroplanes and similar machines. 19180 Detable: Means for automatically re-establishing equilibrium of aeroplanes or the like. 19407 Sachs: Rear wheel hub for velocipedes with back-pedalling brake and free-wheel gearing. 19625 Gravdahl: Method of and apparatus for reversing internal-combustion engines with electric ignition. 19679 Deiss and Fournier: Process for manufacturing oxalic acid and other organic acids used as well as other oxygenated products of carbon with recuperation of the alkalies employed by the use of superheated steam under pressure. 19680 Gorton: Cutting-off machines and the like. 19686 Hoffman: Combination code cards. 19687 Hoffman: Check-identifying machines. 19802 Kanzler Schreibmaschinen Akt.-Ges.: Multi-colour ribbon adjustment. 19945 Wickel: Process and apparatus for hot and relief embossing in gold, silver, metal, and body colours or the like. 19954 Heberlein and Co.: Apparatus for drying fabrics. 19993 Kallmann: Electric resistance. 20115 Berglof: Process for reducing metal ores. 20123 Lassen: Closing or capsuling bottles, jars, and like substances. 20125 Schaef: Aeroplanes. 20130 Rondeau: Method of fixing resilient tyres on vehicle wheels. 20205 Rotter: Working and construction of explosion motors. 20248 Weihe: Cableways for dumping mounds. 20251 Newmann: Roller bearings. 20325 Kaiser: Method of making nitrogen-oxygen compounds. 20334 Farbenfabriken vorm. Friedrich Bayer and Co.: Manf. and production of new azo-dyestuffs. 20353 Smith: Machines for the splitting or other working of stones and the like. 20356 Senn: Eyelet for shoes and other articles. 20411 Blum:

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SOME RECENT DEVELOPMENTS IN MODERN ARMAMENTS.

A great advance has been made of late years in the design and construction of armaments. Improvement has followed improvement with such rapidity that it may truthfully be said that no sooner has one type proved satisfactory and been adopted than another comes along to supersede it.

The British standard 12 in. gun is a case in point. The earlier types weighed 47 tons and were 27 ft. 4½ in. long. These were gradually improved upon until the latest pattern (mounted on the Neptune and sister ships) was evolved, weighing nearly 60 tons and with a length of over 46 ft. No sooner, however, has this weapon been perfected than it is superseded by the 13·5 in. gun, weighing 86 tons; and hardly have the Admiralty decided to adopt this latter when a still more powerful weapon is constructed, the 14·3 in. gun of the Armstrong-Whitworth firm. This gun is claimed to possess an advantage over all others, inasmuch as it is fitted with cylinders containing a special fluid in place of the usual recoil springs, which arrangement is said to lessen the shock and permit of greater accuracy in firing. This weapon can be fired 10 times without relaying.

Again, with regard to the torpedo. In 1895 the standard weapon was the Fiume, weighing something over half a ton, with a maximum effective range of 4,000 yards, a speed of 20 knots, and a gun-cotton charge of 205 lbs. This has now been rendered practically obsolete by the 21 in. torpedo invented by Lieut. Hardcastle, which weighs about a ton, has a maximum effective range of 7,000 yards, a speed of 31 knots, and a charge of 250 lbs. of gun cotton. The accuracy of the torpedo has been also greatly increased by the Obry gyroscopic steering apparatus, the use of which prevents any deflection out of the original line of fire, and also the old difficulty—so well known to naval men—of adjusting the range.

The French wireless or Gabet torpedo is another distinct advance. In shape it is similar to the ordinary torpedo, but is fitted with watertight compartments containing the motor and electric apparatus, the whole thing being controlled and directed by Hertzian waves. In front, in place of the ordinary warhead, it carries two prongs connected with an explosive ram. On these prongs are mounted luminous signals, which, by constantly appearing and disappearing, enable the operator to guide the weapon at night. By tuning the transmitter and the receiving apparatus to the same pitch, interference by counter-Hertzian waves is avoided. The weight of this new torpedo is about 2,500 lbs., and it would carry, in war time, a motor of about 200 H.P., giving it a speed of 25 knots. At the trials recently carried out at Maisons Lafitte, it is said to have given most satisfactory results.

In this country the Government is arranging for a new service rifle, and the Germans are experimenting with what is known as the searchlight rifle, an extraordinarily ingenious weapon which enables a soldier to take accurate aim at night. It consists of a telescopic searchlight containing a small electric lamp, the entire thing being fitted to the barrel below the stock.

The rifle grenâde, which, it is asserted, turns an ordinary rifle into a howitzer, is another modern invention. It can be attached to the ordinary service weapon, has a range from 50 yards to a quarter of a mile, according to the elevation of the rifle, weighs 1 lb. 6¼ ozs., and bursts into about 200 pieces. It can also be used as a hand grenade by inserting a rope tail at the base. When used with a rifle, the required elevation is obtained by a small indicator fixed to the weapon beneath the backsight. Recent tests showed that nothing could live within 50 yards of the bursting point

Another modern weapon is the motor airship gun for high-angle firing against air craft. This type of gun is used in both the French and German armies, that used by the latter being perhaps the most effective. It is made in two calibres, one a 7·5 c.m. gun, with an elevation of 75 deg. and a range of 20,475 ft., for field service, and a 10·5 c.m. gun, with the same elevation and a range of 30,517 ft.; for mounting on warships.

An aerial torpedo has also been invented by Colonel Unge, an officer of the Swedish Army, for use on airships. It has no recoil, and does not, therefore, disturb the equilibrium of the gun platform.

The new British 4·5 howitzer, which is to replace the old 5·7 weapon, appears to be the only step the Government in this country have taken in the matter of high-angle firing guns, this weapon firing at a maximum elevation of 45 deg. The Germans, however, possess a gun which may be described as a grenade gun. In appearance it is like an ordinary quick-firing field gun, except that, protruding from the muzzle, is a large metal ball. Its effect is much the same as the rifle grenade, except, of course, that it has a greater range and bursting area. It is, in fact, an improved schrapnel gun, but of decidedly awkward appearance, and the grenades being bulky there is considerable difficulty in transporting large quantities. Although the rate of fire is comparatively slow, it is said to be extremely effective, and is especially adapted to savage warfare.

The foregoing is, after all, but a brief survey of the latest developments in the art of killing, but it is sufficient to show what a vast change has taken place in armaments even during the last two or three years.

RUMOURED AMALGAMATION OF JARROW AND HEBBURN FIRMS.—It is reported, says our contemporary the *Glasgow Herald*, in its issue of the 17th inst., that negotiations are in progress for the transfer of Messrs. R. Stephenson and Company's shipyard at Hebburn to the Palmer Company at Jarrow. Inquiry at the offices of the latter firm elicited the reply that there was "nothing to communicate." From what the above journal has been able to ascertain elsewhere, however, it seems that a big scheme is maturing, or is in actual process of realisation, the director of the enterprise being, it is rumoured, Lord Furness. The plan of expansion will probably be made known at an early date, and until then it is not expected that particulars of the undertaking will be disclosed officially. In well-informed commercial circles the opinion is held that the two concerns will be amalgamated, and that the merchant work of the Palmer Company will be carried out at the Hebburn Yard, and the Jarrow Yard will be reserved entirely, or almost so, for naval work. Lord Furness is one of the largest shareholders in the Palmer Company, and it is understood that he has recently acquired additional shares in the firm. For many years he has favoured the idea that the company should produce its own armour plate. Whatever there may be developing in that direction, there are grounds for believing that the mid-Tyne amalgamation is likely to be accomplished. Part of the project, it is stated, is to re-model the Jarrow shipyard, engine works, and steel works, and make the works better than ever they have been for the carrying out of Admiralty contracts. Messrs. Stephenson's shipyard is not far removed from Palmer's, and there is an abundance of space for the construction of merchant vessels. The yard has been closed for a considerable time. Attached to it is the largest dry dock on the North-East coast, and that, of itself, will be an important asset to a firm engaged in the building of war vessels.

VESSEL WITH DIESEL ENGINE ON LAKE ZURICH.

AN installation of a Diesel engine on board a vessel intended for passenger service on Lake Zurich is described in an article in the *Zeitschrift des Vereines Deutscher Ingenieure*, Berlin, of April last. The vessel was formerly fitted with a steam engine, and the highest speed attainable was 14 km. an hour. The engine was removed and replaced by a Diesel engine, which enabled without difficulty a speed of 20 km. an hour to be attained with a greatly reduced fuel consumption. The steam engine, which was of 70 H.P., required an installation of a total weight of 14,700 kil., including the water and coal supply for a voyage of 120 km. The complete installation for the Diesel engine of 150 H.P. is only 9,750 kil., that is to say a reduction of weight of 4,950 kil., the supply of fuel being for 1,200 km. instead of for 120 km. The economy in space effected is also considerable, the dimensions of the plant being reduced by 80 per cent. Moreover, a single mechanic is found sufficient for the management of the Diesel engine, whilst two were required for the steam engine, and the former was must lighter work, the temperature in the stoke-hole being much lower than in the case of the steam engine.

The running of the Diesel engine is remarkably regular, the reversing of this Sülzer engine being effected with great ease, which is particularly advantageous in the case of a service where the stoppages are frequent. The steam engine previously used consumed 8·5 kil. of coal per kilometre, which amount corresponded approximately to 28 cm. for a speed of 14 km.

The results of trials with the Diesel engine have been as follows: Speed in kilometres per hour—19·72, 20·20, and 18·80; distance run, 24 km., 24 km., and 9·9 km.; time occupied in minutes, 73, 71·27, and 31·6; consumption of fuel in kilograms, 38, 41·9, and 10,46; consumption of fuel per kilometre, 1·583, 1·746, and 1·057; number of revolutions of screw propeller per minute, 300·0, 310·9, and 259; power of the engine in indicated horse power, 174, 192, and 114; consumption of fuel in kilograms per horse power indicated, 0·179, 0·184, and 0·174; cost of fuel per kilometre in centimes, 9·5, 10·48, and 6·34. The cost of fuel has been, therefore, only about a quarter that of the steam engine, whilst obtaining at the same time an increase in the speed of 34 per cent.

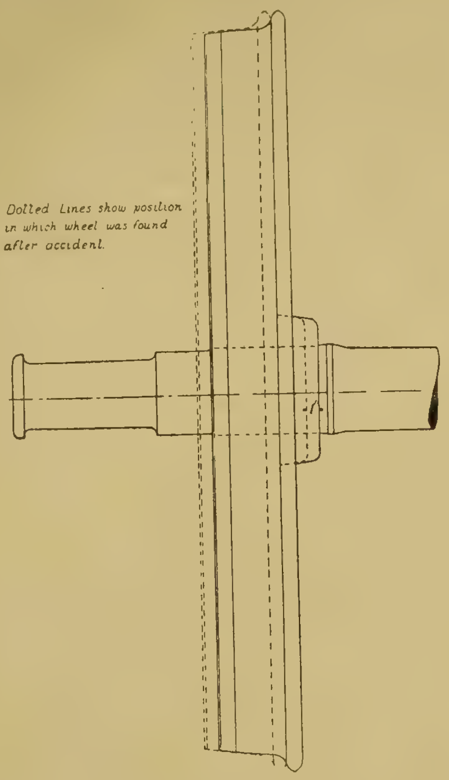
RAILWAY ACCIDENTS DURING FIRST THREE MONTHS OF 1910.

The usual summary of accidents and casualties reported to the Board of Trade by the several railway companies in the United Kingdom during the three months ending 31st March, 1910, has just been issued by the Government in pursuance of the Railways Act of 1871, together with reports to the Board of Trade by the inspecting officers, assistant inspecting officers, and sub-inspecting officers of the railway department, upon certain accidents which were inquired into.

The total number of passengers, companies' servants, and other persons killed during the three months was 294, whilst those injured numbered 1,894. The first figures show an increase of 49, and the latter a decrease of 138 as compared with those for the corresponding figure of 1909.

The accidents which were inquired into were the following: Great Southern and Western accident to a portion of a goods train which left the rails near Felthouse junction; Lancashire and Yorkshire fatal accident to two intending passengers at Townley Station level crossing; London and North-Western collision between a Lancashire and Yorkshire Company's passenger train and a light engine at Hillhouse, near Huddersfield; London, Brighton and South Coast accident to a passenger train, a portion of which left the rails near Stoat's Nest; and North-Eastern collision between a Midland Company's passenger train and the buffer stops at York.

Of these accidents by far the most serious was that on the London, Brighton and South Coast Railway. In this case an up train from Brighton to London, consisting of an engine, tender, and 10 vehicles, was approaching Stoat's Nest Station, when the six rear vehicles of the train were derailed to the left side of the line on which they were travelling; the leading derailed vehicle, which broke loose from the front portion of the train, was swung broadside on to the direction in which it was travelling, and in that position came into collision with the ramp of the station platform; this vehicle was totally wrecked, and five of the passengers who were travelling in it were killed instantaneously, as also were two men who were standing on the platform at the time. The five rear vehicles of the train were also derailed, but they were comparatively slightly damaged, and none of the passengers in them were fatally injured; 65 of the passengers in the train, however, notified the company of personal injuries sustained, but of these only eight were detained in hospital for more than 24 hours, and it is not anticipated that any of these latter cases will terminate fatally. The accident was due to the shifting of a wheel of a third-class carriage carried on two four-wheeled bogies on its axle; the only previous records of derailments due to this cause which can be traced being in 1895 and 1898, when such accidents occurred on the Great Western Railway at Maidenhead and Exeter. The shifting of a wheel on its axle is fortunately, says Lieut.-Colonel von Donop in his report, a very unusual occurrence, but the above instances show that there is an undoubted liability of its occurring, especially with wheels of not very recent construction, and, as in this case, it may lead to disastrous results. As far as can be ascertained, it is not customary on any railway systems in this country to test whether wheels have a firm grip on their axles, in a manner similar to that employed on the Great Western Railway subsequent to 1898, and which is now to be employed on the London, Brighton and South Coast Railway. This accident, with its fatal results, shows the desirability of the general adoption of such tests, and the attention of all railway companies should be drawn to the matter.


Dotted Lines show position in which wheel was found after accident.

The front axle and wheels of the third-class vehicle in which this derailment originated were supplied and fitted together eight years ago by the Leeds Wheel and Axle Company, in conformity with the railway company's specification. The axle was of steel, its diameter being 4½ in. at its centre, and 5¼ in. at its wheel seat, the width of the latter being 6½ in.; the tyres of the wheels were of steel, and the bosses and discs of wrought iron. The railway company keeps at the maufacturers' works an inspector, who submits a certificate to the locomotive superintendent with regard to all axles and wheels supplied to the company, but the certificate with regard to this pair of wheels cannot now be traced. According to the specification, wheels should require a pressure of 60 tons to force them on to their axle, and the Leeds Company produced their books, the records in which showed that the pressure required to force home wheel 59, which was the one which shifted, was 62⅓ tons.

Our illustration, reproduced, on a reduced scale, from that accompanying the Report, shows the axle with its wheel, the position to which the latter shifted being indicated in dotted lines.

STEAM ENGINE DESIGN.—XXVIII.

(*Continued from page 388.*)

BALANCING.

THE balancing of any engine is a matter of considerable complexity. There are rotating and reciprocating forces and moments, and, in addition, the pendulum-like swing of the connecting rod introduces forces and moments of the second order. It is about these secondary effects that the most difficult parts of balancing arise.

ROTATING FORCES.

Referring to fig. 148, which represents an engine having two cranks at right angles. Suppose at crank A the rotating parts are of weight W_a, and at B W_b, acting at equal radii R R, the centrifugal force due to a rotating weight

$$= F = \frac{W}{g} w^2 R = \frac{W}{g} \times \frac{V^2}{R};$$

or, putting

$$\frac{W}{g} = \frac{W}{32 \cdot 2} = M \text{ poundals,}$$

$$F = M w^2 R,$$

where w = angular velocity of crank pin in radians per second,

V = velocity of mass centre of W in feet per second,

R = radius of mass centre of W in feet.

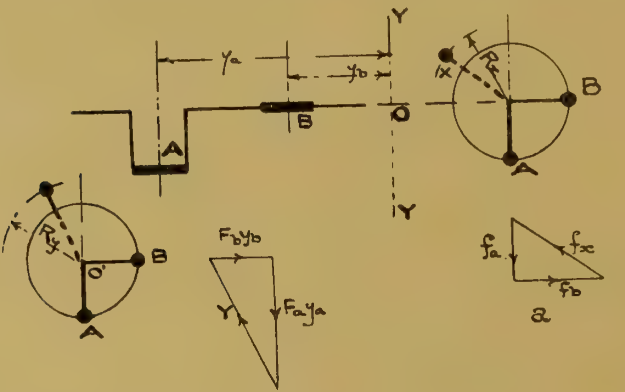


FIG. 148.

Hence the forces acting at A and B are—

$$F_a = M_a w^2 R,$$

$$F_b = M_b w^2 R.$$

If the vector sum of $(F_a + F_b) = 0$, the forces are obviously in balance.

The end view in fig. 148 shows the crank angles. Draw as at (*a*), f_b parallel to crank B, and equal to the force F_b; similarly, draw f_a parallel to f_a, taking care that the arrows, indicating the directions in which the forces act, follow each other round. Since the vector polygon does not close—and therefore the engine is unbalanced—complete by drawing in f_x and mark in its direction, draw in X parallel to f_x, in the crank diagram, in the direction indicated by its arrow; then F_x is the force necessary to balance the engine for rotating weights.

If F_x is placed at a radius R_x, weight of balance weight

$$= F_x \times \frac{g}{w^2 R_x} \text{ pounds.}$$

This method, by determining the forces acting at each crank, can be used for engines having any number of cranks by simply drawing in the vector polygon.

ROTATING COUPLES.

If a reference plane be imagined at Y Y, fig. 148, it will be seen that the force F_a forms a couple of moments y_a, giving a value $F_a y_a$; similarly, F_b forms a couple $F_b y_b$. The former, for the crank position shown, tends to turn the engine in the plane of the paper about point O; and the latter, through the plane of the paper, about the same point.

The condition that the engine may be balanced for rotating couples is—

$$F_a y_a + F_b y_b = 0.$$

This can only happen if the couple polygon is closed. By drawing this in (fig. 148*b*), the dotted side represents in direction and magnitude the couple which must be applied to balance the engine. Suppose the value of this couple to be

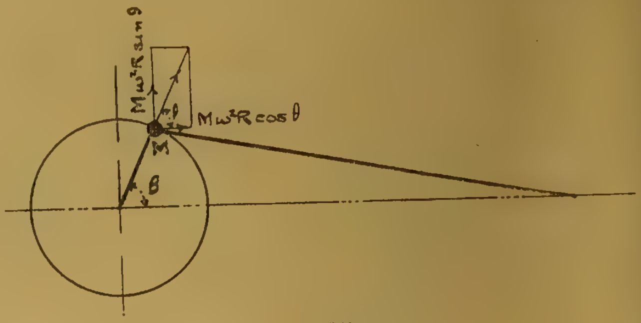


FIG. 149.

Y, draw in its direction in the crank diagram; and if it be decided to place a weight or crank A to obtain this couple, then weight to be applied at crank A in direction shown in crank diagram, viz.,

$$O^1 Y = Y \times \frac{g}{w^2 R y y_a} \text{ pounds.}$$

RECIPROCATING FORCES.

If the connecting rod of the engine was infinitely long, the reciprocating weights would move with true harmonic motion, as they do when the crank moves in a slotted crosshead.

Referring to fig. 149, assuming harmonic motion, as the crank moves from A to B, the accelerating force is given by

$$H = N w^2 R \cos \theta,$$

where $N = \frac{\text{weight of reciprocating parts in pounds}}{32 \cdot 2}$;

R = radius of crank pin in feet, and w its angular velocity in radians per second;

θ has the value shown in the diagram.

Now, in connection with rotating forces, it was shown that the out-of-balance force was

$$F = M w^2 R$$

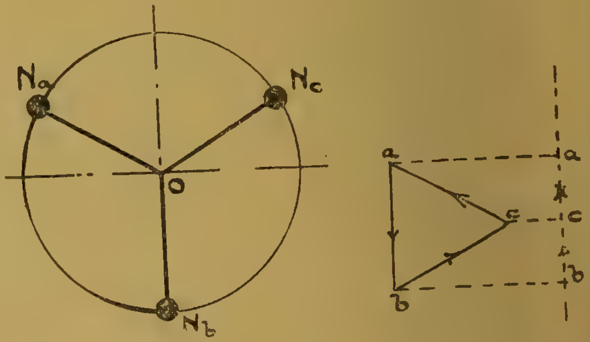


FIG. 150.

(this acts radially); then resolving this into components parallel to and at right angles to the line of stroke, the disturbance due to rotating forces in the line of stroke is

$$M w^2 R \cos \theta \text{ (fig. 149).}$$

It will be seen that this is identical in form to the expression just obtained for the reciprocating harmonic force; hence in order to balance reciprocating forces, assumed to be harmonic, they may be taken as components in the line of stroke of masses (of the same weight as the reciprocating parts) rotating with the crank pin. An example will make this clear, and it is important that the subject be thoroughly grasped, since the whole practice of balancing depends on it.

In fig. 150, let the disposition of the three cranks of an engine be as shown to the left; also, let the reciprocating masses be N_a, N_b, and N_c. Then regarding these as rotating at the crank pin, draw in the force polygon, making $a\,b = N_a\,w^2\,R$, $b\,c = N_b\,w^2\,R$, and $c\,a = N_c\,w^2\,R$; $a\,b$, $b\,c$, and $c\,a$ being parallel to their respective cranks. If the polygon closes, as shown, the forces are in balance. Of course, to get the instant harmonic force at each crank position, the values $N_a\,w^2\,R$ . . . must be multiplied by their respective values of $\cos\theta$, and this is really done in the vector diagram. Since the projection of $a\,b$, on the line of stroke X X, is $N_a\,w^2\,R\cos\theta_a$, of $a\,c$ is $N_c\,w^2\,R\cos\theta_c$, these two forces add together to give an upward force $c\,b$, and this is balanced by the downward projection of $b\,c$. It is instructive to draw polygons for other positions of the cranks during the revolution, and it will be found that they always close. Hence the rule: If it be required to balance any number of reciprocating masses, N_a, N_b . . . at crank angles, θ_a, θ_b . . . imagine their harmonic forces, $N_a\,w^2\,R\cos\theta_a$, $N_b\,w^2\,R\cos\theta_b$ . . . as components in the line of stroke of the centrifugal forces due to masses, N_a, N_b . . . at the given angles, rotating with the crank pin of radius R.

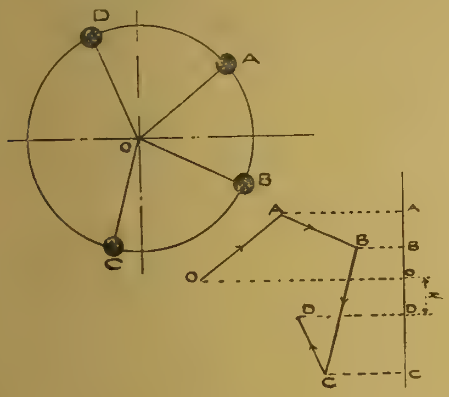


Fig. 151.

The case of a four-crank engine is shown in fig. 151. The polygon fails to close by the side $d\,o$; projecting on to the line of stroke, adding and subtracting the forces with due regard to sign, an unbalanced downward force of magnitude x is found.

Reciprocating couples may be treated in the same way by taking a reference plane (usualy through one of the cranks), and obtaining the moments about it.

So far the determination of the unbalanced reciprocating force or couple only has been obtained, and it now remains to show how this may be eliminated.

Since reciprocating forces act only in the line of stroke, and have no component at right angles, they can only be balanced by other reciprocating forces, and not by any system of rotating masses, since these also have components at right angles.

Suppose it is attempted to balance a reciprocating mass N by a rotating mass N, the components of the latter are $N\,w^2\,R\cos\theta$ and $N\,w^2\,R\sin\theta$. The former always cancels out with the reciprocating force, being a maximum for $\theta = 0$ and 180 deg., and zero for $\theta = 90$ deg. The latter is zero for $\theta = 0$ and 180 deg., and a maximum at 90 deg. Hence the effect of eliminating a reciprocating force or couple by means of a rotating mass is to produce an equal force at right angles to the line of stroke.

The correct way to balance reciprocating forces is to arrange the crank angles, or to so apportion the different masses in such a way that they mutually balance each other, in the manner shown in fig. 150. To balance for couples, the distance apart of the cylinder centres may also be varied. This system is known as "collective balancing," and will be developed in the next article.

Secondary Balancing.

In the case of most steam engines, certainly for those having one, two, or three cranks, balancing is always carried out in accordance with the principles enunciated above; but it must be remembered that with regard to the reciprocating forces and couples that the treatment is based on the convenient assumption of harmonic motion. When the design of an engine permits, it should be balanced for the true state of affairs; also, for any engine, the actual residual forces after balancing should always be determined.

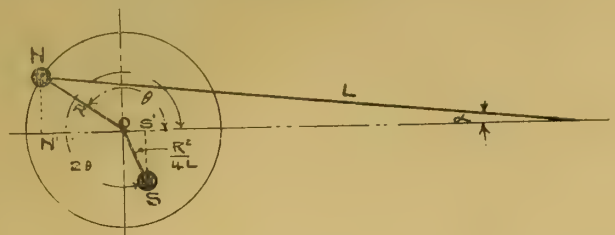


Fig. 152.

For engines having long connecting rods, *i.e.*, when the ratio

$$\frac{\text{length of crank}}{\text{length of connecting rod}}$$

is small, the error in assuming harmonic motion is not very great; but usually, for ordinary rods, the error may be large.

In fig. 152, let

L = length of connecting rod in feet,
R = crank radius in feet,
α = angle between connecting rod and line of stroke,
θ = variable crank angle,
N = reciprocating mass.

The distance, x, of the crosshead from crankshaft centre is

$$x = R\cos\theta + L\cos\alpha\,;$$

but

$$R\sin\theta = L\sin\alpha,$$

expanding,

$$\cos\alpha = \sqrt{1 - \frac{R^2}{L^2}\sin^2\theta}\,;$$

$$\therefore\ \cos\alpha = 1 - \frac{R^2}{2\,L^2}\sin^2\theta - \tfrac{1}{4}\,\frac{R^4}{L^4}\sin^4\theta,$$

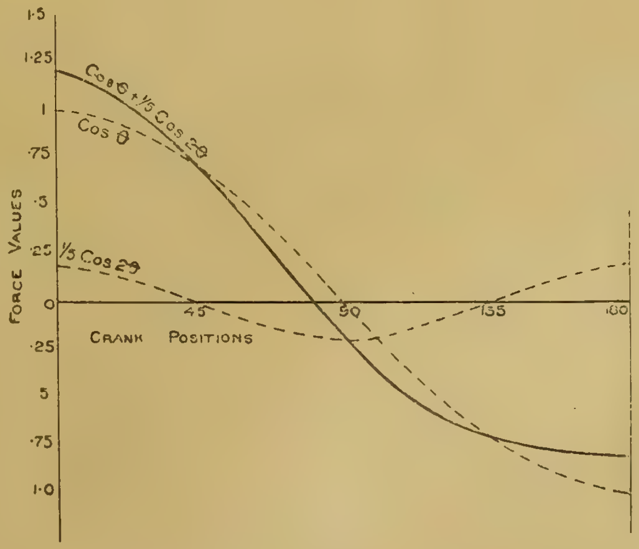


Fig. 153.

or, approximately,

$$\cos\alpha = 1 + \frac{R^2}{4\,L^2}(\cos 2\,\theta - 1)$$

$$= \frac{R^2}{4\,L^2}\cos 2\,\theta + 1 - \frac{R^2}{4\,L^2},$$

and
$$\mathrm{L} \cos \alpha = \frac{\mathrm{R}^2}{4\,\mathrm{L}} \cos 2\,\theta + \mathrm{L} - \frac{\mathrm{R}^2}{4\,\mathrm{L}};$$

substituting,
$$x = \mathrm{R} \cos \theta + \frac{\mathrm{R}^2}{4\,\mathrm{L}} \cos 2\,\theta + \left(\mathrm{L} - \frac{\mathrm{R}^2}{4\,\mathrm{L}}\right):$$

differentiating with respect to time,
$$\frac{d\,x}{d\,t} = \mathrm{R} \sin \theta\ \theta' + \frac{\mathrm{R}^2}{4\,\mathrm{L}} \sin 2\,\theta\ 2\,\theta',$$

and
$$\frac{d^2\,x}{d\,t^2} = -\ \mathrm{R} \cos \theta\ \theta'^2 - \frac{\mathrm{R}^2}{\mathrm{L}}\ \theta'^2 \cos 2\,\theta;$$

then since
$$\frac{d\,\theta}{d\,t} = \theta' = w,$$

and $\frac{d^2\,x}{d\,t^2}$ = acceleration of reciprocating mass at crosshead,

then acceleration $= w^2\,\mathrm{R}\ (\cos\ \theta + \frac{\mathrm{R}}{\mathrm{L}} \cos 2\ \theta)$.

Since force = mass × acceleration, reciprocating force

$$= \mathrm{N}\ w^2\ \mathrm{R}\ (\cos\ \theta + \frac{\mathrm{R}}{\mathrm{L}} \cos 2\ \theta) \text{ pounds} \quad . \quad . \quad (49)$$

$$= \cdot 00034\ \mathrm{W\,R\,N}^2\ (\cos\ \theta + \frac{\mathrm{R}}{\mathrm{L}} \cos 2\ \theta) \text{ pounds} \quad (50)$$

which is the familiar form given in Article XIII., where N = revolutions per minute, and W = weight in pounds.

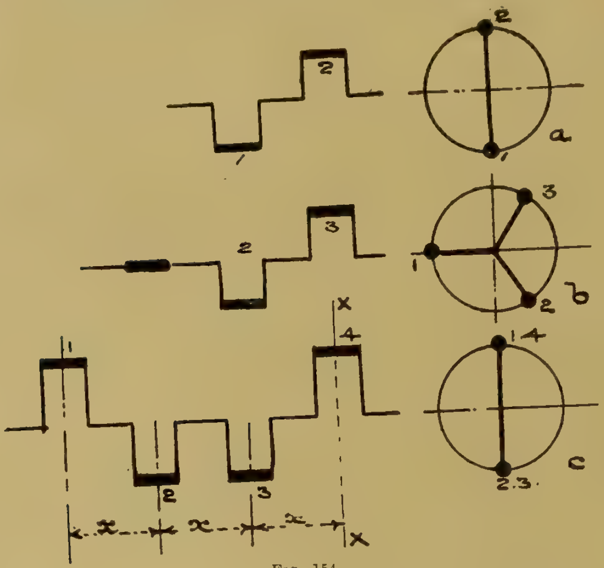


FIG. 154.

The first half of the expression in (49), viz.,

$$\mathrm{N}\ w^2\,\mathrm{R} \cos\ \theta \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (51)$$

is the projection (O N¹) of O N on the line of stroke, and is the same as that given by harmonic motion.

The second half, when multiplied and divided by 4, gives

$$\mathrm{N}\ (2\ w)^2 \times \frac{\mathrm{R}^2}{4\,\mathrm{L}} \cos 2\ \theta \quad . \quad . \quad . \quad . \quad (52)$$

This is equivalent to the projection of a mass N rotating with an imaginary crank of radius $\frac{\mathrm{R}^2}{4\,\mathrm{L}}$, at twice the speed of the crank shaft. Referring to the diagram, the imaginary crank O S will be at angle 2 θ, and its projection will be O S¹. For the positions shown the actual reciprocating force is (the harmonic force − projection of O S).

The forces given by (51) are called "primary forces," and those by (52) "secondary forces."

The way in which the secondary forces modify the primary or harmonic forces can be clearly seen from the curves in fig. 153; the resultant curve is shown in full lines.

For any engine, vector polygons can be constructed for secondary forces and couples in the same way as that given for the other cases above, and in order that there may be complete balance, the polygons must close.

TYPES OF ENGINES.

In the following cases (fig. 154) the effect of number and disposition of cranks will be discussed—reciprocating effects will alone be considered, since rotating weights can always be balanced. The reciprocating masses will be taken as equal for each cylinder line, and the cylinders will be equally spaced.

Case I.—Single-crank engine: Obviously no balance is possible.

Case II.—Two-crank engine (cranks at 180 deg.), fig. 154*a*: Primary forces balance each other, and for secondary balance, $\cos 2\ \theta_1 - \cos 2\ \theta_2 = 0$; but putting $\theta_2 = (\theta_1 + 180)$, there is an out-of-balance force $2 \cos 2\ \theta\ w^2\ \mathrm{R\,N}$. Couples cannot be balanced.

Case III.—Three-crank engine (cranks at 120 deg.), fig. 154*b*: Primary and secondary forces balance, since puttting

$$\theta_1 = 0,\ \theta_2 = 120,\ \theta_3 = 240$$
$$\cos\ \theta_1 + \cos\ \theta_2 + \cos\ \theta_3 = 0$$
$$\cos\ 2\ \theta_1 + \cos\ 2\ \theta_2 + \cos\ 2\ \theta_3 = 0.$$

Again, couples cannot balance.

Case IV.—Four-crank engine (cranks as in fig. 154*c*): This engine is very like the two-crank in Case II.; for the same reasons, there is an out-of-balance secondary force $4 \cos 2\ \theta\ w^2\ \mathrm{R\,N}$. Primary forces are in balance.

Taking a reference plane X X, and calling the equal primary forces H,

$$x\,\mathrm{H} + 2\,x\,\mathrm{H} + 3\,x\,\mathrm{H};$$

therefore primary couples are balanced.

As the secondary forces of cranks 2 and 3 (although equal to each other) are not each equal to those of crank 4, secondary couples are not balanced.

Case V.—Five and six crank engines: These can be completely balanced for all effects, but as they are of no importance in steam engine design, they need not be considered.

PRACTICAL BALANCING.

The above discussion is directly applicable to practical work for two and three crank high-speed engines, since in these cases the cranks are always set at 180 deg. and 120 deg. respectively; also, the piston lines are of equal weight. Of course it will be understood that rotating forces and couples can always be eliminated by the addition of suitable balance weights, and the question in any type of engine is to what extent the primary and secondary effects of reciprocating parts can be eliminated. From the investigation in the last section it will be seen that perfect balance of all effects is not possible, except for engines having five or more cranks. Steam engines seldom have more than four cranks, and, generally, for land work, one, two, or three—for petrol motor car engines six cranks is common. Hence in ordinary steam engines secondary forces can only be completely balanced with the three-crank engine (Case III. above), and secondary couples not at all.

Referring to formula (52), secondary forces vary as (revolutions per minute)²; hence, for engines running under 100 revolutions per minute (usual for slow speed land and marine), secondary effects can safely be neglected, but at high rotations they may be serious.

Since reciprocating forces act only in the line of stroke, and have no component at right angles, they can only be balanced by other reciprocating masses, and not by any system of rotating weights, since these have components of force both in and at right angles to the line of stroke.

Referring to fig. 149, if $\mathrm{N}\ w^2\,\mathrm{R} \cos \theta$ is the reciprocating force, and a rotating balance weight with centrifugal force, $\mathrm{N}\ w^2\ \mathrm{R}$, be applied, this can be resolved into two components,

$N w^2 R \cos\theta$ and $N w^2 R \sin\theta$. The forces in the line of stroke always cancel out, but are replaced by other forces at right angles, viz., $N R w^2 \sin\theta$, increasing from 0 to $N w^2 R$, as θ increases from 0 deg. to 90 deg. Hence, if reciprocating forces be eliminated in the line of stroke by adding rotating weights, equal forces are produced at right angles. This method of balancing is of advantage in many cases, but where the engine design permits, it is customary to make the forces and couples due to one cylinder balance out with those due to other cylinders.

The system of balancing reciprocating weights by means of rotating weights is known as "overbalancing," and the balance of one reciprocating part against another in multi-crank engines as "collective balancing." Both these systems will be fully developed by means of examples in the next article.

(*To be continued.*)

AN IMPROVED RADIATION PYROMETER.

This radiation pyrometer is of that class in which the sensitive element is not subjected to the actual temperature of the body whose temperature is required, but to a portion of the radiant heat therefrom, so that the sensitive element is only raised in temperature by a fraction of the true temperature of the body.

The great advantage of radiation pyrometers is that owing to the fact just mentioned the sensitive element does not wear out rapidly, even though it is used to measure extremely high temperatures. The chief disadvantage in radiation pyrometers hitherto used is that their readings depend not only upon the temperature of the body itself, but upon the nature of the surface of the body and on the temperature of surrounding objects. For instance, if one of these pyrometers be used to determine the temperature of the molten metal in a crucible, the reading obtained by sighting on the surface of the metal will be considerably lower when the crucible is in the open air than it will be when the crucible is inside a closed furnace, the walls of which are at approximately the same temperature as the metal. This is due to the fact that in the latter case the crucible of metal is under what is known as "black body" conditions, whilst in the former case this is not so, and molten metal not being itself a "black body," the readings obtained are therefore low. It is therefore in many cases necessary to apply corrections to the readings obtained by radiation pyrometers in order to obtain true temperatures. Also most types of radiation pyrometers have the further disadvantage that they require focussing on the body whose temperature is being obtained before a reading is taken.

The pyrometer about to be described is the invention of Messrs. The Cambridge Scientific Instrument Company Limited, of Chesterton Road, Cambridge, in conjunction with Mr. Robert Stewart Whipple.

The improved pyrometer is claimed, whilst retaining the advantage already mentioned of keeping the sensitive element outside the zone of intense heat, to secure the further advantage of avoiding the necessity of applying any corrections to the readings to obtain true temperatures, and also to avoid the necessity of focussing the instrument before a reading is taken. A conduit which is closed at one end is so arranged that heat radiated along the conduit from its closed end is always focussed on to the sensitive element without preliminary adjustment. More particularly this pyrometer comprises the combination of a tube closed at one end but open at the other end, a heat sensitive element situated in the open end of the tube, and a device for concentrating heat radiated from the inside of the closed end of the tube on to the sensitive surface.

When using the pyrometer the closed end of the tube is subjected to the heat of the furnace or source of heat for a length of several diameters of the inside of the tube from the closed end. Thus the inside of the closed end of the tube is under black body conditions, and the readings are independent of the nature of the surface of the closed end of the tube.

The pyrometer is illustrated partly diagrammatically in figs. 1, 2, 3, and 4, which show several different constructions.

As illustrated in fig. 1, a tube A A^1 is employed of definite length and closed at the end A^2, having mounted at the other end a pyrometer A^3 of special design, containing the sensitive element B. A concave mirror C of short focal length is mounted in this pyrometer head in such a manner that an image of the inside of the closed end of the tube is formed a few inches in front of the mirror. The sensitive element B is so situated that this image coincides with it. To use the pyrometer the closed end A^2 of the tube is inserted in the furnace, crucible of molten metal, or other body whose temperature is required, the other end of the tube carrying the pyrometer head A^3 remaining at a comparatively low temperature. The sensitive element therefore has its temperature raised above the temperature of the surrounding pyrometer head by an amount dependent upon the intensity of the heat image formed by the mirror, and therefore by an amount dependent upon the temperature of the closed end of the pyrometer tube. Since for the same pyrometer the concave mirror is always at the same distance from the closed end of the tube, the instrument can be adjusted so that the image coincides with the sensitive element once for all, and will therefore not need focussing or otherwise adjusting each time it is used. Also, since the pyrometer tube will in practice be made of a fairly small diameter, and will be subjected to the heat of the furnace for a length of several diameters measured from the closed end, the conditions necessary for true black body radiation from the inside of the closed end of the tube are secured, and the readings will therefore be independent of the nature of the surface of the closed end of the tube.

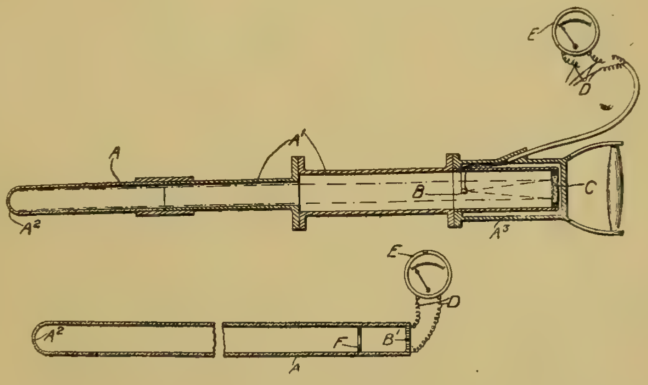


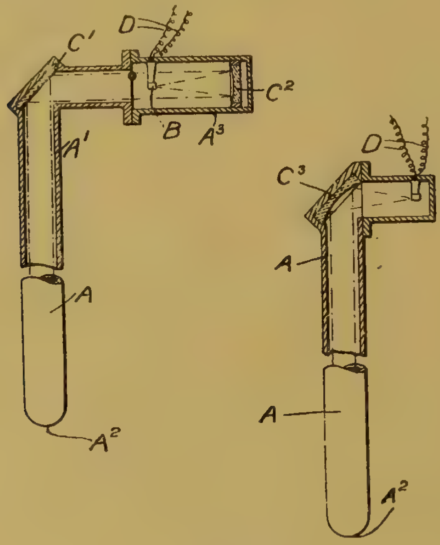
FIG. 1 and 2.

A variety of different devices may be made use of for the sensitive element, one of the simplest being to use a small thermo-couple as diagrammatically illustrated in fig. 1, this being connected by leads D from the pyrometer head to an indicating or recording millivoltmeter E or suitable current-measuring device whose scale is calibrated in terms of the temperature of the closed end of the tube. Other devices might be used depending for their principle of operation on the change of resistance of a wire with temperature, or the expansion of metals with temperature, etc.

It will be seen that the only part of the pyrometer which is subjected to the full temperature being measured is that portion of the tube A near, and at the closed end A^2. Provision is therefore made for renewing this portion quickly and cheaply by making the tube in two parts. The renewable end portion A need not necessarily be of the same material or size as the other permanent portion, and whilst the latter will usually be of steel, the renewable portion may be of steel, porcelain, silica, plumbago, etc., according to the temperature and purpose for which the instrument is used.

It is obvious that modifications may be made in carrying this invention into effect; for example, although a concave mirror has been mentioned as the means of producing the heat image which coincides with the sensitive element, other methods of producing this image might be used. For instance, a convex lens would fulfil this purpose, although, owing to the fact that such a lens absorbs a large proportion of the heat rays it receives, it would not be so satisfactory as a mirror. Or as illustrated in fig. 2, a diaphragm F may be interposed in the path of the rays to insure that the sensitive element B¹ shall be subjected to a constant definite fraction of the radiant heat proceeding from the hot end of the conduit.

In certain cases, as, for instance, when used for measuring the temperature of crucibles of molten metal, it may be an advantage to have the pyrometer of an "L" shape, as illustrated in figs. 3 and 4. This may easily be obtained by fixing a mirror in the angle so that the heat rays received on it from the closed end of the tube are deflected along the axis of the tube to the pyrometer head.



Figs. 3 and 4.

In the construction illustrated in fig. 3 a plane-surfaced mirror C^1 is disposed in the angle, and the heat rays are thereby deflected on to a concave mirror C^2, by which latter they are concentrated on to the sensitive element B.

In fig. 4 a construction is illustrated in which a concave mirror is employed in the angle whereby not only is the path of the heat rays deflected substantially 90 deg., but the rays themselves are concentrated on to the sensitive element B.

The Lloyd's Register scholarship in marine engineering, given under the auspices of the Institute of Marine Engineers, has been gained this session by Mr. James D. Boyle, of Forfar, at present serving his apprenticeship with Messrs. Rankin and Blackmore, engineers, Greenock. The scholarship is of the value of £50 per annum, tenable for two years, and Mr. Boyle will shortly commence his studies at Glasgow University. Two scholarships are given under the auspices of the above institute, one being competed for each year at an examination held in the month of July. The examination is open to all apprentice engineers or young marine engineers who are graduates or associates of the institute. Full particulars may be obtained on application to the hon. secretary, Institute of Marine Engineers, 58, Romford Road, Stratford, London, E.

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"Windmills and Wind Motors: How to Build and Run Them." By F. E. Powell. The "Model Engineer" Series, No. 36. London: Percival Marshall and Co. Price 6d.

This little work is unique in that it touches on a subject that has received but scant attention, whether from an amateur or professional standpoint. Sufficient, however, has been done to convince most people that there is a future in the adoption of wind power for business pursuits. This alone warrants the attack of the subject by the amateur, and within the pages before us is given such information as should enable anyone so inclined to construct a working model of more than passing interest. The elementary principles of wind pressure are explained, the evolution of the windmill is expounded, and a chapter is devoted to the details of an arrangement by which an electrical plant consisting of dynamo, battery, and lamps, including the necessary compound switches for regulation and an automatic charging switch, is operated.

The information is practical throughout, and fully meets the requirements of the amateur and model maker.

"Elementary Manual on Applied Mechanics." By Andrew Jamieson. Ninth Edition, Thoroughly Revised. London: Charles Griffin and Co. Ltd. Price 3s. 6d. net.

The series of works on applied mechanics and allied subjects are now too prominently before our readers to need more than a passing notice whenever a new edition appears.

The many issues that this author's books have gone through speaks more for their merit than pages from the pen of a reviewer, and in saying this we would remark that Mr. Jamieson is not satisfied with re-issues, but takes every opportunity of keeping his books up-to-date by constant revision, and the insertion of new matter which is of current value and appropriate to the subject at hand.

This manual of mechanics is specially arranged to suit those who are preparing themselves systematically for examinations such as those conducted by the Institute of Civil Engineers, the Royal Institute of British Architects, the City and Guilds of London Institute, the British and Colonial Boards of Education, and all kinds of first year engineering students.

Some of the additional matter comprises a description of a new crane-jib arrester, Herbert's turret lathe, and the Whitworth millionth measuring machine; also a system of standard gauges, besides a re-arrangement and increase in the number of test questions taken from recent examination papers.

The text book is thoroughly reliable throughout, and well merits the leading position it has worthily attained on account of its educational value.

"Motor Boats Simply Explained." A Practical Handbook. By John Douglas. London: Percival Marshall and Co. Price 1s. net.

The popularity of the motor boat for business and pleasure purposes is now assured owing to its economy and simplicity in operation. Speeds have been attained by craft driven with internal-combustion motors that were impossible with steam engines, and this has created an incentive to boat building which was hitherto non-existent.

The literature on the subject of boat building is a limited one, and the appearance of a popular handbook on the construction and working of the motor boat and its machinery is a welcome addition.

The two systems of "carvel" and "clincher" built boats are explained, and a specification is given for a motor boat of 25 ft. to 30 ft. length, including the proper section lines and water lines, also some notes on hydroplanes. Both two-stroke and four-stroke motors are illustrated; the silencing of the exhaust, water circulation, and methods of ignition come in for brief reference. Other chapters are devoted to the propelling arrangements, which comprise thrust block, reversing, adjustable, and reversible propellers, with a description of the Douglas motor-propeller combination.

Some notes on the running and maintenance of a motor boat, the bye-laws made by the Thames Conservancy for the regulation of petrol motor launches on the Thames, concludes a manual which deserves the attention of motor-boat owners, builders, and others interested in the subject.

"Four-figure Logarithms." By R. C. Farmer, D.Sc., Ph.D., and M. M. Farmer. London: Longmans, Green and Co. Price 6d. net.

The tables here given are compiled on the graphic system which dispenses with interpolations, and hence for rapid calculations where extreme exactness is not required are very useful. A vertical scale is provided with division marks on both sides, the left being numbers and the right their logarithms. A little practice soon enables one to estimate fairly accurately logarithms to the fifth place. The reverse reading gives antilogarithms.

This method condenses the complete set of logarithms from 1,000 to 10,000 within six pages, and is thus extremely handy for teachers, engineers, chemists, and others.

"Our Home Railways." This interesting series, each part of which contains a complete article on one of the leading British Railways, from the able pen of Mr. W. J. Gordon, is now nearly complete. We have already referred to some of the earlier parts, and we now draw attention to those which are descriptive of the following railways: London, Brighton and South Coast, South Eastern Railway, Great Eastern, London and North-Western, and the Great Northern. They are well illustrated with coloured plates and reproductions from photographs, and when completed will form two worthy volumes containing the story of our railways. The separate parts can be had at 9d. each, the publishers being Messrs. F. Warne and Co.

BOOKS RECEIVED.

"Proceedings of the Incorporated Municipal Electrical Association, 1910." London: Wyman and Sons Ltd. Price 5s.

"Matriculation Directory." No. 56, September, 1910. London: University Tutorial Press.

"The Official Gazette of the United States Patent Office." Vol. CLVIII., Nos. 3 and 4. Washington: Government Printing Office.

"Electric Circuit Problems in Mines and Factories." By Ellis H. Crapper, B.Eng., M.I.C.E. London: The Colliery Guardian Co. Ltd. Price 3s. 6d. net.

"Our Home Railways." By W. J. Gordon. Part V., The South Eastern and Chatham; and Part. VI., The Great Eastern.

"The Indicator Handbook." Part I. By C. N. Pickworth. Fourth Edition, Revised and Enlarged. Manchester: Emmott and Co. Ltd. Price, 3s. net.

"Drying Machinery and Practice." A handbook on theory and practice. By T. G. Marlow. London: Crosby Lockwood and Son. Price, 12s. 6d. net.

BOILER EXPLOSIONS.

ABSTRACTS FROM RECENT BOARD OF TRADE REPORTS.

Explosion of a Boiler.

Report of Formal Investigation No. 1,950.—The explosion occurred about 3 p.m. on the 23rd November, 1909, at Chalk Hall, Langford, Norfolk, the owner being Mr. Henry Garrod, Rowley Farm, Hilborough, Norfolk. The boiler was of the ordinary locomotive type and was attached to a traction engine. The barrel, which was 7 ft. long and 2 ft. 7 in. in diameter, was made of B.B. Staffordshire iron. The outside firebox was ⅜ in. thick at the front plate, throat plate, and arch, and the sides were ½ in. thick. It was 3 ft. 3¼ in. long, 2 ft. 8¾ in. broad, and 4 ft. 2 in. high. The back and front plates were flanged for attachment to the wrapper plate, the back plate being also flanged for attachment to the barrel. The inside firebox, which was of Lowmoor iron, was 2 ft. 8½ in. long, 2 ft. 2 in. broad, and 3 ft. high. The tube plate was $^{9}/_{16}$ in. thick, the top plate ½ in. thick, and the front plate and side plates ⅜ in. thick. The bottom connection between the inside and outside firebox was formed by a wrought-iron ring, 2½ in. by 2¼ in. The firehole was formed by a wrought-iron ring between the inner and outer firebox front plates. The sides of the firebox were supported by stays ¾ in. in diameter, screwed into both plates and riveted over. There were 41 of these stays on each side. The back and front plates were similarly supported below the tubes and firehole. The crown plate was supported by three plate girders with five stay bolts in each. The boiler was fitted with 30 iron tubes, each 2½ inches in diameter, which were expanded into the tube plates at each end. There were two 1¼ in. iron stays above the tubes from end to end of the boiler. These were made with forged eyes, and were attached to the plates by means of pins and angle irons. A man hole was fitted at the smoke-box end, and there were five cleaning holes distributed about the base of the firebox. The top of the firebox collapsed, drawing in the side plates, and through the opening the contents of the boiler escaped, scattering the fire and debris. The explosion was caused by the pressure in the boiler being beyond that which it was capable of standing, and as the pressure could not be released owing to the two safety valves with which the boiler was fitted being set fast, the boiler exploded. At the time of the explosion the pressure in the boiler was at least 125 lbs. per square inch, the pressure at which it was habitually worked, although the boiler had only been designed for this pressure 24 years previously, and at the time of the explosion the firebox was weakened by age and by some of the stays being broken. Three persons were injured by the explosion.

Explosion from a Steam Pan.

Report of Preliminary Inquiry No. 1,951.—The explosion occurred on the 2nd June last, at the confectionery factory of Messrs. Barker and Dobson Ltd., Franklin Place, Everton, Liverpool. The pan was formed of an inner copper shell, which, together with an upper copper rim, was secured on the flange of an outer iron chamber of greater depth and was heated by steam admitted to the space between the inner and outer vessels. The inner shell was about 2 ft. 2 in. in diameter, ·08 inch in thickness, and about 9 in. deep, while the outer chamber, into which it fitted, was about 10½ in. deep and ⅝ in. thick. The upper rim was 8¼ in. in depth. An iron ring, 2 in. by ½ in. in section, was laid on the copper flanges, and secured to the lower chamber by bolts ½ in. in diameter, spaced about 2¾ in. apart. A circular toothed rack was provided on the outside of the iron flange, and was geared into wheels driven by a belt from a counter shaft. The machinery connected with the pan also worked a mechanical mixer in the pan. The steam inlet pipe was $\frac{3}{4}$ in. in bore, and passed through a plug which fitted into a socket bolted to the bottom of the outer vessel. The lower part of the socket formed a stuffing box, and as the plug was held in place by its flange to the stationary frame of the machine, the pan was free to revolve. The hole in the upper part of the plug was about $\frac{1}{4}$ in. larger in diameter than the pipe which passed through it, and the annular opening formed the drain from the steam space, a pipe of $\frac{1}{2}$ in. bore being led from it to a range of piping 2 in. in bore, which exhausted to the atmosphere. Stop valves for regulating the steam inlet and drain outlet were fitted on the pipes, and a non-return valve, to prevent the exhaust steam in the drain pipes from returning to the pan, was fitted between the stop valve and the larger range of piping. One side of the inner copper vessel collapsed and ruptured with a loud report, the line of fracture extending across the bottom close to the boss. The bulged part was raised about $8\frac{1}{2}$ in. at the centre of the pan. The explosion was due to the failure of the copper vessel, through weakness, to resist the steam pressure to which is was subjected. One person was injured by the explosion.

Explosion from a Tube in Water-tube Boiler.

Report of Preliminary Inquiry No. 1,952.—The explosion occurred at about 8 a.m. on the 13th June, 1910, at the Froghall Copper Works, Froghall, Stoke-on-Trent. The boiler is owned by Messrs. T. Bolton and Sons Ltd. The boiler is of the water-tube type. There are 81 tubes, each 4 in. in external diameter, about 18 ft. long, and 9 B.W.G. in thickness. They are expanded into nine staggered mild-steel headers at each end, there being nine tubes in each. Each header is connected with the steam and water drum by a steel tube 4 in. in diameter. The cylindrical steam and water drum is 4 ft. in diameter by about 24 ft. in length, and is made of steel plates $^7/_{16}$ in. thick. The longitudinal seams are lapped and double riveted, and the circumferential seams are single riveted. The end plates are $\frac{1}{2}$ in. in thickness, and are dished outwards and flanged inwards for attachment to the cylindrical shell, and a manhole is provided at the back end. A steam superheater is fitted. It is composed of 36 solid-drawn tubes, $1\frac{1}{2}$ in. in diameter externally, bent into U-shape, and expanded at the ends into steel chests which are connected to the steam and water drum, and to the main steam pipe, respectively. A cylindrical mud drum, 12 in. in diameter and 5 ft. 2 in. long, is connected by suitable nipples to the lower end of each of the back headers. It is fitted with two oval handholes 8 in. by 6 in. A blow-off pipe and valve are also attached. The third tube in the bottom row from the right-hand side ruptured about 3 ft. 6 in. from the front header. The maximum length and width of the opening formed was about 14 in. by $9\frac{3}{4}$ in. Through this opening the contents of the boiler escaped into the atmosphere. The explosion was due to the tube becoming over-heated, owing to an accumulation of scale and sediment in it.

A Colliery Rescue Station.—Considerable interest is attached to the new fire and rescue station at Newcastle-on-Tyne established by the Durham and Northumberland Coal Owners' Association. In order to enable the various mines interested to be reached in the shortest possible time, motor appliances will be employed, and one of these, a Merryweather "Hatfield" petrol fire engine, with a pumping capacity of 450 to 500 gallons per minute, has just arrived at Elswick. It can carry 10 firemen and all the usual gear required for fire-extinguishing work, besides smoke helmets and rescue apparatus. The men composing the rescue brigade are drawn from the Elswick Works Fire Brigade, with Captain Simonds, the chief officer, in charge. A trial has given satisfactory results and the station will be ready before the end of the year.

THE "INCANTO" OXY-ACETYLENE SYSTEM OF AUTOGENOUS WELDING AND CUTTING.

Acetylene ($C^2\ H^2$) is nearly as heavy as air, its density being 13 where air is taken at 15. It is an endothermic gas which is decomposed at the moment of combustion into its elements carbon and hydrogen, and by this decomposition alone about 300 B.T.U. are generated per cubic foot of the gas. The remaining heat is furnished mainly by the combustion in oxygen of the carbon into carbon dioxide and in a lesser degree by the combustion of hydrogen into water vapour, the total heat generated per cubic foot of acetylene being about 1,500 B.T.U. Theoretically two and a half volumes of oxygen are required for the complete combustion of one volume acetylene. In practice, however, with the oxy-acetylene blowpipe it is found that the best welding results are obtained with 1·7 volumes of oxygen to one volume of acetylene.

The flame thus produced has in its centre a small white cone at the apex of which the temperature is about 6,300 deg. Fah. This flame consists almost entirely of carbon monoxide, which is being converted at its extremity into carbon dioxide. Round the flame is a relatively cool jacket of hydrogen, which, not being able to combine with oxygen at the very high temperature in the immediate neighbourhood of the flame, remains temporarily in the free state, and thus protects the inner zone from loss of heat, whilst excluding the possibility of oxidation, which is a difficulty other methods of welding have to contend with.

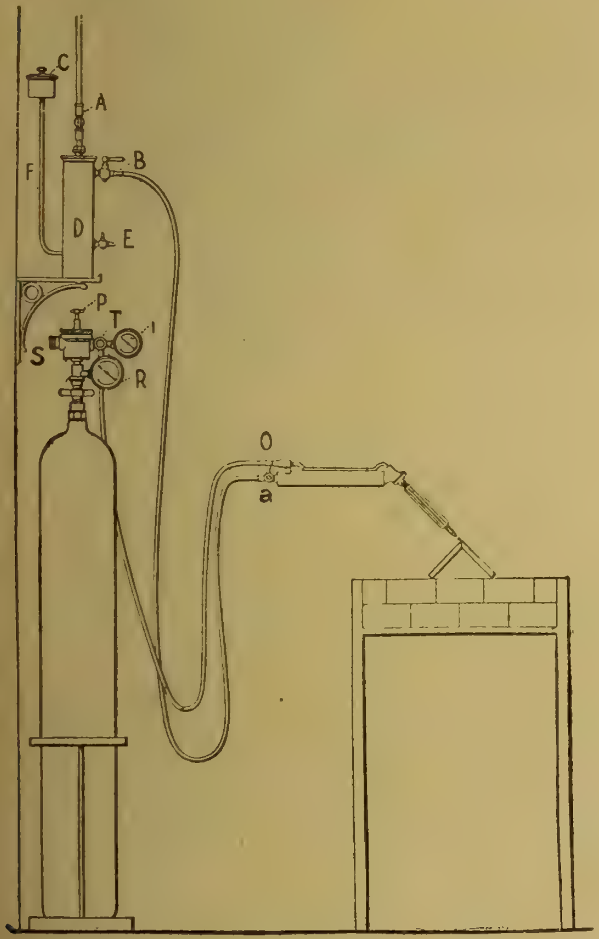
Autogenous welds can therefore be effected by means of the oxy-acetylene blowpipe without any deleterious effect upon the metal. The heat, in addition to being greater than that obtainable from any other blowpipe system, is also more concentrated, whilst the flame being luminous, and in the form of a short steady jet, very little practice is required to make an unskilled workman proficient in the manipulation of the blowpipe.

The low-pressure oxy-acetylene system of autogenous welding described in this article is the invention of Messrs. Thorn and Hoddle Acetylene Co. Ltd., of 151, Victoria Street, Westminster. The illustration shows a complete oxy-acetylene blowpipe apparatus without the acetylene generator (which latter may be placed in any suitable position, preferably outside) at any distance from the blowpipe apparatus. A is a tap connecting the inlet to the hydraulic safety valve with the acetylene supply pipe from the acetylene apparatus. The blowpipe is connected at *a* by means of an ordinary stout rubber tube with the outlet tap B of the hydraulic safety valve. This forms the acetylene supply pipe to the blowpipe. The blowpipe is connected at O by means of a special canvas-insertion strong rubber pipe with the outlet tap T of the oxygen pressure regulator, which is fixed as shown on the oxygen cylinder. This pipe conveys the oxygen supply to the blowpipe, and should be securely attached, as it is subject to pressures varying from 10 lbs. to 20 lbs. per square inch. The hydraulic safety valve is a desirable addition for precautionary motives with the injector type of blowpipe, where acetylene is drawn direct from the generator, or from an intermediate gas holder. It must be fixed on the acetylene supply pipe in a vertical position, and as near to the blowpipe as possible, as shown in our illustration, and in cases where two or more blowpipes are worked from the same acetylene supply, a separate hydraulic valve should be employed for each.

The hydraulic valve precludes the possibility of oxygen at any time flowing back along the acetylene supply pipe. The acetylene pipe from the gas holder is connected with the branch A, and the acetylene pipe leading to the blowpipe is connected to the branch B. C is a loosely-fitting lid through which water can be poured into the chamber D until it overflows at the tap E. The tap at A must be closed whilst the chamber D is being filled with water.

When water shows at the tap E it must be closed, the lid C must be replaced and the tap at A opened. The valve is then in working order. The filling pipe F is made long enough to hold a column of water equal to the pressure of the acetylene holder, which should be about 12 in. of water. The supply of acetylene to the blowpipe may be regulated by the tap on the branch B (where taps do not exist on the blowpipe itself), and the tap at A may be left permanently open.

Should the blowpipe nozzle at any time become choked whilst the oxygen supply remained unchecked, this gas would be forced by its superior pressure along the acetylene pipe. The back-pressure thus caused, acting on the surface of the water in the chamber D, would force this water up the pipe F, displacing the lid C. The hydraulic seal would thus be destroyed, and both gases would escape into the atmosphere until the taps at A and B were closed, thus oxygen can never penetrate the acetylene supply pipe beyond the tap of the hydraulic valve.



General View of Apparatus.

To operate the apparatus, supposing the taps A, B, and T to be closed, first open the cylinder valve by means of the key supplied for that purpose, then by means of the thumb screw P adjust the pressure of the low-pressure gauge I to the correct working pressure for the blowpipe used. (The approximate pressure of oxygen required for each blowpipe is as follows:—No. 1, 10 lbs. per square inch; No. 2, 14 lbs.; No. 3, 19 lbs.; No. 4, 25 lbs.) Open the taps A, B, and *a*, and when acetylene is unmistakably smelt at the nozzle of the blowpipe, ignite it by means of a gas jet, candle or taper. Then open the tap T, which admits oxygen to the blowpipe, and correct the pressure on the gauge I, which will be found to have dropped slightly through the tap being opened; and finally, by means of a tap *a*, slowly throttle down the acetylene until the small white cone of flame at the nozzle of the blowpipe shows a clearly-defined outline.

The tap A should never be used to regulate the supply of acetylene; in fact, after the hydraulic safety valve has been charged with water it is best to leave this tap always on. The pressure of the acetylene supply due to the gas holder should be not less than 6 in. of water, and the supply pipe should be proportioned to the maximum quantity required per hour. It is a good plan to fix a water-pressure gauge near the inlet to the hydraulic safety valve in order to note the pressure supply during work.

It may be here mentioned that the working pressures for oxygen given need not be too rigidly adhered to. Even in the same sizes of blowpipes the conditions must vary slightly, and a little practical experience with each blowpipe will soon indicate the best working conditions. If the flame is not properly regulated it may fire back and go out. If so, the tap B should be shut off at once, and a few seconds allowed to elapse before re-lighting.

When work is carried on for a long time at a stretch, the burner will probably become warm, and it will then be found necessary to slightly open the acetylene supply taps *a* or B from time to time. If work is being done which involves the nozzle of the blowpipe being held in a confined space, it is advantageous to cool this end of the blowpipe by immersing it from time to time in a bucket of water, the gases being turned off.

For welding and cutting work the automatic regulator is specially recommended. It will deliver the high and varying oxygen pressure from the cylinder at any required low pressure from zero to 80 lbs. per square inch. This latter pressure cannot be exceeded, as the safety valve then opens and releases the gas. The pressure can be adjusted by unscrewing the thumb screw on top to reduce, or by screwing it down to increase, the pressure. The tap controls and shuts off the supply of oxygen. When the blowpipe is not in use it is desirable to shut the oxygen cylinder valve also, in order to avoid all possibility of loss through leakage and to release the internal parts of the regulator and its gauges from needless pressure. The lower pressure gauge registers the pressure of oxygen in the cylinder. The exact quantity of gas contained in a cylinder can always be ascertained by means of this pressure gauge. All cylinders are charged to 120 atmospheres, and contain standard quantities of gas at this pressure. When the regulator is attached to, say, a standard 80 ft. cylinder, the gauge will first register 120 atmospheres. Suppose after some use the pressure has been reduced to 75 atmospheres, the cylinder will then contain:—

$$\frac{80 \times 75}{120} = 50 \text{ cubic feet of oxygen.}$$

During the last few years oxygen has come very prominently into use for the purpose of cutting wrought-iron and steel plates and structures of all sorts. The process is based on the well-known fact that a jet of oxygen directed upon a previously-heated spot of metal ignites it with the result that the metal acting as its own fuel burns away rapidly in the form of iron oxide. The same process was practically applied to the opening up of tuyeres in blast furnaces which had become blocked by the solidification of metal.

The use of oxygen for this purpose proved so successful that its value in the cutting of metal was again suggested. Theoretically, once iron is ignited in oxygen, if a powerful jet of the gas is maintained in operation, it should be possible to burn away the metal without any auxiliary source of heat. Oxide of iron, however, is formed at a comparatively low temperature and lacks fluidity. It was found difficult in practice to eliminate all the oxide which was formed. Much of it adhered to the partially molten metal, thus preventing the intimate contact of metal and gas, with the result that combustion soon failed and the cutting operation was arrested. The process was in consequence intermittent, the consumption of oxygen wasteful, and the cut wide, coarse, and irregular. In 1904 a cutting blowpipe, which is a very simple solution of this difficulty, was subsequently introduced. It consists essentially of a blowpipe with an additional passage, through which an independent and separately controlled stream of oxygen is supplied at the discretion of the operator. This separate supply of oxygen may be discharged through the centre of the blowpipe, in which case the mixed gases employed for heating are conducted through an annulus surrounding it, or the supply may be brought in a passage immediately behind the heating flame. The latter is the method preferred by the inventors, and for oxygen cutting machines it is probably the best, and most economical in gases. For the ordinary hand cutters, however, the difference in construction is unimportant, and each method is equally suitable.

This simple expedient of maintaining an independent heating jet in operation whilst the cutter is travelling renders the cutting operation continuous. It furnishes the quantity of additional heat necessary to render the oxide fluid so that it can be blown away through the cut by the separate jet of oxygen, and the heating is so rapid and local that a clean narrow cut is effected through the metal without any deteriorating effect upon its quality and at a speed of travel which is comparable with hot sawing.

The applications of this oxy-acetylene blowpipe are so numerous that it is impossible to enumerate them in anything like detail. The following, however, are some of the applications for which it has already been advantageously employed:—

The fusion welding (in place of brazing) of bicycle frames, forks, tee standards, wheel rims, etc.; the fusion welding of frames, wheel rims, etc., for motor cars; in the manufacture of iron or steel motor or other boats as a substitute for rivets; the fusion welding of domestic and other hot-water boilers; the repair of steam boilers and other apparatus *in situ*; the fusion welding of steel or iron tanks, etc.; in the manufacture of safes; the fusion jointing of pipes of every description and shape for steam superheaters, etc.; the fusion welding of all joints in metallic casks, petroleum barrels, etc.; as a substitute for riveting in thin sheet ironwork, such as enamelware; artistic ironwork; the repair of cracks, blisters, and flaws in malleable iron and steel castings, forgings, etc., also cast iron; cutting away defective parts in boiler furnaces and welding in patches; as a substitute for brazing in nearly all instances; as a substitute for brazing in copper work of all descriptions; by means of the blowpipe, copper pipes and most kinds of sheet copper structures can be fused together as one pipe, where brazing would otherwise be necessary. It is well known that in many instances accidents have occurred through the deterioration of brazed copper joints under galvanic action. This action is obviated by fusion welding, by which means a joint of equal if not greater strength is obtained without any such liability to deteriorate.

As regards cost, much depends on the nature of the work and the capacity of the workman, but it may be stated generally that the system compares very favourably with the cost of most riveted or brazed jobs. It is not claimed that the system will supersede ordinary forge welding where that is applicable, but the blowpipe is such a clean, convenient and portable tool that it enables a large variety of difficult welding to be done *in situ*, where riveted or brazed joints would otherwise be necessary. It therefore greatly extends the scope of welding. Some idea, however, of the strength of an oxy-acetylene blowpipe joint may be gathered from the fact that bars of Staffordshire iron fused together by this system have given tests of over 29 tons per square inch at the joint, and plates of iron and steel varying in thickness from 20 gauge upwards when welded together by the blowpipe have proved stronger at the joint than in the body of the plate.

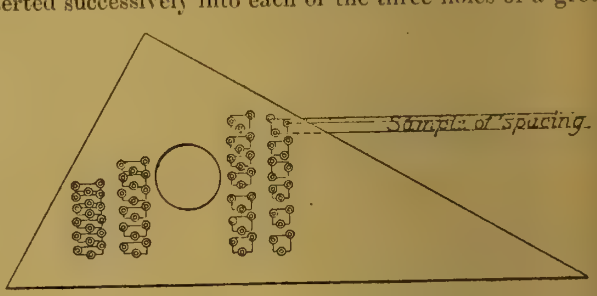
The speed at which work can be welded by the blowpipe varies to a considerable extent with the character of the job and the capacity of the workman; any ordinary workman, however, quickly becomes proficient, and a general idea of the speed at which work can be done may be gathered from the table below, in which the approximate foot-run of weld per hour is given on iron sheets corresponding to various blowpipes, and the quantities of gases consumed per hour by each of these blowpipes being given, the approximate cost of weld per foot-run can be readily calculated:—

No. of blow pipe	1	2	3	4	5
Approximate consumption of gas per hour:—					
Oxygen ....cubic feet	7	10	30	[illegible]	[illegible]
Acetylene ....cubic feet	3·5	7·5	22	35	50
Thickness of plate..........inches	$\frac{1}{16}$	[illegible]	$\frac{1}{4}$	[illegible]	$\frac{1}{2}$
Foot-run per hour	30	20	15	10	[illegible]

The figures in the above table being obtained when working on cold plates, the time and cost could be considerably reduced by previously heating round the part to be welded, in the case of plates of $\frac{1}{4}$ in. thickness and upwards.

LETTERING SET SQUARE.

A sixty-degree lettering triangle, which has been proposed by a correspondent in *Machinery*, is shown in the accompanying illustration. The set square is provided with a number of taper holes in groups of three each, that are used for drawing guide lines of different types for lettering. When guide lines are to be drawn, the pencil point is inserted successively into each of the three holes of a group which are spaced to the required height, and the triangle is moved along the T-square. By having these holes tapering, it is easier to insert the pencil point in them and the pencil can also be inclined at a considerable angle without danger of breaking the point.



The above will be found of considerable value in inserting lettering on drawings of all kinds, the holes necessary being easily drilled and countersunk.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 13th October, 1910.

DUNDEE.—*First class:* C. P. Fleming. *Second class:* R. Meldrum.

GREENOCK.—*First class:* W. Ramsay, W. M. Ferguson, A. Mullen, A. C. McKenzie.

HULL.—*First class:* E. Cawood, J. S. Webster. *Second class:* H. J. Latus.

LIVERPOOL.—*First class:* F. J. Blamey, F. R. Martin. *Second class:* R. H. Bridson, R. F. Thirkell, C. L. H. Hutchins.

LONDON.—*First class:* C. L. Hughes, D. R. Ray, T. H. Webb. *Second class:* J. A. Goddard, A. Macintosh.

NORTH SHIELDS.—*First class:* G. Lamberd. *Second class:* W. N. Brown, J. Parry, J. Peacock, J. Taylor.

STEAM.

LONDON.—A. W. Clemson.

NEW ELECTRIC GENERATING STATION AT NORTHAMPTON POLYTECHNIC INSTITUTE.

Anyone now desiring to enter the electrical engineering profession is practically obliged to pass through one of the recognised technical schools, for with the passing of time the strides made in the application of electricity to commerce have been rapid, and to-day it is hardly possible for a man of good general education to pick up for himself sufficient electrical knowledge as it was in the past. The profession of electrical engineering has to-day in its ranks numbers of men having had both a good general and technical education. The aim of all the best technical schools, therefore, is to produce the class of man in most demand, and to do this it is absolutely necessary to maintain a closer touch with the commercial world than heretofore. The teachers and the methods of teaching adopted by them must be up to date, and all the concrete things in daily use amongst practical engineers must be directly dealt with by them.

It will be obvious that under these conditions a much larger outlay upon electrical laboratory equipment has become necessary than was formerly required, and the examples of commercial apparatus must be not only of such sizes as are used in actual practice, but also facilities must exist for running under conditions identical with those found in actual practical working. In all cases, therefore, where the technical institute has sufficient available space, it is generally found necessary to instal an electric power house, both for the purpose of supplying power, and more especially as an adjunct to the electrical engineering laboratories.

The plant we are about to describe has been recently installed for the above purpose at the Northampton Polytechnic Institute, London, E.C. The plant has been supplied by Messrs. Siemens Brothers Dynamo Works Ltd., Caxton House, Westminster. It is, of course, chiefly designed for instructional purposes, and embodies all the latest ideas in central station practice, comprising electrical apparatus for alternating and for continuous-current working.

The buildings of the Northampton Polytechnic cover an acre and a quarter, and at some parts rise to a height of five stories. Whilst, therefore, the power station necessary for the supply of electrical energy for lighting and power purposes—for there are numerous workshops—cannot be compared in size to a modern generating station erected for the requirements of a large district, yet it is sufficiently large to present experimental facilities on an engineering scale for most of the problems which have to be handled in the larger station. In addition, such details as the keeping of the necessary records of the various items of the cost of generation and of the distribution for the varied needs of the buildings can only differ in degree and not in kind from the work for a big station, for it is intended to run the station on a thoroughly commercial basis. On the one hand, the coal, wages, and other expenses will be strictly charged up, and on the other, every unit of electrical energy supplied for the purposes of the work of the Polytechnic will be regularly metered and sold to it. The senior students will take charge of the work, in conjunction with the technical staff, and will thus gain experience on an engineering basis.

The main features of the plant are two gas-driven sets, each consisting of one continuous-current generator and one high-voltage alternator in tandem. The gas engines were supplied by Messrs. Norris and Henty, and are of the well-known Gardner suction type, each engine being capable of developing 108 B.H.P. at 500 revolutions per minute, when supplied with suction gas. Each engine has six cylinders of 8 in. diameter and water jacketed, while the stroke of the piston is 9 in. The valve boxes are cast solid with the cylinder, and the exhaust valve box is also water jacketed. All valves are capable of being readily removed by taking off the covers, which have ground "metal to metal" joints. The connecting rod is cut from a solid steel forging, as also is the crankshaft. The governing is carried out by means of a governor of the centrifugal type of special design, while starting is effected by the usual compressed-air method. Most of the working parts are enclosed in the crank case and are lubricated by means of an oil bath in the crank case, but the main and connecting-rod bearings are fed by forced lubrications by means of a pump geared from the engine.

A very effective water-jacketed silencer is provided, being arranged along the front of the cylinder. The ignition is by means of an electric spark from a low-voltage magneto which is driven by direct gearing from the crankshaft of the engine. The engines are complete with cooling water tank and arrangements for indicating. The engines are supplied with a compressed-air starter, consisting of an air compressor belt-driven from an electric motor. The flywheels of the engines are of sufficient weight to ensure that the variations in speed do not exceed the limits usually allowable for power and lighting supply, and the cyclic irregularity

$$\left(i.e., \frac{\text{max. speed} - \text{min. speed}}{\text{mean speed}}\right)$$

does not exceed 1/250. This prevents any perceptible flicker in the lights when the set is running direct on an incandescent lighting load. The steady speed variation of the engine in passing from full load to no load, or *vice versa*, is guaranteed not to exceed four per cent, and the cooling water required not to exceed seven gallons per B.H.P. hour with inlet water at 60 deg. Fah. to 70 deg. Fah.

For the supply of cooling water advantage is taken of the Polytechnic Swimming Bath, which fortunately happens to be close to the generating station and forms a very efficient cooling pond. The bath is 100 ft. long by 35 ft. wide, and has a capacity of 120,000 gallons of water. During the summer time, when the bath is in use, the waste heat from the engines will be in this manner turned to account. For use in emergencies, should the connections to the bath become unavailable, there are provided two cooling tanks each of a capacity of 620 gallons.

The supply of gas to the engines can be taken either from the town gas main in an emergency, or, as is intended to be the usual case, from the two suction-gas producer plants. The fuel consumption of these producer plants, when working in conjunction with the above Gardner engines, is guaranteed not to exceed ·9 lb. of anthracite coal per B.H.P. hour on full load, and 1·25 lbs. of anthracite coal per B.H.P. hour at half load, and the consumption of water is guaranteed not to exceed two gallons per B.H.P. hour at full load.

The two suction gas plants were made by Messrs. Bennett and Tapley. The producer plant includes a mixing chamber in which the gases are mixed thoroughly before passing to the engines. This overcomes any trouble which might be caused through the engines drawing gas of different quality from the two producers, due to differences in the quality of the fuel provided or any other cause temporary or permanent.

The pipework connecting the producer plants to the engines is so arranged that it allows of the following combinations:—Either engine can run off either producer with totally independent and separate mains; both engines may draw gas simultaneously from either producer; both engines may draw gas from both producers with the gases thoroughly mixed; either engines may draw gas from both producers with the gases thoroughly mixed. The normal speed of the main shaft of each set is 500 revolutions per minute. Coupled in tandem to each engine are:—One Siemens 280 FC, compound-wound generator, having an output of 0 to 50 k.w., 210 to 220 volts, and capable of shunt regulation by hand between 200 and 230 volts, the field being over-compounded. Direct coupled to the preceding is a Siemens 35·7 U.R. three-phase alternator having an output of 50 K.V.A., or 42·5 k.w. at a power factor of ·85 and a pressure of 2,200 volts, the frequency being 25 cycles per second. These alternators are of the rotating field type, with six poles. The stator frame is of cast iron of great stiffness and substantial design. It is efficiently ventilated by a current of air set up by the rotor, which escapes through ducts in the core and holes in the outer shell of the frame. The core is laminated and built up of punchings insulated on both sides. The slots are open with grooves to receive wooden keys to hold the stator coils firmly in place. This design allows the coils to be thoroughly insulated before they are slipped into position, and also enables repairs or renewals to be easily made. The stator coils are wound on formers, and the insulated conductor is of cotton-braided copper strand, the cotton covering being impregnated with insulating varnish before the coils are wound. The ends of the coils are amply insulated to suit the high voltage for which these machines are designed, and are protected from mechanical injury by shields secured to the frame.

General View of Generating Station.

The rotor consists of six poles attached to a cast wheel, the rim of which is of U section. The poles are round and mounted on flat circular facings on the periphery of the flywheel. They are secured by screws passing through the flywheel from the inside, the screws being provided with lock washers to prevent them from working loose. The pole itself is prevented from turning by a steady pin. The pole shoes are laminated and built up of steel punchings secured riveted together, and are fixed to the pole by means of four counter-sunk screws, which are locked into position after being screwed home. The poles are so arranged that they can be removed complete with their windings without racking the frame sideways. By removing the pole screw and adjusting the frame slightly so as to increase the air gap at one side, the pole may be brought forward so that it will slip out sideways. In this way a large gap is formed which facilitates inspection or repairs to the stator winding. As it is thus unnecessary to make provision for racking the stator frame sideways, a saving of floor space is effected. The field coils are wound on metal formers which fit the poles, a flange on the pole itself holding them in position against centrifugal force. This construction is of great mechanical strength and suited to high peripheral speeds.

The slip rings, which are two in number and provided with two brushes per slip ring, are made of gunmetal shrunk on to a sleeve, from which they are insulated with micanite. They are prevented from moving laterally by an end ring fitted on the sleeve. They are secured by insulated bolts which pass through holes in the slip rings, and are fixed at the back of the sleeve by nut and pin. The complete carrier with rings is then pressed on the shaft. The temperature rise of these machines is guaranteed not to exceed 70 deg. Fah. after six hours' full-load run; the permissible overload is 25 per cent for one hour and 50 per cent momentarily without undue heating and sparking.

Each of the 50 K.V.A. alternators is provided with a cast-iron terminal box having terminals fitted with porcelain insulators, to which the ends of each phase of the stator windings are brought to enable them to be connected either star or mesh. The guaranteed efficiencies of these sets are as follows:—

	Full load. Per cent.	¾ load. Per cent.	½ load. Per cent.
280 FC. machine	88	87½	85½
35·7 UR. machine, with a power factor of 0·85	86½	85½	82½

The voltage drop between no-load and full non-inductive load is less than 10 per cent at constant speed and excitation. The wave form of these alternators is guaranteed to contain no harmonic with an amplitude exceeding two per cent of the amplitude of the fundamental sine-wave, and the maximum deviation of the actual wave from the true sine-curve is not to exceed five per cent.

Another important item of this installation is the Siemens' motor-generator set, consisting of one 35·5 UR. three-phase synchronous motor of the two-bearing type, direct coupled to two 260 FC. compound-wound generators, one generator being coupled on each side of the motor, and the three machines mounted on a combination bedplate. The synchronous motor has an output of 45 B.H.P. at 2,200 volts, 25 cycles per second, and runs at a speed of 500 revolutions per minute. The excitation is taken from one of the continuous-current generators. Generator No. 1 of this motor-generator set has an output of 0 to 25 k.w. at 215 to 220 volts, and is capable of shunt regulation by hand down to 200 volts. Generator No. 2, which for starting the set may be run as a motor, gives an output as a generator of 0 to 27·5 k.w. at 107 to 110 volts, and is capable of shunt regulation by hand down to 100 volts. The general mechanical design of the synchronous motor is similar to that of the UR. alternators described above. This set is also equipped with the necessary series and shunt regulators and a continuous-current starter.

View showing Sub-station Switchboard.

The switchboards in the station have been designed with the object of permitting the maximum number of interchanges between the various units of the plant, and of converting and controlling the electric energy in the

The Engineering and Machinery Exhibition, Manchester.

THE Engineering Exhibition, now running at the City Exhibition Hall, Manchester, is proving very popular, and is very creditable alike to the organisers, *The Engineering Review*, and the exhibitors, who have taken up the matter in a whole-hearted and very thorough spirit of enterprise.

The hall is filled with an exceptionally complete range of exhibits, the large majority of which are machine tools shown in operation under working conditions. There are many tools and appliances which will appeal to those who are on the look-out for the latest practice—machines exhibited for the first time and but recently emerged from the experimental stage. Very noticeable in this respect are the advances made in the integral combination of the definite and automatic control of electric power with the movements of metal-working tools. Of these some details will be given later. It is significant that there is quite a proportion of Continental machinery set out, In some cases very prominent spaces have been taken for the exhibition of classes of machinery, in the making of which engineers of the Manchester district have been wont to consider themselves unassailable. Whether the effect of this foreign entry into a British stronghold will lead to much it is impossible to say, but the fact remains that our Continental rival does not hesitate to push himself right forward into one of our greatest engineering centres.

The Exhibition is to continue until November 5th, and amongst features of general interest may be mentioned the reading of papers on current engineering topics, such as that by Mr. Frank Nasmith, who dealt with the relationship between electrical engineering and textile work, on Monday last; and the papers, "Large Gas Engines—Their Troubles and Tendencies of Development," by Mr. Frank Foster, M.Sc.; and the "Torques and Balancing of Internal-combustion engines," by Mr. A. T. J. Kersey, to be read on October 24th and October 31st, respectively.

Students, apprentices, and workmen are encouraged to take a live interest in the exhibition by having the advantage of a low admission price, and by the institution of a number of prizes for the compiling, in open competition, of short essays on specified engineering topics.

It is impossible to review in detail the exhibits of the one hundred and thirty or so firms who are represented; many of the stands are occupied by specimens of materials and products the names of which are household words in engineering circles the world over—specialities which years of successful usage have standardised, but which, in these days of strenuous competition and advancement, require always to be in evidence where special advertising is to be done—there is always new ground to be broken, and that already cultivated to profit must be looked after to maintain and to increase its fertility. The major part of the folowing descriptions will therefore deal with those exhibits which are essentially new and which have the merit of indicating the tendency of further development.

J. and W. Kirkham Ltd., Bolton.—The specialities exhibited by this firm are their well-known lubricators for steam-cylinder service and a quite recently introduced form of sight-feed drop lubricator. For those who are not already familiar with the former it may be said that whilst it is of the force-pump type, of which there are many on the market, it embodies quite a number of special points making for oil economy, continuity of action, cleanliness, and ease and control and accessibility of parts. The pump rams, of the horizontal type, are placed in the base of the lubricator. They are thus immersed in the oil and effectively air-sealed without glands being necessary. The valves and valve covers are outside the container, and any of them is easily accessible for inspection or cleaning without interrupting the service of the other feeds. The base of the lubricator is a one-piece bronze casting, and any usual number of feeds can be arranged from the one container, the adjustment of each feed being possible irrespective of the others. The feeds can thus be set to deliver the least oil supply necessary for service, and this, in conjunction with the fact that the oil receives a thrust forward at each stroke of the engine ensuring a delivery of the requisite minimum of oil at each opening of the steam inlet valve, makes for the greatest economy in oil consumption. Other minor features of this lubricator, all of which however add to its value, are that the container is of glass, giving constant index of amount of oil available; that it is fitted with a gauze sieve having a solid tray base by which all water is prevented from entering the container; also the sight-feed glasses have central guide wires up which the oil globules pass without smearing or obscuring the glass, and the sight-feed glasses are held in on flat ring seats, and breakages or bursts are prevented.

Kirkham Snap-drop Lubricator.

The new "Kirkham" snap drop oiler, if for no other reason, is worthy of consideration because of its obviously good proportions. By introducing an internal tube into the container for revealing the frequency of the drop-feed in place of the open gap in the lower end of the lubricator, as in the old type, the lubricator has assumed a more solid form. The principle of its action is that instead of showing the actual globules of oil falling from the container, the inner tube shows the bubbles of air which rise through the cup to replace the oil delivered. These air bubbles are, of course, equal in volume to the oil displaced, and give a correct index of the rate of feed of the lubricator.

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SEE STAND Nos. 57 & 58, ENGINEERING EXHIBITION, MANCHESTER.

C. E. Lugard and Co., of Chester, are showing various types of their "S.M." and other Electro-Magnetic Clutches, and the "Pillow" Flexible Couplings.

To illustrate the practical application of the magnetic clutches for driving planing machines, a no-belt planing machine, by Messrs. Stirk, of Halifax, to plane 8 ft. by 3 ft. square, is shown; this machine is electrically driven and has an electrical variable-speed control both for cut and return, each being independently variable; the table speeds can be changed whilst the machine is running. The motor runs continuously in one direction only, and the table reversals are accomplished by a double S.M. electro-magnetic clutch fixed inside the bed. Further particulars of the planer will be given in the review of Messrs. Stirk's exhibit. The magnetic clutch drive is, of course, not only suitable for new planers, but old machines may be fitted with this drive at a trifling cost and thus speeded up; for instance, an old planer 5 ft 6 in. by 16 ft., formerly cutting at 25 ft. per minute, resting 3½ seconds for the belt to come over and returning at 35 ft., after being fitted with these clutches now has two cutting speeds of 28 ft. and 50 ft. with a constant return of 60 ft. per minute. For general power transmission, this firm claim to have supplied the largest magnetic clutch in the world; this clutch, which is of the Vulcan Patent Type, transmits 1,000 H.P. at 75 revolutions per minute, is 7 ft. 3 in in diameter, weighs about 6¼ tons, and is installed in Middlesbrough on a furnace blowing engine.

The S.M. Patent Type has been installed on several rolling mills, in sizes capable of transmitting from 1,400 H.P., at 160 revolutions per minute, down to 400 H.P. at 300 revolutions per minute. These magnetic clutches must not be considered as ordinary friction clutches brought into engagement and released by magnetism; they actually transmit the power partly by friction and partly by magnetic pull, and, consequently, they are capable of dealing with conditions of drive that to an ordinary friction clutch would be impossible. The S.M. type of clutch has a stationary electro-magnet, with a single totally-enclosed or iron-clad coil. There are, therefore, no brushes or slip rings required, and the winding is subject to no mechanical stress. The engaging surface is conical where the friction contact is made, and there is a further large area of radial face which affords the magnetic engagement. The clutch has lately been considerably improved and is designed for more severe work than the older patterns. The Vulcan Patent Type of magnetic clutch is shorter in length than the S.M., and is fitted with a rotating electro-magnet having slip rings to conduct the current to the exciting coil. A reversing model of this type is shown.

From the types of magnetic clutches which are exhibited it is possible to pick one that will be suitable for any existing conditions. A most important feature of the electro-magnetic clutch is the factor of safety introduced by its use. The exciting current can be adjusted to any desired value, and in the event of excessive overload, or jamming occurring on the driven machine, the clutch slips and is automatically released. They are, moreover, remarkably simple in construction, and consequently cheap, and free from breakdown. As instancing the very small current required for their operation, a clutch of the S.M. type, for transmitting 18 H.P. at 100 revolutions is 2·5 amps. at 220 volts, 550 watts. The diameter of such a coupling is 21¾ in., and its overall length 17in. It is also to be mentioned that these clutches are of British manufacture.

The "Pillow" flexible coupling, also exhibited by Messrs. Lugard, is a distinct departure in the way of design in this class of appliance, which is so much sought after for a wide variety of purposes. The new coupling is certainly simple, the machined work on the parts being practically nil. It consists of an inner star wheel, or boss, having a series of longitudinal grooves cast in its periphery; the other half is a cylindrical enclosing casting having a corresponding series of grooves cast on its inner face. The grooves are set to register, and in each is placed a spring consisting of a strip of steel folded to form a split tube. The edges of the tubes do not quite meet, and the folded spring thus formed makes an effective and cheaply renewable cushioning device. A small ring screwed over the open end of the coupling serves to prevent the series of springs from working outwards. A point about this coupling is that the design is readily adaptable for insulating service, and indeed a standard line of insulating couplings are listed, the prices of which are only very slightly in excess of those of the plain form. As indicating the approximate characteristics of the "Pillow" coupling, it may be quoted that to transmit 7 H.P. at 1,000 revolutions per minute, or its equivalent, the coupling has a limiting diameter of 5⅞ in. by 5½ in. long, weighs 35 lbs., and is listed at £2 1s.; it is standardised in a range of seventeen sizes, up to about 40 in. diameter.

Richard Klinger and Co., 66, Fenchurch Street, London, E.C., are specialists in steam-users' fittings and materials. Amongst the many items on their stand which call for special note are the Klinger improved gauge cocks which embody features rendering these important fittings free from the drawbacks which have been more or less identified with asbestos-packed cocks hitherto. Despite the generally acknowledged superiority of asbestos packing, and its world-wide adoption as a means of rendering cocks and valves steam and water-tight, it has the disadvantage that, being a soft material, it is almost certain, sooner or later, to waste away to such as extent that the cock becomes inefficient. Moreover, however good the packing used, those small metal surfaces inside the cock, which are constantly moving upon each other, are always

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subject to exceptional wear from steam, water, high-pressure, chemical conditions, etc. Then, too, when the old-style cocks go wrong, it is usually necessary to take them down from the boiler and to send them to the engineering shop for repair. Klinger's improved cocks, etc., are on an entirely new principle, which is applied also to a variety of valves, test cocks, stop cocks, blow-off cocks, and so forth.

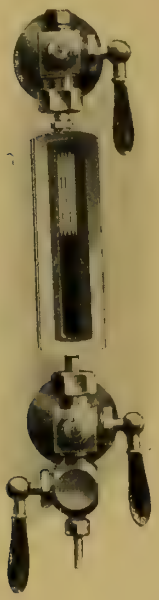

FIG. 1.

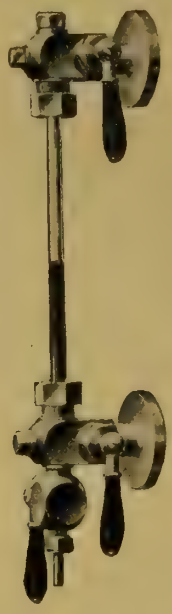

FIG. 2.

The cock or valve body is hollowed out for the reception of a removable inner cup or shaped lining, the outside of which fits accurately into the said hollow. This lining is filled with the best quality asbestos packing, the plug working in the centre in the usual manner. By means of this arrangement, whenever the packing becomes inefficient, the lining, with its contents, may readily be removed and a new one, costing but a trifle, can be substituted, making the whole fitting as good as new. If the plug itself should become worn this, too, can be replaced, as all parts are standardised. The lower gauge cock is provided with ball valve, ensuring safety when fitted with ordinary glass tubes.

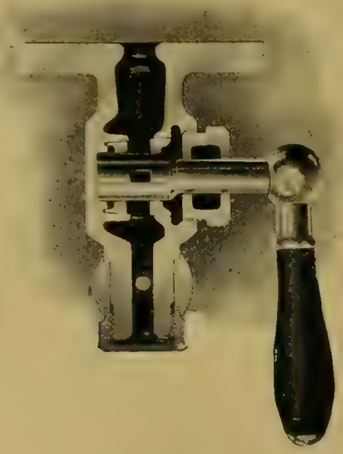

FIG. 3.

The leading advantages claimed for this invention are as follows: The gauge casing lasts indefinitely and never needs to be discarded or even removed from the boiler; the delay caused by dismounting and sending the ordinary-pattern cocks to be repaired is avoided; any mechanic can effect the change from old to new inset in a few minutes; the cost of the replace parts is infinitesimal.

It will be noticed, in the first illustration, that the new cocks may be fitted with Klinger's patent "Reflex" water gauge attachable pattern, of which it is said that more than 250,000 have been sold. The water level can be seen at a glance, the water appearing black while the steam space shines with a silvery lustre; they are proof against explosions; there are no glass tubes to break; they require no protector, and they are easily fitted to existing boiler mountings. Every gauge is tested to 500 lbs. steam.

The Klinger patent two-colour stuffing-box packing is attracting considerable attention. The body of the packing consists of (1) a special fibrous lubricant, embedded in which is (2) a perforated strip of flexible metal, and the whole is encased in (3) an interlaced cotton covering, one side of this being coloured red to denote that that side must be placed directly in contact with the piston rod. The metal strip, being flexible, may be readily bent round any diameter of valve spindle or piston rod, and the lubricant material, being forced through the perforations by the pressure of the gland, forms a perfectly tight joint. As the stuffing box is tightened, from time to time a fresh supply of lubricant is pressed through the perforations in the strip of metal. Being made up of a number of rings, each independent of the other, it is resilient throughout the whole length of the stuffing box, an advantage every engineer will appreciate. The packing is offered as being impervious to the effects of water, superheated steam, acids, ammonia, oil, etc.

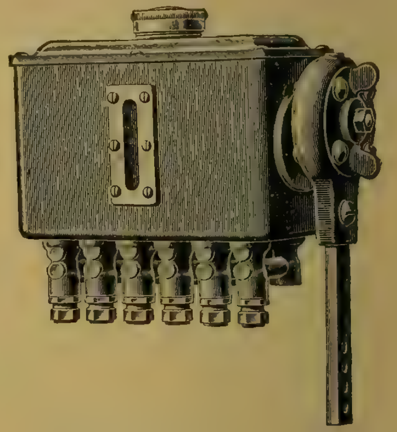

FIG. 4.—The Klinger "Auto Lubricator."

Klinger automatic lubricators are also to be seen in various types, suitable for locomotives, marine, automobile, and stationary engines. The principle of these is entirely mechanical, and they are so arranged that they can be actuated by any moving part of the engine and require no watching or other attention beyond keeping them supplied with sufficient oil. Any number of outlets can be provided, each, in reality, being a separate oil pump, capable of accurate adjustment so that just the right amount of oil required for a given point will be sent forward. The illustration, fig. 4, shows the outside of the automobile pattern, which can be driven by ratchet lever, cardan shaft, chain, or belt.

(To be continued.)

LLOYD'S REGISTER.—The report of Lloyd's Register for the year ending June last shows that at the close of the year 10,302 merchant vessels registering over 20½ million tons held classes assigned by the committee. Of these 8,992 vessels of 18,782,708 tons were iron and steel steamers, 1,132 of 1,725,834 tons were iron and steel sailing vessels, and 178 of 26,945 tons were wood and composite steamers and sailers. Classes were assigned by the committee to 540 new vessels of 929,946 tons. Of these 461 of 923,703 tons were steamers, and 79 of 6,243 tons were sailing ships. Of the total 612,825 tons, or 66 per cent, were built for the United Kingdom, and 317,121 tons, or 34 per cent, for the British colonies and foreign countries.

station, so that, as far as is possible on the scale of the station, modern station and sub-station practice, both with continuous and alternating current, may be demonstrated.

This part of the installation includes four switchboards; one high-voltage three-phase 2,200 volt 25-cycle switchboard, consisting of two generator panels, one synchronous motor panel, and one transformer panel.

The transformer panel controls the high-voltage side of four 13·7 K.V.A. transformers. In addition to the usual switchgear and instrument transformers, these panels are provided with the following: Recording ammeters, watt-hour meters, recording voltmeters, power factor indicators, frequency indicators, rotary lamp synchroscope and reverse-current relay.

The high-voltage gear is mounted in cells, built of artificial stone slabs, the front of the cells being closed with expanded metal screens. This gear is in an adjoining room, and is operated from the desk-type switchboard by a system of remote mechanical control. The low-voltage three-phase 350 volt, 25-cycle switchboard consists of one rotary converter panel to control the rotary converter in the adjoining room; one transformer panel to control the low-voltage side of the four 13·7 K.V.A. transformers; and two feeder panels equipped with the latest type of switchgear.

The cases of all the instruments on these boards are effectively earthed, and no apparatus at high-voltage is accessible from the front of the board. The high-voltage alternating-current board mentioned above is of the "desk" type, while the low-voltage alternating current board is of the "vertical" type. These two boards are placed in a gallery at one end of the power station, at the opposite end of which is situated the low-voltage continuous-current main switchboard, consisting of two generator panels, each 50 k.w.; one generator panel, 25 k.w.; three booster balancer panels; one rotary converter panel; one generator panel, 27·5 k.w.; three feeder panels, 200 to 220 volts; one feeder panel, 500 to 550 volts; and two feeder panels, 100 to 110 volts.

This low-voltage board is divided into two parts—one half being mounted above in the gallery, and the other half being erected immediately underneath.

The high-voltage alternating-current switchgear is mounted in stonework cells and placed in a separate room for reasons of safety and accessibility.

Each generator cell is equipped with one triple-pole oil switch of the Stafford type, having a capacity of 100 amperes; five current transformers having a ratio of 20/5 amperes; one three-phase potential transformer having a ratio of 2,200/110 volts; three single-pole high-voltage potential transformer fuses; and three single-pole isolating switches, each of 50 ampere size.

The transformer cell has a similar equipment, with the exception of the potential transformers and the potential transformer fuses. Side by side with these cells are placed those containing the transformers mentioned above, also protected in front by an expanded metal screen. In this room there is also a four-pole rotary converter for converting three-phase current to continuous current, this machine being fitted with three slip-rings and damping winding. The output on the continuous-curent side is 30 k.w. at a voltage of 500 to 550, the corresponding alternating-current voltage being 310 to 350 volts at a frequency of 25 cycles per second. The set runs at 750 revolutions per minute. The machine is started up from the A.C. side as an asynchronous motor by means of auxiliary tappings on the low-voltage side of the transformers referred to below. The shunt field is divided into three sections and brought out to six terminals, so that during starting the field can be broken up and each section put in parallel with each other to prevent a high induced voltage breaking down the insulation.

In one of the laboratories, situated some 100 ft. from the main station, there is installed a switchboard which will be used as the switchboard of a sub-station receiving power commercially from the generating station through its own recording instruments, etc., and distributing power to the building. The details of this switchboard are as follows: One incoming feeder panel for two 400 ampere circuits; one auxiliary generator panel; one auxiliary balancer panel for 10 k.w.; two feeder panels and one busbar coupling panel. These panels are provided with suitable switch gear for carrying out the various tests desired in such an installation.

The transformer equipment consists of four single-phase air-cooled transformers each having a capacity of 13·7 K.V.A. with a primary voltage of 2,200 and a secondary voltage of 330, the frequency being 25 cycles per second.

Working in conjunction with these are three regulating transformers, having a primary voltage of 330, and tappings on the secondary for giving nine different voltages, from 130 to 350 volts. These tappings are connected to a rotary switch operated by chain gear from the switchboard.

The station equipment also includes a battery consisting of 106 cells, manufactured by the D.P. Battery Co. Ltd., Bakewell, and capable of giving a discharge of 60 amperes for 10 hours, 100 amperes for five hours, or 130 amperes for three hours, the E.M.F. of the battery not falling below 1·8 volts per cell.

Working in conjunction with this battery is an automatic booster balancer set, consisting of three machines coupled together and mounted on a combination bedplate. The booster is capable of the following output: On charge, 160 amperes at 0 to 43 volts continuously; 160 amperes at 0 to 52 volts for one hour; maximum boost, 65 volts. On discharge, 200 amperes at 0 to 32 volts for one hour; or 300 amperes at 32 volts for five minutes; or 400 amperes at 0 to 32 volts momentarily.

The two machines composing the balancer are capable of dealing with an out-of-balance current of 65 amperes in the middle wire, the voltage across the outers being 200 to 220. It is also capable of dealing with the full-load output of the battery, keeping the load on the generators constant within 10 per cent of the fluctuation on the outgoing feeders, and keeping the potential difference on the lines within two per cent, *i.e.* one per cent up or down. This set, which runs at about 930 revolutions per minute, is complete with balancer middle-wire regulator, booster shunt-regulator, booster-potentiometer shunt-regulator, and the usual switches and resistances.

To complete the station there has been erected an overhead electric travelling crane by Messrs. Higginbottom and Mannock, Manchester, of two-tons lifting capacity, with lifting, travelling and traversing gears operated by three Siemens series-wound electric motors and controllers. The span of the crane is approximately 23 ft. and the lift 18 ft. The maximum speeds of the crane with two-ton load are as follows: Longitudinal travelling, 150 ft. per minute; cross traversing, 75 ft. per minute; hoisting, 15 ft. per minute. Lighter loads can, of course, be dealt with at a correspondingly higher speed.

The ventilation of the engine room is carried out by means of a fan, which sucks the air down through sleeve pipes which rise up into the engine room around the exhaust pipes of the engines, fresh air entering through windows and grid ventilators at the top.

A perusal of the foregoing summary of the plant installed should convince the reader that the desired objects will be attained under the skilled supervision of the technical staff of the Northampton Polytechnic Institute, and that the students attending the classes will obtain opportunities for practical work which cannot but be of the greatest service to them in professional life.

Our illustrations depict a general view of the generating station, and a view of the sub-station board.

THE MANUFACTURE OF ROLLED "H" BEAMS*.

Many inventors have devoted time and brain work to the perfection of the means for manufacturing rolled beams, and, of later years, more particularly to the manufacture of so-called "H" beams, or beams having flanges of great width as compared with the height of the beam. With ordinary two or three high mills having grooved horizontal rolls only, the practical economic limit appears to have been reached in the case of the commercial standard sections; but beams of much larger section than these, and more particularly beams having relatively far wider flanges, are rolled more or less successfully in universal mills which have both horizontal and vertical rolls. Moreover, with a universal mill a more economic distribution and better working up of the metal appears to be attainable than is the case with ordinary grooved rolls. Using grooved rolls only, the width of flanges which it is possible to roll is limited not only by the necessity of using rolls of very large diameter to accommodate the deep grooves necessary to produce wide flanges and still leave sufficient metal in the rolls to give the necessary strength thereto, but also by the necessity of making such grooves with a very great inclination of their sides in order to avoid the tendency for the metal to become jammed therein, which results in the flanges being weakened if not torn away altogether.

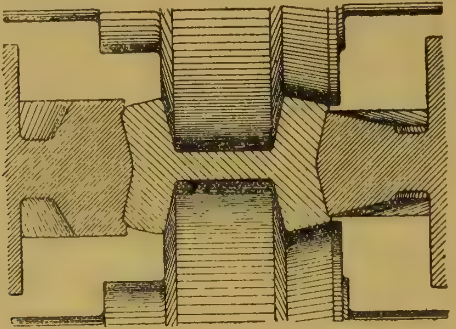

Fig. 1.—Roughing Rolls, Open.

Universal mills having a pair of horizontal and a pair of vertical rolls all in the same vertical plane are now in operation adapted to roll beams of much larger sizes than those hitherto called for, or, say, up to about 30 in. high by 15 in. wide. But the practical difficulties which had to be overcome to ensure success in the production of such sections has necessarily involved a complication of the machinery used as compared with the mills customarily used to roll ordinary standard sections.

The difficulty of working up the metal in a complicated section, such as an "H" beam undoubtedly is, is to secure sufficient uniformity to avoid undue internal stresses, having regard to the comparative thinness of the metal in the web and flanges necessary to enable them to be manufactured sufficiently cheaply to compete commercially with built-up beams. Another difficulty is that of producing finished beams of sufficiently good appearance, free from fins, eccentricity of web, and other irregularities. These are the chief points which the inventor has had to watch, and to overcome which still taxes his ingenuity.

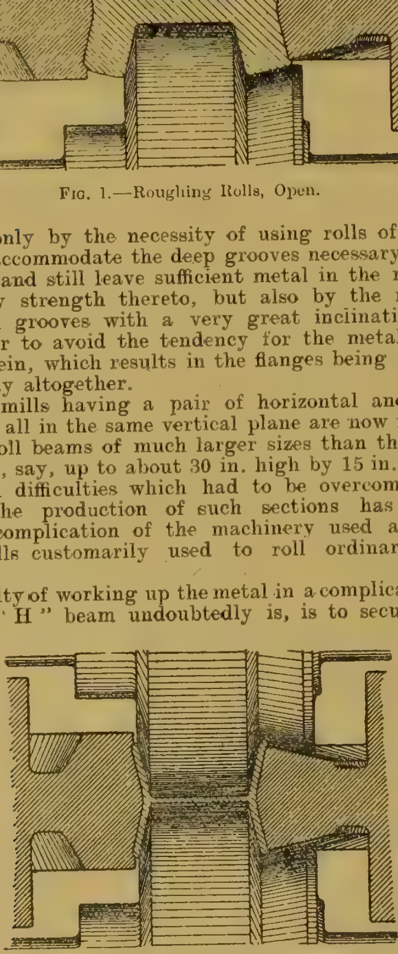

Fig. 2.—Roughing Rolls, Closed.

In his paper the author proposes first to describe briefly a few of the characteristic types of machines disclosed by different inventors, through the medium of the Patent Office of the United States of America, to offer a few remarks thereon, and, finally, to present his own suggestions for criticism.

H. Sack, Patent No. 365100 (1887), describes a single reversing universal mill having a pair of horizontal rolls and a pair of vertical rolls, with their axes all lying in one vertical plane, the two horizontal rolls being both alike but individually unsymmetrical, whilst the two vertical rolls are both different but individually symmetrical, figs. 1 and 2. Thus the gaps between the rolls are, on one side, at the extreme outside edges of the flanges, and on the other side at the extreme inside edges of the flanges. After each pass between the rolls the bar is tilted half round, and the positions of the flange edges relatively to the position of the gaps between the rolls are reversed, and the edges which in one pass were adjacent to the gaps between the rolls are, in the subsequent pass, adjacent to the closed corners of the rolls. In this way the surplus metal extruded between the gaps of the rolls in one pass is rolled down and suppressed in the next.

The use of a single set of rolls for the reduction of the preliminary bar into a beam renders reversing and adjustment of the rolls after each pass necessary, and it is impracticable, with the rolls as described by H. Sack, and illustrated, to have a closed pass between them. At best gaps are left at the corners of the flanges, which gradually become narrower as the pass is reduced and the blank rolled down until the final adjustment is made prior to the final reduction, when the gaps are reduced to a minimum. Nor, even at the final pass, is it practicable to have an entirely closed pass, because, although the rolls may be adjusted prior to the final reduction so that they touch and the pass is practically closed, yet directly the bar enters the pass deflection takes place which opens out the pass, and gaps are left between the rolls where fins will be formed on the bar.

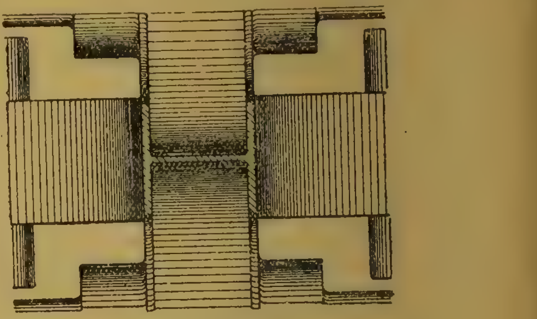

Fig. 3.—Finishing Rolls.

With this method the section is developed with flanges outwardly bent from the longitudinal centre line, in order to obtain a better rolling effect with the horizontal rolls upon the flanges, and this feature renders necessary the use of a finishing set of rolls, fig. 3, through which the bar is passed after having been completely reduced in the previous set. The pass between these rolls need not be adjustable excepting to compensate for wear or displacement, and may be fixed in the ordinary way. Its shape is exactly that of the section required, so that the effect of passing the bar through these rolls is merely to square up the flanges and give a final finish to the bar, particularly at the corners of the flanges where traces of surplus blank metal may have been left after reduction in the previous mill. No appreciable reduction need be given to the bar in the finishing rolls, and consequently no appreciable deflection of the rolls takes place when the bar is passed through them; the pass therefore remains practically closed and the formation of fins on the finished bar is avoided.

(To be continued.)

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* Paper read by Mr. G. E. Moore at the Iron and Steel Institute.

TRADE CATALOGUES.

We have received from **Messrs. John Blake Ltd.,** Oxford Stree Works, Accrington, Lancashire, a copy of their small catalogue of self-acting pumps or hydraulic rams and hydrams.

We have received from **Messrs. John Davis (Derby) Ltd.,** All Saints' Works, Derby, a copy of a pamphlet published by them containing a selection from their various catalogues. This publication should be appreciated by the clients of the firm, as it admits of their seeing at a glance the specialities manufactured without having to wade through their various catalogues.

We have received from **Messrs. W. Cooper Ltd.,** horticultural providers, 161, Old Kent Road, London, S.E., a copy of the latest edition of their "Gardeners' and Poultry Keepers' Guide" and illustrated catalogue. The catalogue, which is substantially bound, now extends to 638 pages, and is a small encyclopædia of its kind.

TRADE NOTES.

Messrs. Smith's Dock Co., of Shields and Middlesbrough, have received an order from Sir John Aird Ltd., contractors, for the construction of a large repairing dock at North Shields. The dock, which will take over 12 months to complete, will be 530 ft. long and 75 ft. wide, and will be the largest in Shields. The site on which the dock is to be built was formerly that of Messrs. Smith's Dock Co.'s shipyard, which was transferred to Middlesbrough last year.

Bolton Lubricating Company.—This Company has recently acquired the business and works of the late firm of Robt. Wood and Co. Ltd., Engineers and Lubricating Specialists, Albion Works, Bolton.

Electrical Equipment for Driving Sewing Machines.—We understand that the **Maschinenfabrik Oerlikon,** Oswaldestre, Norfolk Street, W.C., have designed a special electric drive which gives excellent results, while having the merits of simplicity and high efficiency. The apparatus can be fixed to any machine, and when the latter is stationary the endless band driving it is slack and the brake is pressed by means of a spring against the sewing machine wheel. By pressing the treadle the endless band is tightened or loosened as required, giving almost an unlimited range of speed. The starting is by means of a tumbler switch. Lists are being prepared, and in the meantime further particulars can be obtained on application.

Mr. J. W. Longley, Fairweather Green, Bradford, informs us that he has taken over the businesses of Messrs. J. and C. Hayton and the Hatley Engine Co., and that both firms will still be carried on under their existing names.

Messrs. The Robert Dollar Co., San Francisco, whose agents in this country are Messrs. T. L. Duff and Co., 24, George Square, Glasgow, have contracted with **Messrs. A. Rodger and Co.,** Port Glasgow, for a steamer of 8,500 tons dead weight.

We are informed that **Mr. James Turnbull,** of 3, New Street, Birmingham, has been appointed sales engineer for the whole of Great Britain and Ireland for the various products of Messrs. Gutehoffnungshutte, Oberhausen, Rheinland, Germany.

Large Orders for Railway Rolling Stock.—A large railway rolling stock contract has been placed for no fewer than 1,000 freight wagons for the Central Argentine Railway Co., a British Corporation operating 2,530 miles 5 ft. 6 in. gauge track in Argentina, which has been divided between the **Metropolitan Amalgamated Railway Carriage and Wagon Co. Ltd.,** of Saltley, Birmingham, and **Messrs. Hurst, Nelson, and Co. Ltd.,** of Motherwell, Glasgow.

LAUNCHES AND TRIAL TRIPS.

Walbrook.—Messrs. Ferguson Brothers, Port Glasgow, launched on October 3rd, with steam up, the tug boat Walbrook, built by them for the Port of London Authority. This is the last of three tugs ordered from Messrs. Ferguson by the same owners. The vessels are all fitted with twin-screw engines of about 1,100 H.P. and Babcock and Wilcox water-tube boilers, and a complete set of modern auxiliaries.

Harpalion.—On the 4th October Messrs. William Gray and Co. Ltd. launched the above-named vessel, which they have built to the order of Messrs. J. and C. Harrison Ltd., London. She will take the highest class in Lloyd's, and is of the following dimensions, viz.: Length overall, 441 ft.; breadth, 53 ft. 6 in.; and depth 31 ft. 8 in.; with two decks laid, extra long bridge, poop, and top-gallant forecastle. The machinery will be supplied by the Central Marine Engine Works of the builders; the engines are of the triple-expansion type, and have cylinders 28 in., 45 in., and 75 in., by 51 in. stroke; the main condenser is designed to maintain a high vacuum. Steam is generated in four large boilers of the builders' "flanged shell" type at a pressure of 180 lbs. per square inch, the heating surface being over 8,900 square feet, and is worked under Howden's system of forced draught. The speed of the vessel will be about 11 knots.

NAVAL NOTE.

Blanche.—The unarmoured cruiser Blanche, which left Pembroke Dockyard on the 11th October, and proceeded to undergo the 24 hours' acceptance trial of the turbine propelling and other machinery, has returned there, having satisfactorily completed the trial. According to present arrangement the vessel will be commissioned on the 31st October.

NOTICES OF MEETINGS, &c.

October 21st.—Institution of Mechanical Engineers. Monthly General Meeting, to be held at 8 o'clock in the Institute House, Storey's Gate, St. James's Park. A paper will be read and discussed on "The Standardisation of Locomotives in India, 1910," by Mr. Cyril Hitchcock.

The Institution of Electrical Engineers (Glasgow Local Section). Meeting of Students' Section at the Glasgow Technical College at 8 p.m. Inaugural address by H. A. Mavor, Esq., M.I.C.E.

October 22nd.—The Manchester Association of Engineers. Paper by Mr. D. Wilson, on "Water Tube Boilers."

October 24th.—Institute of Marine Engineers. Meeting at 28, Romford Road, Stratford, London, E. Discussion on Mr. Northcott's paper.

The Junior Institution of Engineers. Meeting at the Royal United Service Institution at 8 p.m. A paper will be read on "The Manufacture of Bottles," by Mr. Bernard Kupferberg, of Budenheim-on-Rhine.

October 25th.—The Society of Engineers. Meeting at Caxton House, Westminster, at 7-30 p.m. Lecture on "The Law Relating to Engineering," by Mr. L. W. J. Costello, M.A., L.B., (Cantab.).

October 28th.—Coventry Engineering Society. Annual General Meeting.

The Institution of Electrical Engineers (Manchester Local Section). Meeting at the Physical Laboratory of the University of Manchester at 7-30 p.m. Address by J. S. Peck, M.I.E.E.

October 29th.—The Glasgow and West of Scotland Technical College Scientific Society. Meeting at the Technical College, when a paper will be read on "Paper Making," by Wm. Linwood.

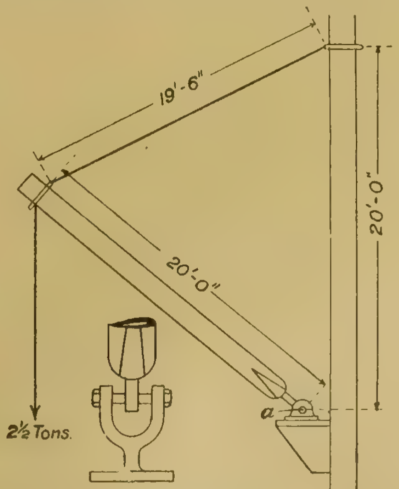
Association of Engineers-in-Charge. Social. Ladies' Night.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2278. **Diameter of Jib.**—Will any reader answer the following? The illustration represents a derrick on the mast of a ship, and it is required to know the diameter of the jib if made of steel plate, and also the diameter of the steel pin *a*.—S.



Answer.—Before it is possible to design the jib section it is necessary to determine the magnitude and nature of the load carried by this member. The framework of the derrick is drawn to scale in fig. 1 (A, B, C, D), a likely value for *d* being assumed in the absence of definite information. C B and D A are produced to meet in E. Then, neglecting the weight of the jib and stay, we have a triangular framework D C E loaded with $2\frac{1}{2}$ tons at C. Draw C F vertically downwards to represent $2\frac{1}{2}$ tons; draw F G parallel to C D, meeting C E in G; then C F G is the vector triangle for the three forces acting at C. The load in C B is clearly compressive (*i.e.*, the jib must be designed as a strut), and by making a scale measurement it will be found that the magnitude of the load is 2·575 tons. It must be noted that the weight of the jib is neglected in the above determination. Having roughed out the dimensions of the jib as below, its approximate weight can be determined, and by assuming half to be concentrated at C and half at B a revised value of the load C G may be found, the tentative dimensions of the jib then being increased if necessary. In the present instance no such correction is likely to be necessary, but in heavier frames it is essential.

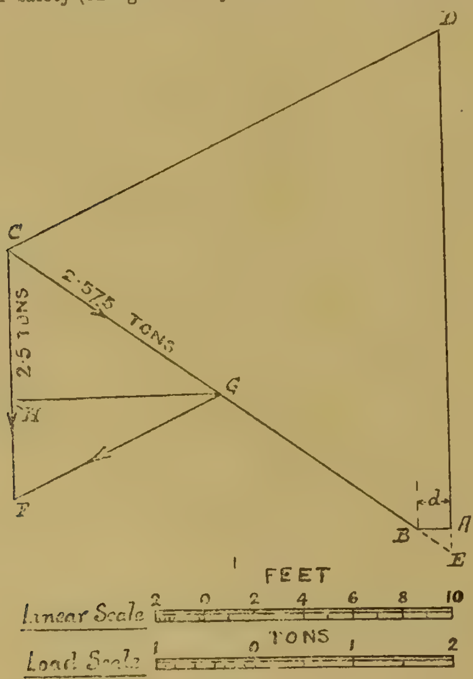
Design of C B as a Strut:—The well-known formula—

$$W = \frac{f_c\,A}{1 \times c\,\frac{l^2}{k^2}} \quad \text{where} \left\{ \begin{array}{l} W = \text{buckling load,} \\ f_c = \text{ultimate compressed stress,} \\ A = \text{sectional area,} \\ c = \text{constant,} \\ l = \text{length strut,} \\ k = \text{radius of gyration of section,} \end{array} \right.$$

is here used. It is at once obvious that this is an awkward formula from which to determine d (the diameter of the jib), the expression reducing to the form—

$$a\,.\,d^4 + b\,d^2 + c = 0.$$

It is, therefore, usual in practice to assume a likely strut section. Determine the buckling load from the above equation, and note whether this provides a suitable factor of safety over the proposed working load. Acting on this principle we may assume the jib to be built of welded or drawn mild steel tube, taking account of the fact that it will actually have a riveted joint by allowing a high factor of safety (though in many instances it will be found that the riveted joint actually strengthens the jib, considered as a strut). It would not be wise in any case to use plates much less than $\frac{1}{2}$ in. thick in the present instance, since the jib will no doubt receive many hard blows, and any dents so caused will seriously weaken it as a strut. Assuming, therefore, 6 in. outside diameter, and 1 in. and $\frac{1}{2}$ in. plates in turn, let us estimate the probable respective buckling loads, and thus the factors of safety in the two cases.



The value of f_c for mild steel may be taken as 48,000 lbs. per square inch, and treating C B as a strut with rounded ends (it is probably stiffer than it would be on this assumption), $c = \frac{4}{30000}$ for mild steel. Hence in

Case I.—
$$W = \frac{(\pi \times 6 \times 1) \times 48000}{1 + \left(\frac{4}{30000} \quad \frac{(240)^2 \times 16}{52}\right)}$$

$$\left(\text{for } k^2 = \frac{I}{A} = \frac{1}{16}\;\frac{d_1^4 - d_2^4}{d_1^2 - d_2^2} = \frac{1}{16}\;\frac{1296 - 256}{36 - 16} = \frac{52}{16}\right)$$

$$\therefore \quad W = 269000 \text{ lbs.};$$

i.e., the safe load along C B, assuming a factor of safety of 10, = 26900 lbs. = 12 tons, approximately.

Case II.—
$$W = \frac{(\pi \times 6 \times \frac{1}{2}) \times 48000}{1 + \left(\frac{4}{30000} \times \frac{(240)^2\ 16}{61}\right)}$$
$$= 15000 \text{ lbs.};$$

$\therefore$ safe load ($f\,s = 10$) = 15000 lbs. = 6·7 tons, approximately.

The jib in Case I. is needlessly strong, and the construction of Case II. provides fully ample strength ($\frac{1}{2}$ in. plate; tube 6 in. diameter externally). If desired, a smaller diameter may be assumed, still using $\frac{1}{2}$ in. plate, and a somewhat lighter jib thus obtained.

Design of Pin *a*.—This pin should be designed (*a*) assuming it it to be in simple double shear (*i.e.*, no bending stresses), and (*b*) assuming it to be a beam centrally loaded with the thrust of the jib C B (allowing for the weight of the latter).

Judging from "S.'s" sketch, the pin has a "span" of about 4 in., and, by treating it as a beam with free ends, and allowing a low working stress, a safe design will be secured.

Case (*a*).—Pure shear—

$$2 \times \frac{\pi\,d^2}{4} \times f_s = 2{\cdot}575\,;$$

and f_s ultimate = 18 tons per square inch; $\therefore$ factor safety = 6, f_s working = 3 tons per square inch,

$$\text{and } d^2 = \frac{2{\cdot}575}{3} \times \frac{4}{2\,\pi} = 0{\cdot}55,$$

when pin diameter = $\frac{3}{4}$ in. = d_1, say.

Case (*b*).—Pure bending—

$$\text{Bending moment} = \frac{2{\cdot}575}{2} \times 2 \text{ inch-tons,}$$

$$S_b = 4{\cdot}5 \text{ tons per square inch,}$$

$$Z = \frac{\pi\,d^3}{32}$$

$$\therefore\ 2{\cdot}575 = 4{\cdot}5 \times \frac{\pi\,d^3}{32},$$

whence $d_{11} = 1{\cdot}8$ in., which being larger than d_1 is here accepted. Hence, under the above conditions, a 2 in. pin should be of ample strength.—Wren.

2286. **Conical Steel Tubes.**—Could any reader inform me where I could obtain conical-shaped steel pipes as follows: Inside from 6 in. to 14 in. diameter, $\frac{3}{8}$ in. thick, with flanges 12 in. and 18 in. diameter; length of pipe, flange to flange, 12 in.?—A Reader of your Paper.

MISCELLANEA.

The New Thames Bridge.—The proposed St. Paul's Bridge is estimated to cost £2,000,000, and will be commenced next August.

We have received from Messrs. Lloyd's Register of British and Foreign Shipping a copy of the "Report of the Society's Operations" during the year 1909-1910.

The Technology of Paper.—A course of six lectures will be delivered on Wednesday evenings, commencing November 9th next, at the London Chamber of Commerce. They will be confined to the principals and heads of departments only, the fee being fixed at £3 3s. the set.

Wood and Metal-turning Exhibition.—To-day (Friday) is the last day of the exhibits on view at the Mansion House, London, between 11 a.m. and 2 p.m., for the thirty-third prize competition. The exhibition is being held by the Worshipful Co. of Turners.

Sugar Beet Cultivation.—Sir Fortescue Flannery, M.P. for the Maldon division of Essex, speaking at Wetherfield (Essex) on the 13th October, said that with the object of encouraging the cultivation of sugar beet he would remit the rent of any land up to five acres on each farm which his tenants might wish to plant with beet as an experiment.

It has been decided to hold the first World's Aerial Exhibition at the Crystal Palace from December 1st, 1910, to January 31st, 1911. This will also be the headquarters of the National Aero Corps. His Grace the Duke of Argyll, P.C., K.T., G.C.M.G., has consented to accept the presidency of the Council of the exhibition.

Institution of Automobile Engineers.—The inaugural meeting of the fifth session of this institution was held at the Institution of Mechanical Engineers, Storey's Gate, S.W., on the 12th inst., when Mr. F. W. Lanchester, the newly-elected president gave his presidential address. The meeting was preceded by a council meeting at which 12 new members were elected, besides associate members, associates, graduates, and one transfer.

PATENTEES' CHRONICLE

OF

Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

OCTOBER 10th, 1910.

23370 Sewer cleaner. Doleman.
23371 Turbine. Wuitton.
23372 Fog signalling. Ludlow.
23373 Fire lighters. Bobker.
23374 Labelling of bread, etc. Moore.
23375 Boiler furnaces. Franklin.
23376 Treatment of carbonaceous materials. Moore.
23377 Electric switch. Foster.
23378 Hat hangers. Edman.
23379 Press studs. Hall.
23380 Sounding device. Allen.
23381 Speed gear. Jeffares.
23382 Earthenware jar manf. Brownlow.
23383 Pneumatic tyres. Foy.
23384 Safety pin. Sharp.
23385 Treating deafness. Hackett.
23386 Meat carcase storage. Straiton.
23387 *Turbine. Howden.
23388 *Step ladder. Crispin.
23389 Dough moulder, etc. Bench.
23390 Window blind. Jameson.
23391 Steam condensing apparatus. Morison.
23392 Brake. Roberts.
23393 Printing machine. Meldrum.
23394 Aeroplane. Read.
23395 Slide gauge. Jones.
23396 Pistons. Hoorn.
23397 Ball cock. Abrahams.
23398 *Tyres. Bell.
23399 Mudguard. Reader.
23400 Furnace door fastening. Kittridge.
23401 *Lids for cooking pots. Adamson.
23402 *Drilling machine. Noll.
23403 *Drilling machine. Noll.
23404 Supporting wires for metal filaments. Mond.
23405 Gramophone. Ennis.
23406 Gas taps. Bourne.
23407 Motors. Culverwell.
23408 Hypodermic syringes. Hughes.
23409 Pistons. Martin.
23410 *Shaving brush. Britton.
23411 Means for tapping casks. Healy.
23412 Tobacco pipes. Monks.
23413 *Rail joints. Johnson.
23414 Duplicating machine. Gyles.
23415 *Spraying syringe. Sänger.
23416 *Signalling device. Seitz.
23417 *Boot sewing device. Heinz.
23418 *Hydrogen production. Gerhartz.
23419 *Cycle support. Berthold.
23420 Pocket inkstands. Springer.
23421 Rail joints. Giesler.
23422 *Lamps. Robbens.
23423 Ploughs. Wardle.
23424 *Neck bands for skirts, etc. Leuer.
23425 *Motor sledges. Belliveau.
23426 Hopper wagons. Lyon.
23427 Interest calculator. Hans.
23428 Stamp affixing device. Kirkby.
23429 *Furnaces. Edwards.
23430 *Furnaces. Lockyer.
23431 Patten carrier. Broussard.
23432 *Tool feed mechanism for boring. Bonjean.
23433 *Car couplings. Durbin.
23434 Hair slides, etc. Morfey.
23435 Reinforced concrete. Engholm.
23436 *Vacuum brake. Harding.
23437 Cyclist's trousers clip. Tillotson.
23438 Electric switches. McNaught.
23439 *Printing rollers. Merteres.
23440 *Holder for dental silk. Guiterman.
23441 *Internal-combustion engine. Schwarz.
23442 Keys. Kenrich.
23443 *Marine engine. Tanner.
23444 *Boot soling engine. Tanner.
23445 Electric connectors. Royce.
23446 *Electric insulating composition. Rasmussen.
23447 Ships' loading, etc., apparatus. Melandri.
23448 *Gas burner lighting, etc. Gunning.
23449 Gramophones. Dibdin.
23450 *Drinking trough. Matthews.
23451 Closet pan. Smith.
23452 Indicating apparatus. Haimouich.
23453 Weighing apparatus. Haimouich.
23454 Indicating apparatus. Haimouich.
23455 *Chest expander. Schmidt.
23456 *Air purification. Lean.
23457 *Braiding machine. Treckmann.
23458 *Combining machine. Schubert.
23459 *Coke ovens. Still.
23460 Box manf. Roeckner.
23461 Power hammer. Honeywood.
23462 Power hammer. Honeywood.
23463 *Projectiles. Brückner.
23464 *Spinning mules. Lowe.
23465 *Talking machine. Boult.
23466 *Separating device. Richter.
23467 *Purification of hydro-carbons. Richter.
23468 Vacuum cleaner. Pride.
23469 Vacuum cleaner. Pride.
23470 Torsional testing machine. Lilly.
23471 *Saw filing machine. Arnesen.
23472 *Jack spools. Herbden.
23473 *Plate printing device. Valentine.
23474 *Type casting machine. Boult.
23475 Braces. Holden.
23476 Gas burners. Cannon.
23477 Fungicides, insecticides, etc. Voss.
23478 Sewing machine. Boult.
23479 Steam superheaters. Gordon.
23480 *Clothes props. Lapworth.
23481 Targets. Willett.
23482 *Clothes line pulleys. Hiatt.
23483 Frictional gearing. Ryland.
23484 *Hollow axle manf. Wales.

OCTOBER 11th, 1910.

23485 Vegetable basket. Darlington.
23486 Hat trimming. Flatan.
23487 Pneumatic tyres. Gritton.
23488 Gas generator. Southey.
23489 Book, etc., covers. Routledge.
23490 Thermo-electric batteries. Barker.
23491 Locks. Tonks.
23492 Gas working apparatus. Burstall.
23493 *Weighing machine. Koch.
23494 *Coupling. Perry.
23495 Magnifier of gas, etc., light. Farlane.
23496 Blotting pad. Oswald.
23497 Life saving garments. Berman.
23498 Line casting machine. Brown.
23499 Hatpin protector. Bates.
23500 Refrigerating apparatus. Johnson.
23501 Picture frames. Livesley.
23502 Ship's propeller. Clarke.
23503 Lathe tool holder. Taylor.
23504 Engine cooling system. Ruckstuhl.
23505 Internal-combustion engine. Smith.
23506 Feeding sheets. Shackleton.
23507 Inhalers. Longmate.
23508 Preparation of starch. Hall.
23509 Preparation of laundry blue. Hall.
23510 Locking device. Schaffer.
23511 *Automatic grease cups. Lewis.
23512 Hinges. Rowlands.
23513 Raising, etc., gear. Pett.
23514 Roundabouts. Rogers.
23515 Screens. Baxter.
23516 Lock mechanism. Gosling.
23517 Safety lock. Taylor.
23518 Fountain pen. Morgan.
23519 Indicating the contents of boxes. Richmond.
23520 Hat sweat bands. Cassels.
23521 Supporting device for glass globes, etc. Laggan.
23522 Ophthalmoscope. Banks.
23523 Relating to railways. Jenkins.
23524 Pneumatic elevators. Mitchell.
23525 Electric switch. Eckstein.
23526 *Electric switch. Eckstein.
23527 Acetylene generator. Holland.
23528 Locking carding engine doors. Bradsley.
23529 *Turbine. Desenberg.
23530 Torpedoes. Toole.
23531 Collision avoiding device. Croker.
23532 Phonographs, etc. Avenell.
23533 Ticket holder. Bowling.
23534 Glass cleaner. Thompson.
23535 *Electric lamp. Atwood.
23536 Protecting tramway trolley wires. Dudgeon.
23537 *Looms. Brauer.
23538 Submarine. Sullivan.
23539 Warming device. Rogers.
23540 *Water closets. Robbins.
23541 Folding machines. Pejano.
23542 *Washing machine. Hulkenberg.
23543 Cultivation devices. Epstein.
23544 Motor cycle wheel. Smith.
23545 Bakers' ovens. Humphreys.
23546 Billiard cue tips. Brown.
23547 *Rotary piston pumps. Pratt.
23548 *Manf. of persulphuric acid, etc.
23549 Gas producer. Hutchins.
23550 Coal carbonising ovens. Aarts.
23551 *Potassium persulphate manf. Adolph.
23552 *Wind motor. Schies.
23553 *Postcards. Busam.
23554 Internal-combustion engine. Rozic.
23555 Weaving device. Hart.
23556 Candle sticks. Bowman.
23557 Treatment of cereals. Banks.
23558 Motor car screens. Jolliffe.
23559 *Gas producer. Frambs.
23560 *Ventilators. Turlur.
23561 Chamber for hydrant pits. Ruse.
23562 *Substitute for yarn. Schumann.
23563 *Safety razor.
23564 *Liquid purification. Hülsmeyer.
23565 *Furnaces. Edwards.
23566 *Furnaces. Edwards.
23567 *Valve. Pollet.
23568 *Musical instrument. Reichelt.
23569 *Clocks. Berger.
23570 *Corking machine. Bergner.
23571 *Valve regulator. Lake.
23572 *Boat launching. Brum.
23573 *Products from cellulosic products. Cohoe.
23574 Toothed gearing. Humphris.
23575 *Gyroscopic compasses. Melhuish.
23576 *Steam condensing device. Beckett.
23577 *Sparking plug. Macquaire.
23578 Piano player. Merkel.
23579 *Automobile. Noé.
23580 *Advertising device. Weinberg.
23581 Gun sighting. Riley.
23582 *Trip release device. Gibson.
23583 Bottle stoppers. Hurst.
23584 Firebars. Peters.
23585 *Turbines. Monsson.

OCTOBER 12th, 1910.

23586 Hose heels. Purser.
23587 Bridge scorer. Beakbane.
23588 Bags, etc. Worrall.
23589 Gas mantles. Hall.
23590 Attaching milk cans to doors. Chinn.
23591 Hatpin. Crosly.
23592 Garment suspenders. Wall.
23593 Jet carburetter. Wolstenholme.
23594 Manhole covers, etc. Holcroft.
23595 Aeroplanes. Neale.
23596 Boot, etc., lace. Saunders.
23597 Ticket printing. Otto.
23598 Air gas generator. Hennessy.
23599 Induced draught. Monahan.
23600 Sanitary laver. Bowie.
23601 Aeroplanes. Linzell.
23602 Collapsible boxes. Hutton.
23603 Self-raising, etc., blinds, etc. Bradshaw.
23604 *Single objectives. Zeiss.
23605 Polishing device. Greenwood.
23606 Folding, etc., door runners. Pruce.
23607 Steam engine. Borham.
23608 Rivet, etc. Case.
23609 Coloured theatre lights. Barnard.
23610 Cure for ringworm. Wilson.
23611 Mail receiving, etc., apparatus for railways. Dearmid.
23612 Air cushion. Strachan.
23613 Shuttle for weaving. Starkie.
23614 Flushing device for W. C. Jarvis.
23615 Carding engine. Grundy.
23616 Lathe attachment. Cooke.
23617 Picture frames, etc. Kehnan.

23618 *Table games. Hargreaves.
23619 *Parlour ball game. Hargreaves.
23620 Box bobbin. Ratcliffe.
23621 Insulating slabs. Turner.
23622 Electric switches. Welford.
23623 *Optical theatres. Messter.
23634 *Golf caddies. McLean.
23625 Textile fabric stretchers. Harrap.
23626 *Carburetters. Ivor.
23627 Spring tyres. Baier.
23628 Game. Thompson.
23629 *Protective seal. Wood.
23630 Taking animated pictures. Lane.
23631 Sliding drawers. Abbott.
23632 Internal-combustion engine economiser. Todd.
23633 *Polyphase electric commutator. Siemens.
23634 *Polyphase electric induction generators. Siemens.
23635 Searchlight pedestals. Siemens.
23636 Twin projectors. Siemens.
23637 *Clutches. Winklhofer.
23638 *Keyboard violins. Harcourt.
23639 *Electric lamps. Schilling.
23640 *Electric lamps. Schilling.
23641 *Spinning machine. Siemens.
23642 Bulkhead doors. Cornish.
23643 Sewing machine. Waller.
23644 *Aeroplane rudder. Wildeblood.
23645 Wheels. Jacobs.
23646 *Propulsion, etc., of ships. Micallef.
23647 Stamp affixing device. Wilson.
23648 Bicycle support. Adriansen.
23649 Valve mechanism. Ripley.
23650 Tyres. Barnett.
23651 Tyres. Barnett.
23652 Mudguard. Stormont.
23653 Collar supports. Short.
23654 Centrifugal plate whirlers. Sauger-Shepherd.
23655 Shackles. Berner.
23656 *Submarine mine mooring. Campagnie.
23657 *Wheels. Treier.
23658 *Ray flames. Wallis.
23659 *Firearms. Reid.
23660 *Hydrogen peroxide manf. Pietzsch.
23661 *Lubricating pumps. Bosch.
23662 *Improving inferior pressed yeast. Bradsch.
23663 Water-tight doors. Swiggs.
23664 Furnaces. Hill.
23665 Spare wheel attachment. Brace.
23666 Gas burner. Flavel.
23667 Gas burner. Flavel.
23668 Gas burner. Flavel.
23669 *Telephone system. Newhold.
23670 Hacking machine. Barbour.
23671 *Insulating material. Peterson.
23672 *Bracket support. Owens.
23673 Razor stropping device. Stuart.
23674 *Drinking cup. Hussey.
23675 *Insulating device. Küttner.
23676 *Treatment of milk. Birney.
23677 Call signal sign. Freeman.
23678 *Rolling shutters. Gibson.
23679 Motor car foot warmer. Harris.
23680 Manf. of isoprene, etc. Perkin.
23681 Manf. of isoprene, etc. Perkin.
23682 Projectiles. Dawson.
23683 Meat chopping, etc., machine. Bainbridge.
23684 Aeroplanes. Goldman.
23685 Aeroplanes. Mommott.
23686 *Looms. Marks.
23687 *Nut locks. Bartley.
23688 Metallised paper manf. Dupuis.
23689 *Airships. Lobro.
23690 *Bottle washing. Boult.
23691 *Bottle filling apparatus. Boult.
23692 *Bottle capping machine. Boult.
23693 *Saucepan, etc., lids. Philipoot.
23694 *Cardboard box manf. Gheeraerdts.
23695 *Heating apparatus for dinner, etc., plates. Mohren-Witz.
23696 Gas stoves, etc. Russell.

OCTOBER 13th, 1910.

23697 Gas lamp. Hassall.
23698 Chimney pots. Garsed.
23699 Easy chair. Bannister.
23700 Letter boxes. Pittsford.
23701 Dustless roads. Beall.
23702 Spinning, etc., frames. Bannister.
23703 Boxes. Myers.
23704 Electric water heater. Feibusch.
23705 Pipe joints. Yarrow.
23706 Tea drying device. Douglas.
23707 Ironing machine. Longsdon.
23708 Gramophones. Baker.
23709 Isolation of fibre from flax, etc., materials. Silberrad.
23710 Bottle stoppers. Leach.
23711 Wind screen frame joints. Holeday.
23712 Whisking machine. Morton.
23713 Boot eyelets, etc. Downs.
23714 Valve gear. Davidson.
23715 Window frame. Glover.
23716 Feed gauge for power presses. Green.
23717 Bakers' ovens. Horseman.
23718 Show stand. Baldwin.
23719 Gas mantle. Detmold.
23720 Beer saver. Wyld.
23721 Tyres. Barron.
23722 *Gas burner. Deutsshe.
23723 Cycle rim polisher. Cleaver.
23724 SECRET APPLICATION.
23725 Flywheel brake. Jones.
23726 *Glazing roofs, etc. Knobel.
23727 Ageing rubber sheets. Beaver.
23728 Calculating machine. Evans-Cross.
23729 Aeroplane. Hammer.
23730 *Transportable engine. Ritter.
23731 *Nut locks. Bradshaw.
23732 Safe blasting of bore holes. Kowastch.
23733 Converting reciprocating into rotary motion. Dixon.
23734 Centrifugal pump. Weir.
23735 *Electric welding. Koopman.
23736 Pins. Wicking.
23737 Date perforating device. Kelly.
23738 Cycle brake. Bohle.
23739 *Underground ventilation. MacLachlan.
23740 Envelopes. Cowtan.
23741 Artificial teeth. Day.
23742 *Telephone apparatus. Graham.
23743 Hat guard. White.
23744 Scaling and annealing metals. Cowper-Coles.
23745 Table salt. Crowther.
23746 *Pontoon bridges. Forssell.
23747 *Potato digger. Wesberg.
23748 *Telephone receivers. Baehr.
23749 Evaporating, etc., devices. Jager.
23750 *Photo dark room. Thompson.
23751 Carburetters. Bickford.
23752 *Paint manf. Vernis.
23753 *Corking machine. Bergner.
23754 Flushing cistern. Newland.
23755 *Metallic wheels. Thompson.
23756 *Engine starter. Wilson.
23757 *Electric motor starter. Höfle.
23758 *Pumps. Bartelli.
23759 *Navigable balloon. Bullmann.
23760 Internal-combustion engine valve. Taite.
23761 *Power press safety device. Sugden.
23762 *Ventilating device. Rawston.
23763 Turbines. Price.
23764 Coat hanger, etc. Flexmore.
23765 *Fuses for projectiles. Cothias.
23766 Hatpin protector. Lee.
23767 Music binder. Blake.
23768 Boot manf. Boult.
23769 *Bottle cleaner. Petersen.
23770 *Yarn winding machine. Boult.
23771 Internal-combustion engine. Robb.
23772 *Flying machine. Wunderlich.
23773 *Clock winding apparatus. Boult.
23774 Ordnance. Formby.
23775 Ordnance. Formby.
23776 Aerial machine. Formby.
23777 Flying machine. Desford.

OCTOBER 14th, 1910.

23778 Toilet outfit. Stevens.
23779 Gas burner. Challis.
23780 Alarm clock. Walker.
23781 Cycle hubs. Grist.
23782 Looms. Marsden.
23783 Yarn winding. Kershaw.
23784 Fountain pen. Johnston.
23785 Garden edging. Glazier.
23786 Door frame. Marshall.
23787 Engine packing. Beldam.
23788 Internal-combustion engine. Scott.
23789 Looms. Robinson.
23790 Loomers slay-hooks. Smith.
23791 Tobacco cartridges. Snowden.
23792 Twin reproducer. Huntsworth.
23793 Haulage plant. Barclay.
23794 Carburetter. Pearson.
23795 Slated roofs. Chilcott.
23796 Window lowering, etc., device. Bailey.
23797 Fuel economiser. Thomas.
23798 Bullets. Fenly.
23799 Guards for trams, etc. Thompson.
23800 Vacuum cleaner. Paskell.
23801 Vacuum cleaner. Seddon.
23802 Collapsible boxes. Jamieson.
23803 Guards for tramways, etc. Thompson.
23804 Spring wheel construction. Wilson.
23805 Tyre fixing. Coates.
23806 Propulsion of ships. McKay.
23807 Sparking plugs. Fletcher.
23808 Composing machine. Bowman.
23809 *Corn elevators. Liddle.
23810 *Crushing mills. Dejardin.
23811 *Stocking suspenders. Clark.
23812 *Laundry iron handle. Demoulin.
23813 Smoke preventative. Garland.
23814 *Tyre. Wilford.
23815 Pneumatic tyres. Southall.
23816 Haulage clips. Worthington.
23817 Manf. of slag wool. Herdman.
23818 *Wrenches. Cook.
23819 Tobacco pipe. Boonzaier.
23820 *Boot manf. Brock.
23821 Gloves. Tyler.
23822 Gas generator. Giorgi.
23823 *Carburetters. Jules.
23824 *Drilling machine. Tilemann.
23825 *Economical pillow. Audsin.
23826 Door fastening. Kupper.
23827 Pneumatic tyre. Urwin.
23828 Box. Read.
23829 *Flushing cistern. Leuick.
23830 Internal-combustion motor. Lamplough.
23831 *Electro-magnets. Société "Phi."
23832 Levers. Browne.
23833 Bearings. Pedersen.
23834 Sawing machine. Wicksteed.
23835 *Tube casting. Molinder.
23836 Catamenial apparatus. Robinson.
23837 Uterine irrigators. Lyth.
23838 Load measuring. Murray.
23839 Magneto ignition device. Brown.
23840 *Composing machine. Lanston.
23841 Heavy guns. Dawson.
23842 *Book binders. Pitavy.
23843 Loading heavy guns. Dawson.
23844 *Friction clutch. Diesel.
23845 Coin-freed delivery machine. Butterworth.
23846 Envelopes. Williams.
23847 *Paper sheet feeding mechanism. Spiers.
23848 Guns. Dawson.
23849 Animated pictures. Fulton.
23850 Loading heavy guns. Dawson.
23851 Meat suspenders for cooking. MacEwan.
23852 Ink erasers. Renton.
23853 *Liquid measure. Weckmann.
23854 Non-refillable bottle. Wing.
23855 *Relating to oxy-acetylene blowpipes.
23856 *Filling receptacles with porous material.
23857 Treatment of bran. Stevenson.
23858 Suit for aviators. Wood.
23859 Foot valve for gas bottles, etc. Phillips.
23860 *Window frames. Müller.
23861 *Printing device. Mertens.
23862 Electric lamp holder. Prescott.
23863 *Folding box. Maier.
23864 *Saw manf. Sonnleithner.
23865 Tapping rubber trees. Fyffe.
23866 Internal-combustion engine. Simms.
23867 Valve mechanism. Ripley.
23868 Baby carriages. Halloway.
23869 Outlet valve. Fletcher.
23870 Ore concentration. Nutter.
23871 Nitro-glycerine purifying. Wharton.
23872 Displaying information. Hudson.
23873 *Rubber wheel tyres. Heyl.
23874 Dock gates. Whitworth.
23875 *Internal-combustion engine. Boadwood.
23876 *Clamping apparatus. Brotherhood.

OCTOBER 15th, 1910.

23877 Cinematograph film manf. Gowlland.
23878 Dyeing machine. Sorton.
23879 Door locking device. Ruggero.
23880 Smoothing mosaic pavements. Ruggero.
23881 Firebars. Smaling.
23882 Carriage door handles. Taylor.
23883 Preparation of coffee, etc. Roessler.
23884 *Fog signals. Dutton.
23885 Aeroplanes. Lyon.
23886 Knitting circular goods. Hutchinson.
23887 Automobile lights. Binks.
23888 Carburetters. Binks.
23889 Self-locking screw cap. Sankey.
23890 Electric motor control. Hindle.
23891 High and low tension wires. Meigh.
23892 Locking motion. Mills.
23893 Colour matter. Frank.
23894 Measuring, etc., apparatus. Eckstein.
23895 Turbine. Verity.
23896 Raising sunken vessels. Godfry.
23897 Wire covering machine. Counter.
23898 Portable photo studio. Saunderson.
23899 Fowling pieces. Verdud.
23900 Knives. Beardsell.
23901 *Sight feed lubricator. Heys.
23902 Electric heating irons. Hirst.
23903 Looms. Picking.
23904 Manhole covers. Adams.
23905 *Twist drills. O'Reilly.
23906 *Multicolour reproducing apparatus. Newman.
23907 Speed gear. Dawson.
23908 Tyres. Crouchley.
23909 Electric switch gear. Griffiths.
23910 Thermometers. Zeal.
23911 Winding device. Salisbury.
23912 Window cleaning. Wimble.
23913 *Wheel.
23914 Door spring. Brierley.
23915 *Tea making apparatus. Longstaff.
23916 Thermostats. Yates.
23917 Electric bells. Pearson.
23918 *Rock-cutting mechanism. Corsi.
23919 *Rock-cutting mechanism. Corsi.
23920 Signal lamp. Hoare.
23921 Smoke abating device. Spieer.
23922 *Hair treatment. Burton.

23923 *Sulphuryl chloride manf.
23924 *Acetic anhydride manf.
23925 Cash delivering device. Browne.
23926 *Gas burner. Deutsche.
23927 *Firearms. Tomischka.
23928 Tea leaf rolling. Davidson.
23929 Gas lamp. Anderson.
23930 Gas controller. Anderson.
23931 Roller skate manf. Brown.
23932 Boots, etc. Popp.
23933 Rail contacts. Tarrant.
23934 Brace bits. Ramsay.
23935 *Latch for doors. Hill.
23936 Nut crackers. Drews.
23937 Loading guns. Dawson.
23938 *Water feed injector.
23939 Preventing railway accidents. Vitali.
23940 *Railway signalling. McDonald.
23941 Centrifugal pump. Rankin.
23942 Evaporators. Carmichael.
23943 Curtain rods, etc. Depledge.
23944 Decolouring flax, etc. Thompson.
23945 *Nut locks. Bart.
23946 *Explosives. Bonchayer.
23947 *Alarm apparatus. Penner.
23948 *Gas washer. Stolte.
23949 Concentration device. Nutter.
23950 *Anti-vibration device for motors. Sterne.
23951 *Brushes. Sonneroy.
23952 Vapour lamps. Bishop.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

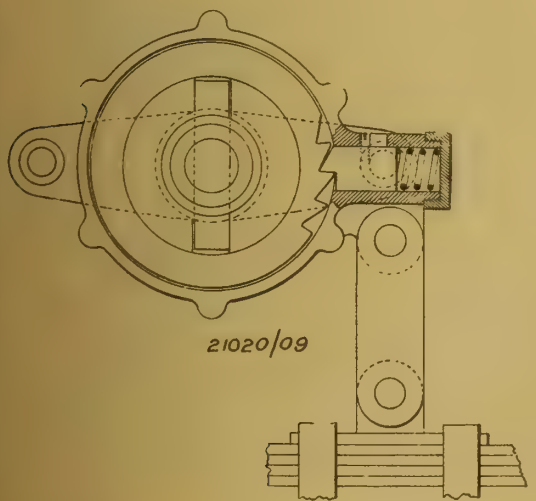
Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to November 21st, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

13266 Claridge: Firebars for boilers and furnaces. [Postdated December 7th, 1909.] 13478 Lanston Monotype Corporation Ltd. (Bancroft and Indahl): Milling or grooving machines. 13933 Sulliger: Mowing machines. 16078 Wainwright: Sliding bolts for doors, windows, and the like. 16304 Cowper-Coles: Lamp reflectors and other glass articles. 18445 Boult (United Shoe Machinery Co.): Machines for preparing welted boots and shoes for the sole-laying operation. 18468 Meiro: Extraction of grease and glue from bones. 18636 Taylor: Methods of charging and discharging electric accumulators or secondary batteries. [Cognate Applications. 18783, 1909; 19600, 1909; and 21239, 1909.] 18783. *See* 18636, 1909. 19600. *See* 18636, 1909. 20550 Hebb and Mackinlay: Adjustable spreader for apparatus for cooling water or other liquid. 20608 Harris: Wood-working machines. 20668 Storey and Kitchen: Internal-combustion turbine motors. 20676 T. G. Green and Co., and King: Manf. of stoneware foot warmers. 20686 McLean: Steam tube bakers' ovens. 20710 Tonkin: Valve mechanism of internal-combustion engines. 20715 Petitpierre: Apparatus for raising liquids. 20718 Johnston: Atmospheric vapour burners. 20721 El Buen Tono: Apparatus for removing tobacco dust from cigarette-making machines. [Date applied for under International Convention, February 6th, 1909.] 20747 Percival: Golf clubs. 20758 Uhlhorn: Shaft drier for corn with automatically-regulated discharge of the dried material. 20764 Wakefield: Hand signalling lamps. 20766 Vasey: Soluble protein or albumen and process for the production of the same from meat fibre or other insoluble protein matter. 20777 Cunningham: Portable wardrobe. 20778 Napier, Son, and Co., and McAlpine: Boilers and boiler flues of kitchen ranges and the like. 20805 Meurant: Process of making oil colours having a magnesium base. 20853 Rustige: Incandescent vapour lamps for illuminating purposes. 20869 Walters: Devices for automatically regulating the voltage of and between electrical machines running in parallel. 20897 Wahlen and Schreiner: Flying machines. 20951 Olney: Spraying attachment to garden hoses. 20962 Placek: Flying machine. 20965 Thompson: Picture films. 20975 Fritz: Method of purifying fuel and increasing its heating power. 21007 Pichon and Truchelut: Method and means for utilising chlorides of carbon for rendering benzines, alcohol, ether, and the like non-inflammable, and for the preparation of rubber solution and other useful products therewith. 21008 Cibie: Arc lamps.


21020/09

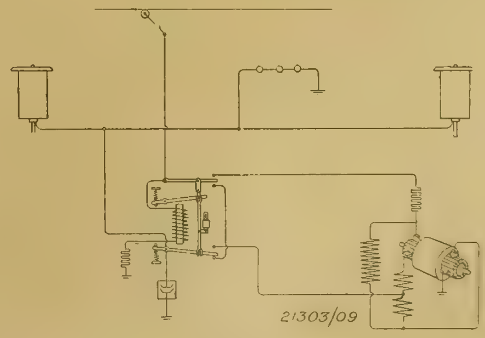
21020 Sgal, and Pioneer Engineering Syndicate: Shock absorbers for the suspension of vehicles.

> This invention relates to shock absorbers for the suspension of vehicles, and consists essentially in a frictional shock-absorbing device for vehicles comprising a divided ring adapted to be expanded by a conical bolt against a ring which is connected with the spring through a one-way clutch so as to be rotated during movement of the spring in one direction only.

21103 Gustafson: Pile-elevating mechanisms for sheet-feeding apparatus. [Date applied for under International Convention, September 18th, 1908.] 21105 Brien: Tool carrier with rotary part actuated by a turbine connected with it. [Date applied for under International Convention, September 15th, 1908.] 21124 Boult (United Shoe Machinery Co.): Pulling-over and like machines. 21127 White: Systems of and apparatus for washing and refilling locomotive boilers. 21131 Drachmann: Copying machines. [Date applied for under International Convention, September 15th, 1908.] 21153 Fabri: Method for the deodorization and treatment of mineral and like oils. 21168 Woods: Fire-extinguishing powder. 21219 Anderson, Russell, and Gray: Systems for the distribution of electric energy. 21239. *See* 18636, 1909. 21244 Hollingworth (Crompton and Knowles Loom Works): Shuttle-changing mechanism and indicating mechanism to be used in conjunction therewith. 21287 Merkham Trading Co., and Freeman: Pens.

21303 British Thomson-Houston Co. (General Electric Co.): Selective switch systems applicable to electric traction systems and for other purposes.

> This invention relates to selective systems or switches, and is particularly intended for use in connection with electrically-driven cars designed for operation on railroads on which current is furnished on different sections of the line at different potentials, for example, 1,200 and 600 volts. The invention is designed to provide a safe, simple, and efficient arrangement whereby the auxiliary circuits of the car will be automatically connected either directly

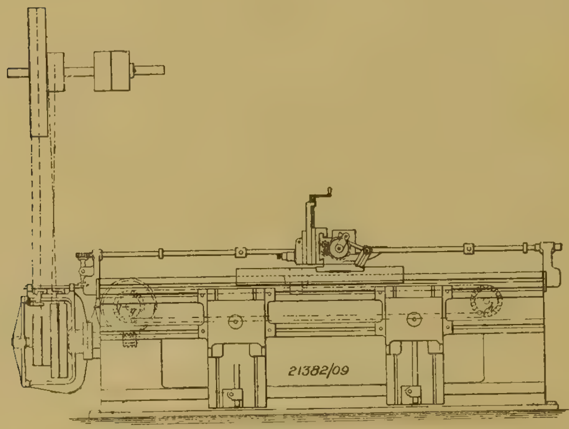

21303/09

to the trolley or to the dynamotor according as the car is upon a low or a high potential section of line, and whereby, at the same time if desired, the automatic starting and stopping of the dynamotor according as the car is upon a high or low potential section will be provided for. The invention is not limited to use in this particular connection, but may be utilised for any other purpose where it is desired to vary certain electrical connections in response to change of conditions in some circuit. The main feature of the invention consists in a dynamotor carried by the car for reducing the potential when necessary and an electro-magnetic selective switch having a single actuating coil connected to the source for automatically connecting the car circuits either to the dynamotor when the car is on a high potential section or disconnecting the dynamotor and connecting directly to the source when the car is on a low potential circuit.

21308 Crell: Multiple spindle turret lathes. 21329 Brooks and Sharples: Method of holding the tee square when being used on a blackboard or drawing board. 21341 Turner: Couplings for railway vehicles and other purposes. [Post-dated April 18th, 1910.] 21349 Benkert: Portable ovens for baking and fruit drying. 21369 Cambridge Scientific Instrument Co., and Whipple: Radiation pyrometers.

21382 Mathewson: Planing machines.

The present invention has reference to side planing and similar machines wherein are employed means for reciprocating the tool or the saddle which carries the tool, which means can be so operated as to impart an advance movement at a comparatively slow rate and a retiring movement at a much faster rate. According to the present invention the usual driving and reversing mechanism of fast and loose pulleys and open and crossed belts is connected to worm gearing set to work one of a pair of sprocket wheels which carry an endless chain arranged in a suitable position adjacent to the sliding saddle of the planing machine. The chain is connected between the sprockets to the saddle so that as the chain moves to and fro the saddle does likewise.

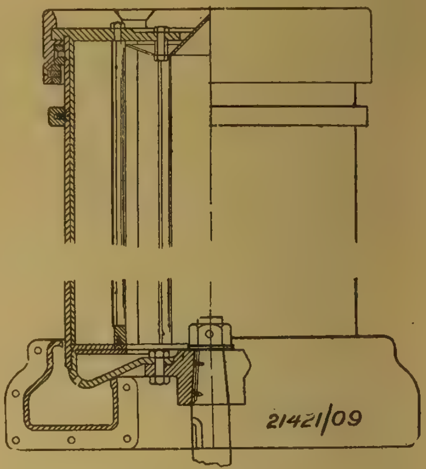


21398 Claridge: Coal-saving appliances for domestic fireplaces. [Post-dated March 19th, 1910.]

21421 Gee, and Hydraulic Separating and Grading Co.: Centrifugal apparatus.

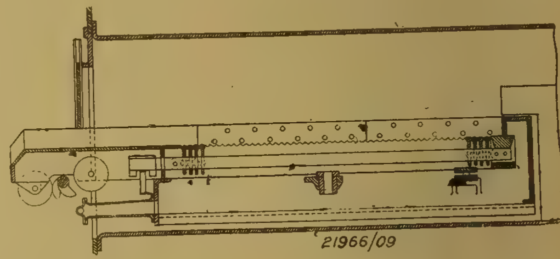
This invention relates to improvements in centrifugal apparatus. In accordance ith the present invention, attached to the top or cap of the cylinder is a frame which carries trays or equivalent devices, and the frame extends down to a false bottom of the cylinder. The shaft or spindle that carries the cylinder is not continued through the latter, but only rises high enough therein to afford stability and to accommodate the outlet passages if desired. In order to give stability to the cylinder it is provided with a collar or the like at or near its upper end adapted to run in suitable bearings. On the collar or on the cylinder are provided means for attachment of the top. The frame suspended from or forming part of the top consists of a series of plates extending radially inwards and at the bottom connected by struts, cross pieces, or a solid plate upon which the trays, if any, may rest.

21422 Lock, Pearce, and Billington: Typographical composing machines. [Application for Patent of Addition to 23000, 1907.] 21423 Russell: Liquid fuel tanks. 21435 Meikle: Radiator for heating rooms and buildings and other structures. 21459 Butler: Sewing machines. 21479 Westerheide and Garpheide: Portable folding stretchers. 21482 Marchant and Marchant: Elastic tyres. 21494 Cornford: Piano player attachment for pianofortes. 21512 Hollingworth (Crompton and Knowles Loom Works): Shuttle-changing mechanism of looms for weaving. 21706 Bouracier: Card games particularly suitable for advertising. 21760 Minlos: Apparatus for delivering measured quantities of liquids. 21847 Hudson and Sleigh: Production of printing surfaces upon printing cylinders. [Cognate Application. 23034, 1909.] 21849 Walker: Method of and apparatus for removing earth and debris from pits, shafts, and like excavations. 21936 Michel and Paulet: Kneading machine.



21966 Wills: Furnace grates.

The object of this invention is to improve the combustion in furnaces specially constructed for the consumption of small or dirty coal. The improvement consists essentially of an enclosed pan provided with blast openings, the upper surface of which is constructed of sloping fixed side grates inclining downwards towards moving compound firebars sliding between them, the compound firebars being so constructed that the surface of the bar portion is capable of being automatically rocked, the compound firebars being moved separately in towards the back of the furnace and outwardly together, the whole forming a complete self-contained structure.

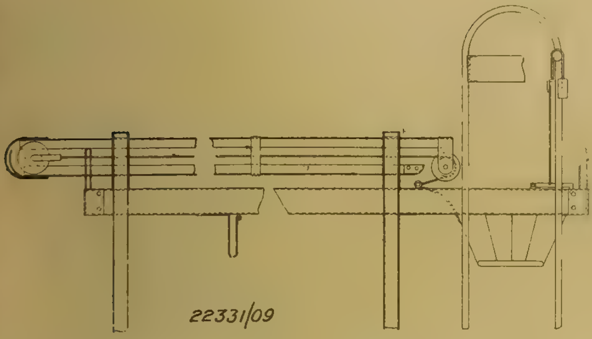


21990 Shepherd: Attachment for bedsteads and the like. 22068 Barron: Wheels for motor cars and other road vehicles. 22139 Chambers: Beer engines. 22194 Thompson and Fyfe: Sealed tins or cans. 22240 Gass and Horton: Machines for use in the manf. of firelighters. 22287 Highfield: Manf. of supply conductors.

22331 Adair: Mechanical conveying and arrangements connected therewith. [Application for Patent of Addition to 17238, 1908.]

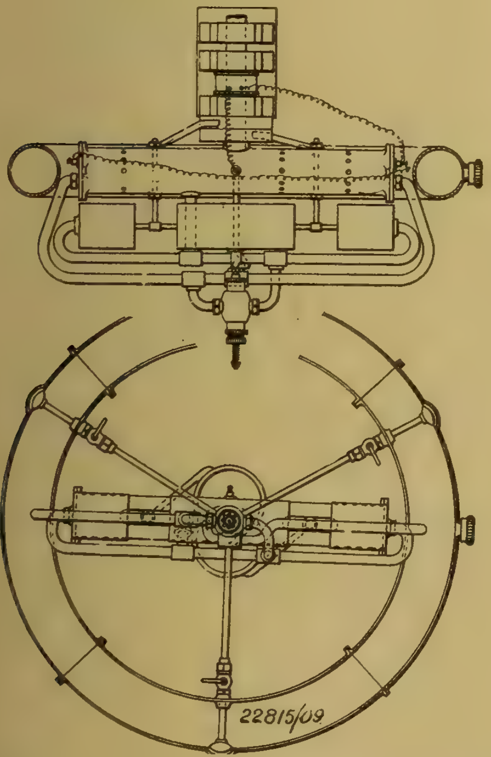
This invention relates to mechanical conveying. To cause the emptied conveyer to travel to the place for re-loading, a weight or weights travelling along a rail or rails is employed, and lines of rail which run underneath and at right angles, or other angles, to the line of rail are provided for the travelling of the conveyer. The conveyer on the upper line discharges into a conveyer on the under line.

22401 Barringer: Clarifying oils. 22418 Reeves: Fuel-enriching compound. 22520 Wilson: Ball valve. 22559 Tacchi and Kirschbaum: Speed control levers of motor cycles and the like.


22331/09

22815 Jenkins: Internal-combustion engine.

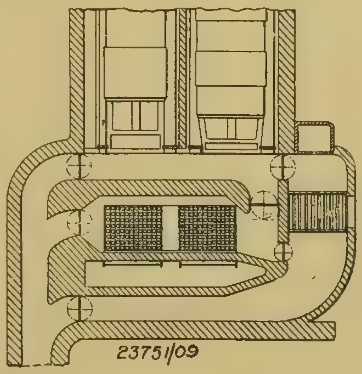
This invention relates to an internal-combustion engine of the type in which the cylinders and pistons are radially arranged upon and rotate around a common centre, the engine being particularly designed for use on aeroplanes and motor cars. The improved type of engine has *inter alia* the distinguishing features that a single cylinder in one or more parts containing two double-ended pistons is employed, the pistons moving to and from the centre simultaneously and propelled by a single explosion between their adjoining ends and simultaneously by separate explosions behind their outer ends. The fuel tank is preferably of annular tube-like form and arranged around and adapted to rotate with the cylinder, the fuel being led by tubes from inside the outer edge of the tank to the carburetter. The cylinder has slot-like openings alongside the pistons, and rigid rods are attached to the pistons through these openings and connect same to eccentrics mounted free on a shaft, the centre of which is coincident with the centre upon which the whole engine revolves, the shaft being rigid with the cylinder and conveying the rotary movement to wheels, or other mechanism to be driven, or directly connected to a propeller or other device which may be fixed to the shaft. The engine may be constructed with more than one cylinder, in each of which a pair of pistons is arranged.


22815/09

22852 Brooks and Holt: Seats for aeroplanes and other aerial machines, automobiles, motor cycles, and other uses. 22878 Ball and Readman: Electric telegraph insulators. 22927 Kistruck: Pencil holders. 23017 Lattly: Motor-driven road-sweeping machines. [Date applied for under International Convention, December 23rd, 1908. Application for Patent of Addition to 22933, 1909.] 23034. *See* 21847, 1909. 23057 Parker: Wooden putters for golf. 23098 Scott: Pneumatic tyres. 23194 Wood: Tobacco pipes. 23443 Ewart: Cowls for ventilating and other purposes. 23565 Freebury: Game apparatus. 23580 Digby, Beatty, and Huskinson: Methods of and means for measuring, indicating, and recording vibrations and expressing the same in terms of a standard. 23612 Cooper: Combined brush and scraper for roads, paths, and the like. [Post-dated March 23rd, 1910.] 23692 Moorley: Beer pipes and the like. 23706 Taylor, Taylor, and Taylor: Apparatus for waving or crimping hair or the like. 23710 Daniel: Match box holders. 23739 Capell: Reversing fans for mines and other uses.

23751 Musgrave: Hot-air drying plants.

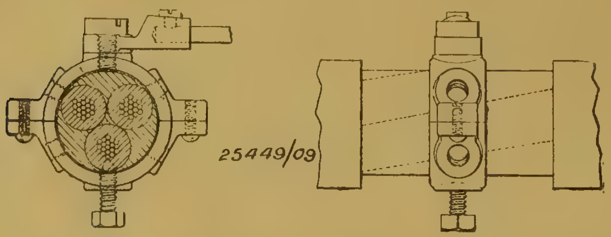
This invention relates to hot-air drying plants, and has for its object to provide a drying machine and plant especially suitable for drying flax, wool, and calico, although also suitable for drying other substances such, for example, as corn or the like. The plant employed is of the type wherein air is caused to flow, as by a fan or the like, continuously through the drying machine, past a cooler or water extractor, through the air heater and back to the drying machine, the goods or material to be dried being conveyed through a series of chambers constituting the drying machine in succession from one end of the machine to the other in the reverse direction to the flow of hot air. In the improved drying machine the inlet and discharge passages for the goods or material are located at one end and the hot-air inlet and humidified air outlet at or near the other end. The heating plant can be combined with boilers that supply steam for motive power purposes and with a heat economiser arranged in a flue of such boilers, and in such an arrangement dampers may be provided for directing the flow of gases at will through the hot-air generator alone, through the economiser alone, through the air heater and economiser in series, or direct to the chimney without passing through either the hot-air generator or economiser, the waste heat being supplemented as may be required by steam heating devices.


23751/09

23791 Landells and Jobling: Production of induced draught in chimneys and the like. 23943 Dunsmore: Means for feeding materials, such as ground ores, dross, and the like to machines, furnaces, and the like. 23965 Hare: Music stands and desks. 24342 Walker: Braking arrangements for mail-carts, bassinettes, and like vehicles. [Post-dated April 23rd, 1910.] 24467 Jacobs: Steam superheaters. [Date applied for under International Convention, October 24th, 1908.] 24516 Hadfield: Tramway and like points. 24556 Daniels: Web-coating machines. 24669 Lowe, Elliot, and Poynton: Pump or inflator connections. 24682 Hammond: Combination writing table. 24801 Parkinson Stove Co., and Spreadbury: Taps and cocks. 24974 S. Sims and Sons Ltd., and Sims: Washing vessels, baths, buckets, and like vessels. 25034 Wilde: Combination article of furniture serving as a leg rest, a fire screen, a table, or the like. 25123 Breitkreuz: Automatic valves for water pipes. [Date applied for under International Convention, April 5th, 1909.] 25164 Parker: Rotary engines. [Cognate Application. 9227, 1910.] 25185 Wm. Simons and Co., Brown and Brown: Cutters for submarine excavation. 25189 Hodges and Searle: Picture suspender. 25267 Witmer: Steam generators, hot-water boilers, and air heaters. 25278 Schultz and Holt: Electric switches. 25284 Parsons: Key rings or rubber rings capable of being opened and again secured. 25304 Brodrick: Compounds for manufacturing drinks. 25321 Chambers and Moffatt: Wool-scouring solution for cleansing wool for manf. and the extraction of wool fat, also the cleansing of woollens, cloth, and such like in cold-water solution. 25346 Elkan and Stephenson: Tobacco pipes. 25403 Ashworth and Hart: Felt and like hats.

25449 W. T. Henley's Telegraph Works Co., and Penning: Coupling devices for electric cables.

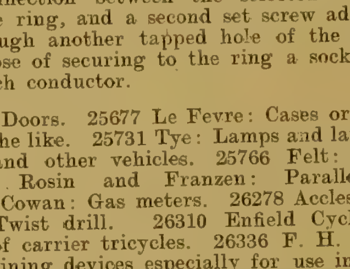
This invention relates to insulated multi-core underground electric cables for lighting or power supply to domestic and similar consumers, and it has for its object to provide an improved form of coupling device specially adapted for enabling a branch conductor to be connected readily to any core of a cable at any desired point without the necessity of removing the insulation which covers the individual cores. The invention consists essentially in the combination with a ring formed of conductive material divided diametrically and adapted to be halved together about and secured around the cable, and provided with a series of radially extending holes similarly tapped of a pointed set screw adapted to be inserted through one of the holes so as to clamp the ring in place and establish electrical connection between the selected core of the cable and the ring, and a second set screw adapted to be inserted through another tapped hole of the same series for the purpose of securing to the ring a socket terminal for the branch conductor.


25449/09

25484 Colman: Doors. 25677 Le Fevre: Cases or holders for visiting cards or the like. 25731 Tye: Lamps and lamp brackets for motor cars and other vehicles. 25766 Felt: Calculating machines. 26199 Rosin and Franzen: Parallel knitting machines. 26277 Cowan: Gas meters. 26278 Accles (Pratt and Whitney Co.): Twist drill. 26310 Enfield Cycle Co., and Smith: Frames of carrier tricycles. 26336 F. H. Ayres Ltd., and Colson: Straining devices especially for use in connection with nets for lawn tennis, Badminton, and other similar games and for other purposes. 26424 Snell: Appliances for public amusement. 26450 Mauser: Cartridge magazine for automatic firearms. [Date applied for under International Convention, December 9th, 1908.] 26591 Spong: Food-chopping machines or mincers.

26653 Brown: Variable-speed gear for belt-driven motor vehicles.

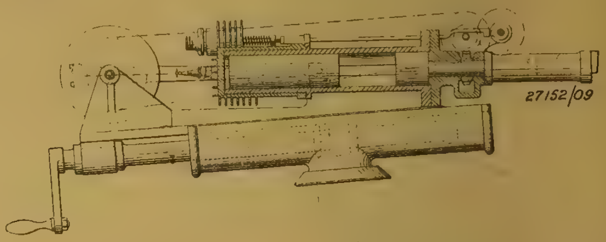
This invention relates to variable-speed driving mechanism for belt-driven motor cycles, comprising a pulley having relatively adjustable flanges to vary the diameter at which the belt can act, and means for moving the driven wheel relatively to the driving pulley to take up the slack of the driving belt. The invention consists in providing the ratchet teeth rigid with the sleeve of the axially stationary flange, providing the other flange, which is axially slidable on the sleeve, with a spring detent for engaging with the ratchet teeth and adapting another sleeve or like sliding member to disengage the spring detent from the ratchet teeth when the flanges are to be moved apart to effect a decrease in speed, and to thrust one flange towards the other when an increased speed is required.


26653/09

26763 Millard: Spring forks for cycles, motor cycles, and the like. 26812 Baumann: Hoppers for loading steamers with coal to prevent breakage and for like purposes. 26863 Iddon: Means or appliance for use in enamelling or japanning baths or the like. 27030 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new pharmaceutical compounds. [Samples furnished under Section 2 of the Act.] 27037 Bamford: Grinding mills. 27113 North: Taximeter vehicles and taximeters therefor. [Cognate Application, 28806, 1909.] 27135 Pauling: Anti-rust composition, and process of manufacturing the same.

27152 Musgrave: Portable tools suitable for drilling and other purposes.

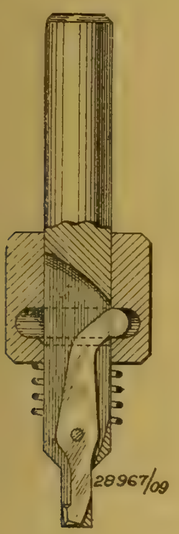
This invention has for its object to provide a simple and efficient portable tool suitable for drilling wood, metal, or other substances and for other purposes of the type wherein the tool proper is rotated by an explosion or internal-combustion motor and the feeding is effected as desired by hand. In a portable tool according to this invention the tool spindle is mounted to rotate in one of the end covers of the cylinder of an explosion motor and is driven through belt, chain, or other gear from the crankshaft of the motor which is situated at the other end of the motor cylinder, all the parts being carried by a frame that is capable of being moved as by a feed screw upon a supporting cradle or the like.


27152/09

27343 King's Norton Metal Co., Bayliss and Melville-Smith: Method for priming rim fire cartridges. 27349 King: Barriers for checking wind and drifting sand. 27392 Marthinson: Paper boxes or like receptacles. [Date applied for under International Convention, July 22nd, 1909.] 27522 Wills: Gas cooking stoves and cooking ranges. 27528 Hiscox: Grinding and crushing mills. 27577 Barton: Containers for use in applying packs or poultices. 27600 Rousseau: Crucible furnaces. [Application for Patent of Addition to 6028, 1908.] 27650 Reese: Organic phosphates. 27681 Salenius and Separator Aktiebolaget Fama: Centrifugal drums or the parts thereof and the method of manufacturing the same. 27802 Metcalfe, Metcalfe, and Metcalfe: Ejectors for vacuum brake apparatus of railway and like vehicles. [Request under Section 19 of the Act not granted.] 27893 Giroud: Paper-sheet feeding mechanism. [Date applied for under International Convention, December th, 1908.] 27946 Schutze: Feeding bottles. 28084 Marchant: Road motor wheels. 28166 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new pharmaceutical compounds. 28178 Witzenmann: Metal hose pipe. 28291 Woodward: Method of preventing leakage in a flexible tube formed by a strip or strips of material helically wound. 28296 Burnet, Temple, and Burnet and Temple Ltd.: Tool for curling feathers. 28352 Hovell: Calendars or date indicators. 28457 Green: Device for retaining a necktie in position with relation to a collar or shirt neck band. 28490 Rehkop: Manf. of ultramarine. 28561 Berliner Akt.-Ges. fur Eisengresserei und Maschinenfabrikation: Malt drums. [Date applied for under International Convention, December 8th, 1908.] 28637 Molkentin: Fastening devices for doors, windows, and the like. 28806. *See* 27113, 1909. 28820 Paton and Philps: Ironing machines. 28951 Burney, and Sterling Telephone and Electric Co.: Intercommunication telephone systems.

28967 Bruce, Peebles, and Co., and Klaps: Device for undercutting drilled holes.

This relates to an improved device for undercutting or enlarging the inner end of a drilled hole adapted to be used in an ordinary drill press, and intended more particularly for use on soft materials, such as carbon brushes, insulating material, or the like, used in electrical machinery. The device comprises a spindle with pivotally mounted cutter and a sleeve sliding on the spindle adapted to move the cutter radially. The upper end of the spindle forms a shank adapted to be held in the drill socket or clutch of the drill press spindle, and the lower end of the spindle is reduced in diameter so as to be adapted to fit within and reach to the bottom of the hole to be operated upon. The intermediate part of the spindle, upon which the sleeve already mentioned is mounted, is of uniform diameter, so as to permit the sleeve to slide and turn thereon. The cutting tool is integral with a comparatively long and thin flat lever which extends longitudinally in a diametral slot formed through the lower end of the spindle; this cutter lever is pivoted rather below the middle of its height on a cross pin fitted diametrically through the spindle. The cutting part of the tool projects laterally from the lower end of the cutter lever and its contour is the same as that of the undercutting to be effected; in its retracted position the cutting tool is entirely housed in the reduced lower end of the spindle, so that the latter can be inserted to the bottom of the hole to be operated upon.



29098 Muchka: Apparatus for heating and purifying boiler feed water, also applicable for cooling liquids. 29101 Clark and Bence: Manhole covers, gulley grates, or the like for roads and pathways. 29143 Winter: Vacuum tubes. 29472 Kershaw and Helliwell: Machinery for finishing cords, fustians, velvets, and other suitable pile fabrics. 29536 Cruickshanks and Gourlay: Machine for making gas from petrol or gasoline. 29540 Hutchinson: Circular knitting machines. 29622 Borchardt: Trigger mechanism for automatic firearms. [Date applied for under International Convention, February 26th, 1909.] 29635 Kitchen and Storey: Pneumatic tyres. [Application for Patent of Addition to 23724, 1906.] 29701 Smith: Fastening devices for driving belts and the like. 29713 Lowry, and H. Lowry Ltd.: Apparatus for removing obstructions in water and sewage pipes, gully traps, closets, and the like and thoroughly cleansing same. 29759 Munscher: Alarm clocks. 29978 Bate: Train signalling apparatus. 30037 Pradeau: Wheels for motor cars and other road vehicles. 30111 Fawsitt: Fireside shovels. 30237 Charles H. Pugh Ltd., and Bull: Manf. of metallic boxes or cases for containing cigars, cigarettes, smokers' requisites, and other small articles. 30245 Butler: Internal-combustion engines. 30314 Du Brau: Painting apparatus. 30328 Ham: Construction of apparatus for cleaning screens used in sewage and other works. 30333 Fitz: Electric generating machines. 30393 Wilzin: Process for the manf. of metal forks and spoons. [Date applied for under International Convention, August 31st, 1909.] 30439 Deam: Packing for stuffing boxes or the like. 30520 Starck: Automatic reels for winding wire and the like. 30522 Dan and Kuroda: Loading apparatus. 30555 Strecker-Aufermann: Process for preparing printing plates. [Application for Patent of Addition to 3699, 1909.] 30567 Clark: Safety razors. [Date applied for under International Convention, January 9th, 1909.]

1910.

306 Lane: Soft metal sheets or ribbons adapted to be torn into wires by the user. 310 Berthier: Means for cooling the barrels of firearms. [Date applied for under International Convention, September 19th, 1908. Originally included in 21383, 1909.] 424 Fairweather (Singer Manufacturing Co.): Buttonhole sewing machines. 463 Stephan: Conduits for granular matter. 749 Von Tillow: Apparatus for melting sealing wax. 855 Van Driel: Apparatus for automatically recording the time at which audible signals are given. 922 Hare: Loose-leaf binders. 984 Moncrieff: Spinning and twisting frames. 1044 Richards: Nut locks. 1048 Snoad: Exercising appliance for invalids. 1086 Gilmour: Fixing pulleys to cam shafts. 1144 Spurin and Coleman and Co.: Insets for advertising in books and the like. 1145 W. A. Stevens Ltd., Stevens and Lambert: Brushes for electrical apparatus. 1149 Auster: Wind and weather screens for motor vehicles. 1163 Baker: Driving and controlling of petrolised air-gas plants. 1215 English: Washing machines. 1217 Von Bechtolsheim: Counting and calculating apparatus. [Date applied for under International Convention, November 29th, 1909. Application for Patent of Addition to 30600, 1909.] 1835 Bailey and Lewis: Manf. of stands for displaying boots, shoes, and the like. 1885 Hydorion Internat. Wascherei-Maschinen Ges.: Rotary washing machines. [Date applied for under International Convention, April 19th, 1909.] 1932 Cosby: Tooth brushes and other toilet brushes. 2195 Nicholas: Boots, shoes, and the like. 2497 Leptien: Apparatus for producing low temperatures by expansion, with the performance of external work, of compressed gases. [Date applied for under International Convention, February 1st, 1909.] 2708 Wallwork: Tobacco pipes. 2748 Adams Manufacturing Co. (Cutler Hammer Manufacturing Co.): Electric switches. 3002 Johnson (Badische Anilin and Soda Fabrik): Manf. and production of colouring matters of the pyrazolone group. 3101 Thompson (Union Special Machine Co.): Apparatus for feeding and sewing filled sacks. 3474 Erlemann: Toy flying machine or aeroplane. [Request under Section 19 of the Act not granted.] 3488 Arbuckle: Apparatus for the treatment of crushed ore products for the recovery of the metal contents. 3507 Piening: Gloves. 3519 Inokuty: Universal coupling. 3596 May: Smoke-conveying attachments for railway trains. 3637 Patterson: Electric cab-controlling system for railways. 3649 Farup: Manf. of colouring matters of great covering power and polishing powders from titaniferous iron minerals. 3720 Krzywiec: Petroleum incandescent lamps. 3779 Snell: Caps for bottles or other vessels. 3825 Wallin: Electrical apparatus for perforating designs. 3843 Merton and Ridge: Rabble shafts, arms, and plows for roasting furnaces. [Date applied for under Rule 13, June 10th, 1909.] 3933 Auster: Joints of adjustable wind and weather screens for motor cars and other analogous uses. 3988 Bailey: Foldable or collapsible chairs, seats, and the like. 4241 Adams: Variable pressure indicator, recorder, or the like. 4395 Sunngard: Detachable rotary magazines for guns. 4490 Fletcher, Russell, and Co., and Fletcher: Blast tube burners. 4557 Meunier: Process for the treatment of animal substances, such as wool, silk, or hair to increase their resistance to the action of water, heat, and chemical agents. 4564 Crabtree: Rims or tyres of wheels. 4883 Oehring: Circuit-closing and opening device for coin-freed apparatus. 4907 Farny: Dynamo electric machines. [Date applied for under International Convention, March 1st, 1909.] 4956 Spencer: Malt liquors and the process of producing same. 5153 Ermbter: Bearings for cylinder teaseling machines. [Application for Patent of Addition to 24823, 1909.] 5162 Rowe: Turned shoes. [Date applied for under International Convention, March 30th, 1909.] 5239 Matthews: Tobacco pipes and means for filling the same. 5378 Kamprath: Tubes for artists' colours, cosmetics, pulverulent matter, and the like. 5384 Hanwell: Anti-vibrators for gas burners or electric lamps. 5438 Stuting: Tube-rolling mills. 5472 Rose and Rose Bros. (Gainsborough) Ltd.: Apparatus for applying bands, wrappers, or labels to boxes, blocks, or packages. [Application for Patent of Addition to 16740, 1909.] 5666 Plant: Shoe sole flexers. 5736 Storm: Floor and car for amusement purposes. 5844 Freisinger: Incandescent gas lamps. 5871 Robertson: Reckoning and computing apparatus. 5930 Garms: Receptacles for cosmetics, perfumery, and other contents. 5939 De Jahn: Manf. of organic acid anhydrides. [Date applied for under International Convention, March 27th, 1909.] 6043 Degener, and General Composing Co. 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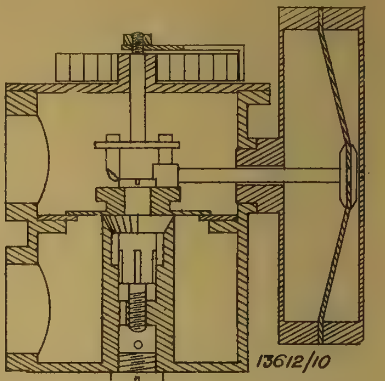
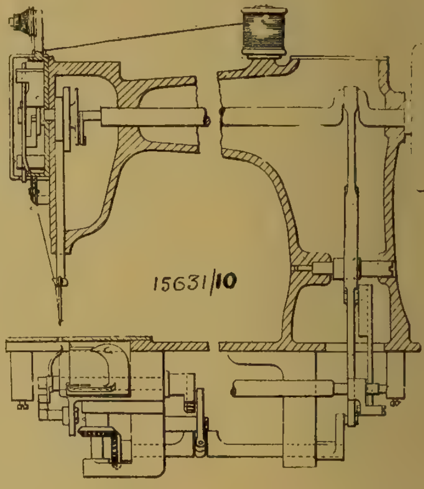
goods laden in bulk preparatory to removal by conveyers. 7600 Davis: Safety whip holders. 7665 James (Continental Paper Bag Co.): Carton machines. 7730 Floyd: Razor blade sharpeners. 7784 Timmler: Strengthening punching machines for letters and the like. [Date applied for under International Convention, April 2nd, 1909.] 7833 Frei: Combined walking stick and seat. 7851 Deutsche Telephonwerke Ges.: Device for sending current impulses, particularly applicable to automatic telephone systems. [Date applied for under International Convention, November 8th, 1909.] 7888 Longstreet: Portable sawing machines. 7914 Clark: Shaving mugs and the like. 7940 Bohn: Apparatus for separating granular admixtures from clay and like plastic substances. 8018 Thompson (Arco and Rendahl): Variometers for electrical oscillations. 8098 De Malglaive: Four-stroke cycle internal-combustion engines. [Application for Patent of Addition to 7461, 1909. Date applied for under Rule 13, September 17th, 1909.] 8282 Dittmar: Trunk fasteners. 8410 Siemens Bros. Dynamo Works (Siemens Schuckertwerke Ges.): Armature windings for dynamo electric machines. 8684 Jacobsen and Livens: Crankshaft governors. 8748 Shoop: Wrenches. 8794 Wilkins: Internal-combustion engines. 8838 Vermond and Quellennec: Rotating harrows or diggers. [Date applied for under International Convention, April 30th, 1909.] 8857 Petersen: Egg cutter. 9065 Schneider: Lathing and wall linings. 9074 Richter: Implement for the sowing of potatoes. 9093 Hoppe: Fixing of knife blades in the hafts. 9212 Houdaille: Shock-absorbing devices. [Date applied for under International Convention, September 6th, 1909. Application for Patent of Addition to 9193, 1910.] 9227. *See* 25164, 1909. 9347 Monnoyer, Monnoyer-Rommelaere, and Monnoyer: Hollow building blocks, slabs, bricks, and the like, and process for the manf. of the same. 9365 Quisling: Shrapnel shells. 9507 Fleigel: Guides for sewing machines. [Date applied for under International Convention, April 24th, 1909.] 9638 Polyphon-Musikwerke Akt.-Ges.: Sound-reproducing and talking machines. [Date applied for under International Convention, July 27th, 1909. Application for Patent of Addition to 9606, 1910.] 9714 Kunze: Bread-cutting machine. 10145 Forrester (M. B. Schenck Co.): Casters. 10162 Lee: Automatic telephones. 10172 Siemens Bros. Dynamo Works (Siemens Schuckertwerke Ges.): Polyphase electric series motors. 10319 Harrison (United States Phonograph Co.): Manf. of phonograph record blanks. 10345 Johnson: Construction of loose-leaf ledgers or binders and the like. [Application for Patent of Addition to 30061, 1909.] 10408 Lambert, Kennedy, and Farthing: Forming mitres to any angle in plaster mouldings, internal and external. 10432 Storey and Stone: Bunks, furniture, and the like for use on board ship. 10450 Nicholson: Swath turner. 10455 Firm Nier and Ehmer: Talking machines. [Date applied for under International Convention, May 1st, 1909.] 10462 Wyler and Instanter Ltd.: Key ring combination tools and the like. 10547 Anthony: Wheel rims for pneumatic tyres. 10612 Desenberg: Small impulse water turbines. 10663 Shone: Sewerage systems. 10692 Allgemeine Elektricitats Ges.: Alternating-current dynamo electric machines of the commutator type. [Date applied for under International Convention, May 1st, 1909.] 10765 Godwin (Lebrun): Combination of drugs forming a medicine for the relief of sea sickness and the like. 10775 Atleson: Means for raising the rods of well-drilling apparatus or the tubes of artesian wells. [Date applied for under International Convention, May 1st, 1909.] 10778 Smith: Foldable ladders. 10804 Fleigel: Guide attachment for sewing machines. 10893 Rex Motor Manufacturing Co., and Sarginson: Clutch mechanism for motor cycles and the like. 10922 Ketcheson: Pulp stoppers. 10923 King, Hughes, and Hall: Construction of mausoleums. [Date applied for under International Convention, January 11th, 1910.] 11057 Windhoff: Brake mechanism. 11081 Uhlemann: Eyeglass mountings. 11119 Wylie and Wright: Vehicle wheels. 11468 Newton: Hanger straps or hand-holds for cars and the like. [Date applied for under International Convention, May 10th, 1909.] 11532 Dujardin: Concrete sewers. 11782 Maschinenfabriken vorm. Geb. Guttsmann und Breslauer Metallgiesserei Akt.-Ges: Rotary liquid meter. [Date applied for under International Convention, July 19th, 1909.] 11900 Katz: Collars for identifying strayed and stolen dogs and other animals. 11932 Sherkel: Snap hooks. [Date applied for under International Convention, June 8th, 1909.] 12259 Lugard: Electro-magnetic clutches. 12331 Kilburn (Noack): Toy figures. 12572 Liddle (McCoy and Beckers): Rotary engines. 12731 Fust: Seed drills. 12945 Booth: Grinding mill. 13108 Reinhardt: Process and apparatus for producing malt grist for brewing purposes. [Date applied for under International Convention, May 29th, 1909.] 13514 Rager, Gordon, and Camp: Nut locks. 13580 Palfoldy: Peripheral structure of spring wheels. [Date applied for under International Convention, June 7th, 1909.] 13592 Lehnig: Method of mounting glass and similar bodies to form letters and ornaments on sign boards and the like.

13612 Souter: Automatic carburetter for internal-combustion engines.

This invention relates to carburetters for internal-combustion engines. The improved carburetter is primarily intended for use on motor car and other engines using petroleum spirit or other fuels, and consists essentially in an ordinary float chamber to maintain the fuel almost as high as the top of the jets or annular spaces. The jets or annular spaces extend round two opposite quarters of a circle. Coincident with these jets or spaces are air ports in a diaphragm which divides the jet chamber horizontally. The air ports also extend round two opposite quarters of a circle. A shutter having a partially rotary motion covers both air and fuel ports or jets. A flexible diaphragm is connected to the shutter in such a manner that the suction of the engine piston or pistons tends to rotate the shutter and open up the air and fuel ports. A spring is fixed so that it returns the shutter to a closed position on the cessation of the suction of the engine. The engine is controlled by a throttle valve in the induction pipe or by other means.


13612/10

13916 Peraux: Tyre levers. 13939 Seabrook: Method of applying lubricant to bearings. [Date applied for under International Convention, July 6th, 1909.] 13985 Siemens and Halske Akt.-Ges.: Receiving and registering appliances for electric signals. [Date applied for under International Convention, August 26th, 1909.] 14012 Lloyd (Straughan): Mechanism for driving reciprocating pumps or the like by means of a wind or other motor. 14032 Heintze: Sound conductor for gramophones and such like instruments. 14328 Stone: Grain-separating screen. 14923 Pindstofte: Bottling machines. 15144 Degener, and General Composing Co. Ges.: Type-line setting and casting machines. [Date applied for under International Convention, February 25th, 1910. Application for Patent of Addition to 28007, 1908.] 15254 Farbenfabriken vorm. F. Bayer and Co.: Manf. and production of a new substance similar in its properties to natural caoutchouc. [Date applied for under International Convention, September


15631/10

29th, 1909. Samples furnished under Section 2 of the Act.] 15545 Zabranski: Spittoons. 15630 Marks (Butler): Sewing machines. [Application for Patent of Addition to 3705, 1909. Date applied for under Rule 13, September 20th, 1909.]

15631 Marks (Butler): Sewing machines. [Application for Patent of Addition to 3705, 1909. Date applied for under Rule 13, September 20th, 1909.]

> This invention relates to mechanism for spreading the loop which is formed around the lower spool of lock-stitch sewing machines. The improvement consists essentially in mechanism for spreading the loop formed by the upper cotton of a lock-stitch sewing machine comprising a pivoted link, a lever fulcrummed upon the link, a shaft provided with a crank, a pin pivoting the lever to the crank, a thread hook secured to the end of the lever, and means for rotating the shaft.

15700 Vereinigte Glanzstoff-Fabriken Akt.-Ges.: Process for the utilisation of the refuse from the manf. of artificial silk of all kinds from cellulose. [Date applied for under International Convention, December 20th, 1909.] 15853 Waigh: Lubricators. 15947 Chaddock and Chaddock: Gloves. 15960 Siemens and Halske Akt.-Ges.: Change-over valves for water meter connections. [Date applied for under International Convention, July 15th, 1909.] 16518 Saccharin-Fabrik Akt.-Ges. vorm. Fahlberg, List, and Co.: Manf. of chlorosulphonic acid. [Date applied for under International Convention, September 4th, 1909.] 16540 Chemische Fabrik von Heyden Akt.-Ges.: Manf. of anhydrous hydrosulphites of alkaline metals. [Date applied for under International Convention, June 16th, 1910.] 16635 Jones: Playing cards. 16683 Wilson: Resilient metal tyres. 17230 Firm A. W. Nagel: Process of manufacturing lace insertion. [Date applied for under International Convention, June 30th, 1910. Application for Patent of Addition to 16568, 1910. 18056 Von Mach: Process for protecting balloons against fire. [Date applied for under International Convention, August 20th, 1908. Originally included in 18375, 1909.] 19388 Placek: Driving apparatus for flying machines. [Date applied for under Rule 13, September 14th, 1909.] 20886 Von Mach: Process for protecting balloons against exterior influences. [Date applied for under Rule 13, August 9th, 1909.]

COMPLETE SPECIFICATIONS OPEN TO PUBLIC INSPECTION BEFORE ACCEPTANCE, UNDER THE PATENTS ACT, 1907.

1910.

1353 Burgess and Muir: High-pressure filter. 6898 Huessener, Schaefer, and Henss: Process and apparatus for removing the aqueous vapours from dry distillation gases freed from tar and ammonia. 6900 Huessener, Schaefer, and Henss: Process and apparatus for extracting ammoniacal salts from dry distillation gases which have been freed from tar. 9391 De Stuckle: Method of manufacturing dehydrated zinc sulphide. 9609 Plinatus: Production of elastic or resilient masses. 10342 Fahrradwerke Bismarck Ges.: Manf. of metallic structures. 10377 Vandercook: Printing presses. 10785 Mongen: Method of and means for producing air in drying furnaces for the moulds in foundries. 12258 Bors: Cork-drawing device. 12719 Belknap: Stencil-printing machines. 12748 Sinding-Larsen and Storn: Process of separating a single gas from a mixture of gases and apparatus for use therewith. 14431 Yost: Processes of treating materials. 15874 Van Wienen: Suction and pressure dredgers. 17087 Farbwerke vorm. Meister, Lucius, and Bruning: Manf. of dyestuffs of the triphenylmethane series. 18850 Cooper: Driving connection for electrically-propelled vehicles. 19322 Akt.-Ges. Brown, Boveri, et Cie.: Dies or drawing devices. 19593 Gibbs: Apparatus and process for making wire electrolytically. 19594 Gibbs: Apparatus and process for annealing wire. 19609 Meyer: Valves for pumps. 19877 Harrison: Motor-driven lawn mowers. 20137 Edmonds: Automatic water pipe cleaner. 20223 General Composing Co., and Degener: Matrix-setting and type-line casting machines. 20256 Broc: Valveless motor with rotary piston. 20339 McNitt: Reduction of metals from their compounds. 20362 Bioletti: Door holder. 20475 Carl Zeiss: Spectacle glasses cut out eccentrically for obtaining prismatic effect. 20594 Levoz: Production of steel by electrical methods. 20620 Carl Zeiss: Magnifying spectacle glasses for myopes. 20634 Specialfabrik fur Aluminium Spulen-und-Leitungen Ges.: Process for securing oxide or salt films on wire ribbons or coils especially of aluminium and its alloys. 20636 Quentell: Calculating machines. 20660 Schmeisser: Automatic firearms. 20679 Boirault: Automatic

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THE basis and justification for employers' liability laws have already been discussed in the technical press, and a considerable divergence of opinion seems to exist upon the subject. Laws of this description are in force in practically every industrial nation except the United States, and the latter are now coming into line—the State of New York having recently enacted legislation concerning compensation for accidents in shop and factory.

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Some years ago it was argued by some authorities upon the subject that a diminution of industrial accidents would result from an extension of the principle of employers' liability, employers being assumed to be completely indifferent to the injury of their employees, and only concerned with the saving of expense to their own pockets by the neglect of any necessary safeguards. This, it was held, would be remedied were employers more or less heavily mulcted when an accident occurred. Instead of the Employers Liability Act, however, causing a diminution in the number of accidents, the actual effect was the contrary. From the year 1898, when the Workmen's Compensation

Act came into force, to 1907 the number of deaths of workpeople resulting from accidents in the manufacturing trades rose by 62 per cent, and the number of those injured by 115 per cent. In fact, ten years after the above Act became law the House of Commons was asked by the leaders of the Labour party to consider the recent alarming increase of workshop accidents, and a committee was appointed to enquire into the subject.

The leaders of the Labour party who were responsible for the workmen's compensation law insisted on there being no contracting-out clause, which would have benefited the elderly and less able-bodied workpeople, and consequently there has been an elimination by the masters of the latter—the safer and least liable to meet with accidents—and a corresponding increase in accidents.

The average annual compensation per head in the metal trades in this country has been estimated at something over a farthing a day. In America this figure will no doubt be considerably increased by reason of the higher rate of wages and the larger amount of the compensation that would result from this fact; probably there a halfpenny per day per head would cover the risk.

A satisfactory feature in the working of the law in this country has been the increase in the number of cases settled out of court and the compensation arranged directly between the parties interested in acordance with the law, thus saving the expense of litigation.

New Cable Factory.—The establishment of a new cable factory to be erected in this country has been—according to the *Manchester Guardian*—announced. This is, our contemporary observes, a matter of considerable interest. Most British cable makers are in a ring, and keep the prices up to what is, judging by tenders received at times from Continental firms, a most profitable figure. Credit must be given the Cable-makers' Association for setting up a high standard of work, but users would be glad of lower prices if the new factory should result in any real competition for cable orders. Perhaps, however, the new factory may find its way into the ring, for it is likely that the promoters have their eye on the large profits now made by cable makers and are not actuated by any desire to sell cables cheaply.

Foreign Supplies to Spanish Government Departments.—Regarding foreign supplies to Spanish Government Departments, a recent issue of the *Gaceta de Madrid* publishes a list of emendations and additions to the list of articles, for the acquisition of which, owing to the high cost or impossibility of production in Spain, it is considered necessary to invite foreign competition. The new list includes electric lighting apparatus, disinfectants, sowing and mowing machines, electrical and steam machinery, angle iron, steel products, army commissariat wagons, emery paper, driving belts for hemp and india-rubber, tarpaulin, brass cartridge cases and caps, heavy motor vehicles, swords and sabres, hospital tents, medical and surgical apparatus, office accessories, such as gumming and perforating machines and typewriters, scales, laboratory materials, minting machines, microscopes and instruments, cements, stone-grinding machines, metal railway sleepers, switches and crossings, electrical pumps, metal tablets and sign boards.—*Board of Trade Journal.*

Improvement of South Russian Waterways.—The official *Commercial and Industrial Gazette* reports a project under consideration by the Government for rendering the Dnieper and Northern Donetz rivers suitable for navigation by means of a system of locks. It is stated that in this way vast districts of the Smolensk, Minsk, Mohilov, Chernigov, Kiev, Ekaterinoslav, Poltava, Kherson, Taurida, Kursk, Kharkov, and Voronezh Governments and of the Don Cossack Territory would be brought into direct communication with the Black Sea and the Sea of Azov. Moreover, the surplus water which would be created by the lock system could be utilised to very great advantage for irrigation in the arid regions traversed by the Donetz. The whole of the water of the Northern Donetz would have to be controlled. In the case of the Dnieper, it would not be possible to control the whole body of water, and the work would consist chiefly in the excavation of a canal with locks to run parallel with the cataracts. It would be most desirable, at the same time, to make an irrigation canal, branching off from the Dnieper between Ekaterinoslav and Alexandrovsk, by means of which the whole south-western district of continental Taurida could be transformed into a fertile fruit-producing country.—*Board of Trade Journal.*

MODERN AUTOMOBILE PRACTICE.

By A.M.I.A.E.

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(Continued from page 360.)

Piston Rings.

These are usually three in number, for sizes up to 4 in. diameter, and four for pistons between 4 in. and 7 in. diameter. It has been almost universal practice to place all of the rings as near the head as possible, but it has been proved beyond all doubt that if one of them is at the open end of the piston that little, if any, lubrication oil passes up into the combustion spaces. The number of rings above mentioned are necessary to retain the compression above the piston, and one ring in the head is essential to keep the cylinder wall in a suitable condition to permit of the efficient working of the piston, but it is almost immaterial from the above considerations where the intermediate ring or rings are placed. If therefore these rings are also brought to the open end, we are able to move the gudgeon pin further up the piston, resulting in a slightly shorter cylinder; and further, being below the gudgeon pin bosses, this part may be machined inside and out, which will result in a lighter piston, and permit of slightly higher engine speed with less vibration. The piston wall below the gudgeon pin is usually one-half to one-third the thickness of the piston head.

The rings are generally $^3/_{16}$ in. wide up to 3 in. diameter, $\frac{1}{4}$ in. wide up to $4\frac{1}{2}$ in. in diameter, $^5/_{16}$ in. wide up to 6 in. diameter, and $\frac{3}{8}$ in. wide up to 7 in. diameter, but those situated at the open end can be narrower than the widths here given, the thickness of the rings being usually about $^5/_{32}$ in. for sizes from $2\frac{3}{4}$ in. diameter to $4\frac{1}{2}$ in. diameter.

Machining Allowances.

The tolerance allowed the cylinder grinder is from dead size to half a thousandth large, and for the piston from dimensioned size to half a thousandth small, so that the total possible variation should not exceed $^1/_{1000}$ in. The cylinder and piston should both be truly cylindrical, and thus the only remaining disturbing factor is the warping of the piston and cylinder out of true when subjected to heat in running. A rough but somewhat common method to overcome this is to give the engine a severe run on its preliminary test, and then take it down and relieve the high places. This method, though somewhat expensive, is fairly satisfactory.

COOLING.

Two features of cylinder and piston design which are often looked upon as points for later consideration, but which should be dealt with in the first place, are:—

(1) The form of cooling to be employed for the engine; and

(2) The system of lubrication to be adopted. We will therefore proceed to examine these matters in the order given above, and to show some of the advantages and disadvantages of the systems at present employed.

AIR COOLING.

In the first place we should realise thoroughly what is desired of a cooling system, taking into account the special requirements of the case under consideration.

On examining the balance-sheet of an existing engine, for simplicity take a water-cooled engine, we shall see that, roughly speaking, we have heat given off as brake horse power of the engine, about 20 per cent; heat wasted in the water, about 30 per cent; heat escaping in the exhaust pipe, about 50 per cent; added to which we know that the temperature of maximum efficiency lies in the neighbourhood of 160 deg. Fah., from which we can gather the approximate extent of the cooling capacity required.

The advantages claimed for the air cooling of engines are:—

(1) The simplicity of the casting, with absence of water jackets and pipes, and reduction in the chances of shifted cores.

(2) That the simplest mechanism is the best in every-day use, and that air cooling is a direct method and obviates the necessity of conveying the heat to an expensive radiator and there dissipated.

(3) Absence of leaking radiators and troublesome pumps. No fear of cracked cylinders in frosty weather, owing to presence of water; great reduction of weight of water, radiator, pipes, pump, and pump drive.

(4) No trouble from the working of the pump, fouling of the pipes, or omission to fill the radiator.

(5) Less trouble when taking down the engines, as there are no water pipes to be disconnected and no radiator in the way, or to be emptied and removed.

The above are advantages which are very desirable, if they can be conveniently obtained, and further, they permit of a very much cheaper car, and therefore, when considering a small, light, cheap car, for which there is undoubtedly a large market, the question of air-cooling should, and certainly will, receive some serious consideration. In the case of several aeroplane engines, where lightness is of great importance, this form of cooling has been adopted. In order to obtain efficient results from this method, it is necessary to *impinge* the air upon the radiating fins owing to air being an inferior cooling medium to water.

In the Gnome engine this is easily accomplished, and naturally adopted, by virtue of the fact that the cylinders revolve about a stationary crankshaft. The American "Frayer-Miller" Company, who manufacture one, two, and three ton lorries, adopt a different form of air cooling. In their engines they use a Sirocco fan as a blower, which they drive by means of a Renolds silent chain off a wheel in the engine gear case; this fan, which is mounted on ball bearings, has about 64 corrugated blades, and is 1 ft. in diameter, delivers the forced draught through a large passage, which runs along the top of the cylinders to aluminium jackets around the cylinders, thus ensuring a positive path for the air to travel.

Another, but less positive form of American practice of air cooling, is to have vertical radiating fins, and to shut off the top piston of the bonnet which contains them from the lower, and to employ the flywheel as a fan; the air is drawn into the top portion of the bonnet, and has to find its way down between the fins above mentioned, and is exhausted under the floorboards behind the dashboard. The flywheel in this particular instance is in the form of a paddle wheel in the forward end of the rim, and is therefore somewhat on the principle of the Sirocco fan.

The well-known three-cylinder Anzani engine, which came into prominence by being used by Blériot, who was the first to cross the English Channel in an heavier-than-air flight, is another example of an air-cooled engine, the model in question being one of 35 H.P., the cylinders being arranged radially round the crankcase, which is split vertically; the middle cylinder is placed vertically, and the other two at 80 deg. on either side of it. The crankshaft has but a single throw, the connecting rod of the vertical cylinder being straight, and the other two being forked and branching to either side of the central big end. The exhaust valves are mechanically operated at the rear of the engine, and the inlets are atmospherically operated, and are situated over the exhaust with the sparking plug placed horizontally between them. The valve arrangement is open to much discussion, for although lightness has evidently been given first place, it would have been better to have the exhaust valves at the front to catch the cold air, to have the inlet where the exhaust valves now are, and each to be mechanically operated from the two flywheels, which are in the crankcase, as in motor-cycle engine design. M. Anzani is the maker of the motor cycle bearing his name.

One feature in this engine, and one which goes far towards the efficient cooling of air-cooled engines generally, is to have a number of holes drilled in the cylinder body immediately above the piston when at the bottom of its stroke, thus facilitating the quick escape of the burnt gases. This has repeatedly been proved to be beneficial, and should invariably be adopted.

The radiating fins are very difficult to cast nicely, and in fact this is so much the case that one large maker of engines has to go abroad for the castings, and has so much trouble even then that he has been considering the necessity of giving up the manufacture of these engines; but we think that this is rather an exceptional experience, and need not deter anyone from the serious consideration of air-cooled engine manufacture. The fins should be fairly thin and nicely tapered, and placed closely together with good large fins on the cylinder head, where the greatest heat occurs.

In view of the great success of air-cooled engines for use on motor cycles, aeroplanes, and American industrial vehicles, we think that the case of the *possibility* of using them on small, light cars is proved, and that in time we shall be seeing their development.

WATER COOLING.

The reason of the popularity of water cooling is that when the system is suitably proportioned and properly attended to, it is impossible to have the cylinder walls at such a temperature that trouble can arise from faulty lubrication, seizing of the pistons or other working parts, or of pre-ignition; and further, it is possible to have higher compression ratios than are permissible with air cooling. By keeping the cylinder walls cooler, the incoming mixture is not heated so much, and therefore is not so rarefied, which ensures the drawing in of a greater weight of gas, which in turn means more power. Another advantage obtained with water cooling is the ability to more easily keep the temperature of the valves low enough to prevent burning and pitting, with its consequent troubles and loss of power; but this may be lessened by using valves with cast-iron or nickel-steel heads, suitably fixed to the mild-steel stems, either by screwing and riveting or by oxy-acetylene welding, which is now a commercial process. Water cooling is of necessity one of two kinds, the simpler of which is that working on the thermo-syphon principle, that is, by convection, and the other in which the water is circulated by means of a pump.

Thermo-Syphon Circulation.

With this system the cylinder is able to more quickly attain its temperature of greatest efficiency, and to maintain it. The system is very little different in cost to the pump circulation, for whilst the pump and its drive are omitted, the radiator has to be increased in size, and therefore initial cost. G. H. Lanchester states that with a pump delivering two gallons per minute, the cooling surface of the radiator should be of the ratio of 40 to 1 of the cylinder surface exposed, and for thermo-syphon it should be 45 to 1; but the author's experience goes to show that the difference is somewhat greater than this, particularly when the radiator is behind the engine.

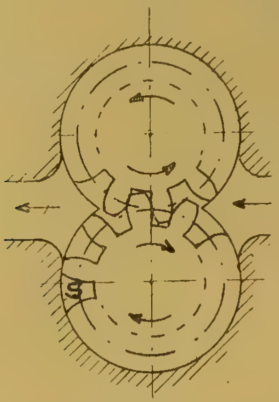


Fig. 26.

One point which is not generally appreciated, but which is a good argument in favour of natural circulation, is that the lubrication of the pump gets into the circulating water, and after some use, it may be a year or two, the deposit from the grease, which is usually of a mineral origin, will greatly affect the efficiency of the radiator, and render the cooling surface insufficient; this has recently been the case with several London omnibuses, and involves much expense to correct the trouble.

The circulation is proportional to the output of the engine, for increase in the heat given off to the cylinder walls increases the hyrostatic head, which causes more rapid movement in the water; therefore, if any portion of the cylinder is subject to becoming hotter than the rest, as, for instance, round the exhaust valve, this tendency is resisted by the increased movement of the water automatically set up, as explained. Whereas, on the other hand, it is quite possible for a good pump, fan, and radiator to keep the temperature of the water below that of greatest efficiency under certain conditions of service.

When this system is employed, care should be taken to see that the waterways are not restricted at any point; a large water space should be allowed round the valve pockets and over the cylinder head, and the outlet at the top should be of ample dimensions, thus if

D = diameter of cylinder in inches,
N = number of cylinders in one casting,

then the bore of the outlet should be

$$\frac{D \times N}{4}.$$

Hence if the engine is a four-cylinder one of $3\frac{3}{4}$ in. bore, cast in pairs, the water outlet should be

$$\frac{3\frac{3}{4} \times 2}{4} = 1\frac{7}{8} \text{ in. diameter.}$$

Furthermore, the design of the cylinder jacket head should be arranged to be semi-circular in transverse section, and to rise longitudinally towards the outlet, so as to prevent the possibility of steam pockets forming, either when the vehicle is on the level or on a rise of, say, one in six; the outlet pipe should be cast solid with the cylinder cover, and should be run into it with large and easy curves, so as to assist in the above-mentioned object. The top line of the top water pipe should be kept in one straight line, and have a slope of, say, one in five, which should not be difficult to arrange. The inlet to the radiator should be gradually increased in area, and spread as much as possible, with a good free sweep so as to distribute the water as it enters the cooler or radiator. The author knows one instance where this fitting on a four-cylinder engine has an area equal to one and a quarter times the diameter of one of the cylinders; but this, of course, is unnecessarily large, and need not exceed the sizes given above, although it is impossible to make them too big, except for cost and appearance.

If we take the atmospheric temperature as 60 deg. Fah., and assume that the whole of the water in the system is brought to boiling point, this represents an expansion of, roughly, $4\frac{1}{2}$ per cent, or two pints in five gallons; this, of course, would be impossible, as it neglects the cooling effect of the radiator, but explains why after much hard work, even if the radiator has not boiled, from half-pint to one pint of water is sometimes lost, it having escaped down the overflow pipe. In view of the slight alteration in volume, we do not think it necessary to make any difference in the size of the inlet and outlet pipes, which would mean stocking two sizes of pipes, rubber hosing, and water-pipe clips, which is a great inconvenience in the works.

Gear Pumps.

The simplest form of pump for water circulation is the gear type, though the efficiency is not as high as might be expected, owing to leakage of pressure, unless it is well made.

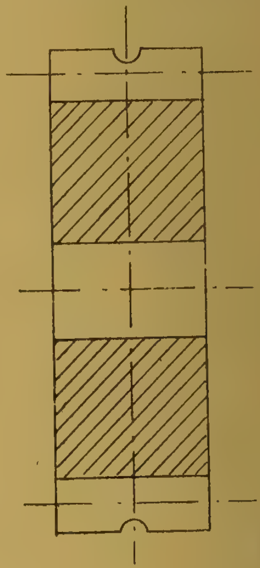


Fig 27.

In fig. 26 we give a sketch showing the direction in which the water passes through a gear pump, for although this is a matter always pointed out by those writing on this subject, it is not always appreciated unless attention is drawn to it. It will be noticed that on entering the pump the water does not pass straight through, but is carried round on either side of the pump body, as indicated by the arrows. The usual sources of trouble are (1) leakage through the gears; (2) leakage past the ends of the gears, due to too much clearance of the wheels in the casing; (3) breakdown due to obstructions in the pump, which trouble can usually be traced to bad gear cutting.

The teeth should be properly-cut involute teeth, the wheels being in gun metal, or some other non-rusting metal, as also the pump body. The leakage past the ends of the wheels has been cured in the Woolston gear pump by means of turned washers of a diameter equal to that of the pitch circle diameter, so that they are in rolling contact; the washers are fairly thick, and fit into suitable recesses bored in the pump casing. This method is not very expensive, and saves a lot of fitting, besides appreciably increasing the efficiency of the pump.

To find the output of a given pump, let

S = the tooth space in square inches, shown on fig. 26,
l = the length of the tooth in inches;
n = the number of teeth in *both* wheels;
N = the number of revolutions per minute;

then the theoretical output

$$= \frac{S \times l \times n \times N}{277 \cdot 27} \text{ gallons per minute.}$$

The efficiency should be taken as ·5, then the probable output

$$= \frac{S \times l \times n \times N}{554 \cdot 5} \text{ gallons per minute}$$

$$= \frac{S \times l \times n \times N}{9 \cdot 24} \text{ gallons per hour.}$$

The diameter of the inlet and outlet pipes should be

$$\frac{D \times N}{15}$$

where D = diameter of cylinder,
N = number of cyclinders,

the bore being given in the same notation as D.

The pump is usually run off the spindle which drives the magneto, and should be driven at not less than 500 revolutions per minute, for above this speed the output is approximately proportional to the speed, and unaffected by pressure. As little suction as possible should be given to the pump, the inlet and outlet should be as easy as possible, and all sharp curves avoided in the pipes, and to avoid the drop in pressure the water should be taken through from cylinder to cylinder, and not divided, as is usually done.

(*To be continued.*)

THE BRUSH QUARTZLITE LAMP EXHIBITION.

Messrs. The Brush Electrical Engineering Co. Ltd., of Loughborough, and 1, Kingsway, W.C., have opened at 37 and 38, Strand, an exhibition at which are shown samples of their new Quartzlite lamp. The burner of this lamp consists of a tube of quartz containing a small quantity of mercury, and when switched on a brilliant cylinder of light of great intensity is produced, which has considerable penetrating power. On a 100-volt circuit the lamp gives 1,800 candle power, and consumes one-third of a unit per hour. On a 200 to 250 volt circuit it gives 3,000 candles, and takes about two-thirds of a unit The colour of the light is at present unsuitable for houses and shops, but for open spaces and for factories, etc., the Quartzlite should prove a cheap and convenient form of lamp. No attention or renewal is required for about 2,000 hours burning.

The Minnehaha.—The Atlantic transport steamer Minnehaha, which was saved from a perilous position on the Scilly rocks some months ago and afterwards towed to Southampton, has left the dry dock, and after coaling proceeded to London to resume her sailings towards the end of the month on the Trans-Atlantic route.

APPARATUS FOR AUTOMATICALLY CONTROLLING THE REVERSAL OF ELECTRICALLY-DRIVEN MACHINE TOOLS.

The construction of the apparatus is of the kind in which a tumbler is thrown by the table or other reversing part of the machine, and the improvements which have been patented by Messrs. Wm. Beardmore and Co. Ltd., Glasgow, in conjunction with Mr. J. A. Sykes, comprise a weight moved alternately in opposite directions over the vertical dead centre of its pivot, and first lagging behind and then over-running the part which moves it—a dashpot preferably controllable so connected to the tumbler device as to control its over-running movement, and also connected to the tumbler device an electric controller switch or switches operating the circuits for reversal and control of the motor by which the tool is driven.

Fig. 1 is a side elevation, fig. 2 a front elevation showing the purely mechanical parts, and fig. 3 a rear elevation showing the switch gear.

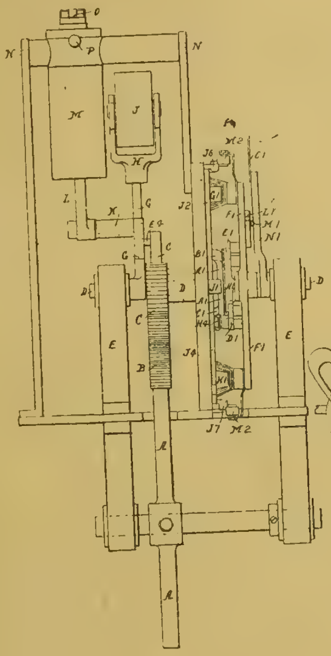


Fig. 1.

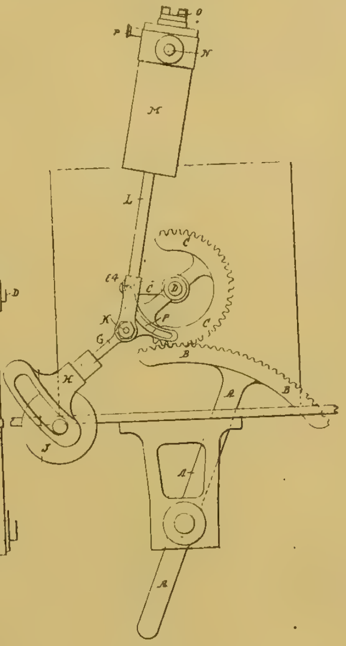


Fig. 2.

In brackets projecting downwardly from the base of the apparatus, there is a shaft having on it a lever A adapted to be moved in the usual manner by tappets on the moving table or equivalent part of the machine tool to which the controlling device is applied. This lever has on it an arc B of teeth gearing with an equivalent arc of lesser radial distance upon a second lever C. The lever C is mounted freely upon a horizontal shaft D, which, as will be seen in fig. 1, is supported on brackets E fixed to the base.

On the kicker lever C (as it may be termed) is a pin E^4 engaging an arc slot F in a tumbler lever G fast upon the shaft D and bearing in an arc-slotted head H a rolling tumbler weight J. A pin K also connects the tumbler lever G with the piston rod L of a pneumatic dashpot cylinder M on pivots N. The cylinder M is provided with a non-return valve O for the free outlet of air and with a regulatable valve P for the controlled inlet of air.

In operation of this the mechanical part of the device, the tappet on the table or other part of the tool, towards the end of its stroke and travelling to the right in fig. 2, encounters the first lever A and moving it, moves, through the gearing B on it and on the kicker lever C, the latter lever. The pin E^4 on that lever engaging the end of the arc slot F in the tumbler lever G moves that lever with its rolling tumbler weight J up towards the vertical dead centre, at the same time moving the piston in the cylinder M through the rod L and pin K towards the inner end of its stroke and expelling air through the valve O. Upon the dead centre of the weight J and tumbler lever G being passed, the weight falls to the opposite end of its slot and the tumbler also falls, the weight of the parts then acting at an effective radial distance. The period of their fall is, of course, controlled by the adjustment of the valve P.

The tumbler lever G, it will be remembered, is fast upon the shaft D, therefore that shaft is rocked concurrently with its movement, and it is of course clear that reversal of the movement of the lever A by the machine tool at the other end of its stroke performs the same action in the reverse direction, returning the parts to their original position shown in fig. 2

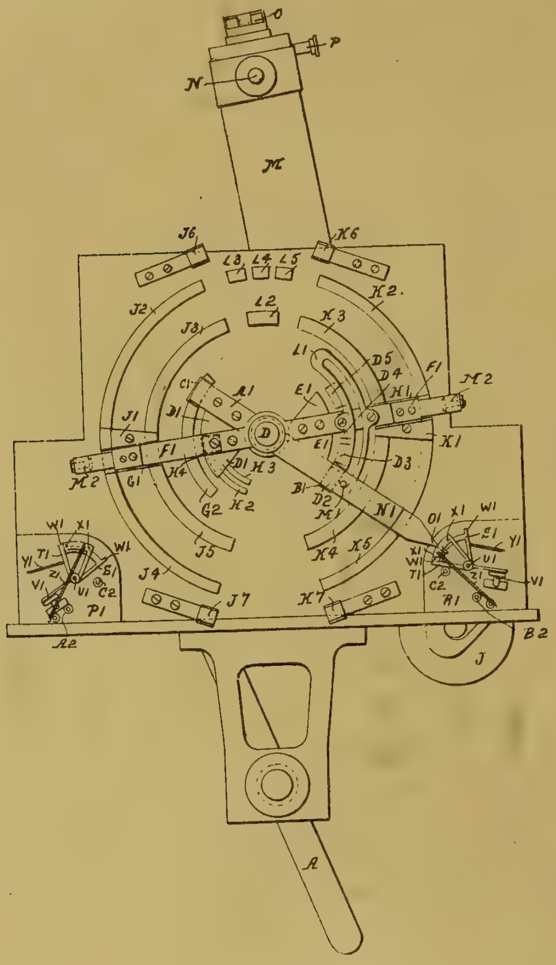


Fig. 3.

The electrical gear is shown in fig. 3, and consists of a starting switch arm A^1 loose upon the shaft D carrying brushes $B^1 C^1$ (fig. 1) engaging contact strips. The starting switch arm A^1 is engaged by tappet blocks $D^1 E^1$ upon a reversing switch arm F^1 loose upon the shaft D. This arm F^1 carries brushes $G^1 H^1$ (fig. 1) engaging contact strips, and its travel is limited by stops $J^1 K^1$ fixed to the base. Fixed to the arm F^1 is an arc slot guide L^1 engaged by a pin M^1 on a lever N^1 fast upon the shaft D, so that this lever N^1 moves both switch arms $A^1 F^1$ successively as determined by the tappet blocks $D^1 E^1$ and arc slot guide L^1 and pin M^1.

This lever N^1, swung by the operation of the device through a wide arc, bears on its outer end a finger O^1, which engages and throws alternately in opposite directions two contact breaking and making devices raised on blocks $P^1 R^1$ to a convenient distance above the base, omitted from fig. 1.

These devices each consist of a pair of quadrants $S^1 T^1$ mounted one above the other loosely on a pin U^1. The lower quadrant S^1 has an arm bearing a switch device V^1 and two projecting tappets W^1, while the upper quadrant T^1 has on it two pins X^1 engaging between the tappets W^1 with considerable lost motion. The lower quadrant S^1 is controlled by a light spring Y^1, while the upper quadrant T^1 has a stronger spring Z^1 so positioned that it passes from one side to the other of the quadrant pivot, and so tends to continue the movement of the quadrants in one direction or the other after they have been moved to mid position. The switch device V^1 makes or breaks contact with studs $A^2 B^2$, while stops C^2 limit the travel of the quadrants in the other direction.

The finger O^1 on the lever N^1 engages between the pins X^1 on the quadrants in passing them and trips the switch devices to make or break circuit as it is moving in one direction or the other. That is to say, in either the open or closed position one or other of the pins X^1 lies in the path of the finger O^1 and that finger encountering it moves the quadrants over dead centre, when the spring Z^1 drives them ahead of the moving finger, moves the pin in front of the finger out of its path, and the pin behind the finger into its path (so that the finger strikes it when next it travels in the reverse direction).

The brushes B^1 C^1 carried on the starting switch arm A^1 and interconnected by a conducting strip are adapted to engage contacts $D^2 D^3 D^4 D^5 G^2$, while the two contacts $H^2 H^3$ are bridged by a third brush H^4 on the arm F^1.

The brushes $G^1 H^1$, which are insulated from the arm F^1 on which they are carried, engage contact strips $J^2 J^3 J^4 J^5$, $K^2 K^3 K^4 K^5$, $L^2 L^3 L^4 L^5$, while the ends of the arm F^1 may bear sparking contact rollers M^2 connected to the brushes and engaging counterpart rollers $J^6 J^7$, $K^6 K^7$, connected to the strips $J^2 J^4$, $K^2 K^5$, and rollers (not shown) connected to contacts L^3, L^4, and L^5.

The contacts $J^2 J^3 J^4 J^5$ and $K^2 K^3 K^4 K^5$, operated by the brushes $G^1 H^1$ on the arm F^1, control the main circuit and act therefore for reversal, those $L^2 L^3 L^4 L^5$ operate usual brake circuits and devices, while the remainder G^2, $D^2 D^3 D^4 D^5$, operated by the brushes $B^1 C^1$, control the motor starting device, and $H^2 H^3$, operated by the brush H^4, control the motor field, while the trip contact devices controlling the contacts $A^2 B^2$ operate further control devices by means of alterations in the motor field.

Considering the tappet lever A to be just moving towards the left (fig. 3) under the impulse of the machine tappet at the end of the cutting stroke, the finger O^1 on the arm N^1 trips the quadrant switch device and closes the contact B^2, which effects in known manner the stiffening of the field of the motor, the slowing of the motor, and the return of current to the mains. The brush H^4 on the lever F^1 then opens the circuit $H^2 H^3$. The brushes $G^1 H^1$ on the arm F^1, which is, of course, moved by the arm N^1 through the guide L^1 and pin M^1, then break their respective circuits $J^4 J^5$, $K^2 K^3$, and the tumbler weight J, having commenced to fall, it continues the movement of the parts under control of the dashpot cylinder M. The braking contacts $L^2 L^3 L^4 L^5$ are next successively engaged by the brush H^1 and the motor stopped. Continued movement of the parts under the controlled fall of the tumbler weight J causes the various brushes then to make successive contacts, reversing the motor, starting it, and speeding it up until the trip switch device being operated by the finger O^1 on the arm N^1 and the circuit A^2 opened, the motor runs at the predetermined speed for the high-speed return stroke, reversal in opposite cycle of course taking place when the lever A is engaged and moved in opposite direction and back to its original position by the other machine moved tappet.

THE USES OF COAL GAS.

A writer in the *Zeitschrift des Vereines Deutscher Ingenieure* discusses the employment of coal gas and the reasons which have hastened its development or stopped its use. It has been superseded by electricity for lighting purposes, but it has found new fields of usefulness in heating and as a source of motive power. Gas accommodates itself readily to the requirements of small grates, and high thermodynamic results can be obtained. It is easily regulated as regards the size of its flame, and as to temperature by the admixture of air, and in laboratories a regularity of temperature can be attained up to one-tenth of a degree. Gas is, moreover, a very valuable adjunct for subsidiary operations in the largest works. Soldering, annealing, and tempering, especially for tools of all shapes and kinds; heating mould furnaces by gas gives all the advantages of other methods without the inconveniences; when used for heating an oil bath or a salt bath it admits besides of maintaining the polish of steel. Tempering furnaces have numerous applications in all the industries by reason of their convenience, of their rapid heating, and of their small dimensions. In addition to the above, mention may be made of soldering furnaces, brazing furnaces, furnaces for the fusion of precious metals, and for special purposes. There are quite a number of industries in which gas heating is of the greatest service. Lastly, there are apparati in which intermittent use is made of hot water, or of boiling water, and where such regulation is required that the use of gas affords the only satisfactory solution of the problem. All these uses for coal gas, which grow larger as time goes on, assure for it a safe future.

NOTICES OF MEETINGS, &c.

October 28th.—Coventry Engineering Society. Annual General Meeting.

The Institution of Electrical Engineers (Manchester Local Section). Meeting at the Physical Laboratory of the University of Manchester at 7·30 p.m. Address by J. S. Peck, M.I.E.E.

North-East Coast Institution of Engineers and Shipbuilders. Annual General Meeting.

October 29th.—The Glasgow and West of Scotland Technical College Scientific Society. Meeting at the Technical College, when a paper will be read on "Paper Making," by Wm. Linwood.

Association of Engineers-in-Charge. Social. Ladies' Night.

October 31st.—Institute of Electrical Engineers. General Meeting to be held at Armstrong College, Newcastle-on-Tyne, at 8 p.m.

Institute of Marine Engineers. Presidential address and presentation of awards by Sir David Gill, K.C.B.

Bradford Engineering Society. Paper on "Utilisation of Waste Heat in Boiler Flue Gases," by Geo. R. Tansley, Esq., B.S., A.M.I.C.E.

November 1st.—Manchester Students' Section of the Institution of Electrical Engineers. Meeting to be held at the Municipal School of Technology, Sackville Street, Manchester, at 7-30 p.m.

Institute of Marine Engineers. Meeting at 58, Romford Road, Stratford, London, E.

November 4th.—Institute of Marine Engineers. Annual Dinner at the King's Hall, Holborn Restaurant.

November 5th.—The Birmingham Association of Mechanical Engineers. Monthly meeting. Paper on "The Flywheel," by J. Batey.

New P. and O. Steamers.—The new mail boat which is being built at Greenock for the P. and O. Co. is to be called the Medina, and the sister ship which is in progress at Belfast the Maloja. They are much bigger vessels than the Mörea, measuring 12,500 tons gross, as compared with her 11,000 tons, and in some respects the excellent original design has been improved upon.

THE "LEA" WATER RECORDER.

The measurement and automatic recording of the flow of water through channels and pipes has for long occupied the attention of inventors, and a number of devices intended to effect this operation with accuracy have from time to time been brought out. This might be expected when it is remembered that water has been used from the earliest ages, although no doubt in earlier times but little importance was attached to accuracy of measurement.

The subject, however, is at the present time a very important one to all engineers and steam users who wish to run their plants economically.

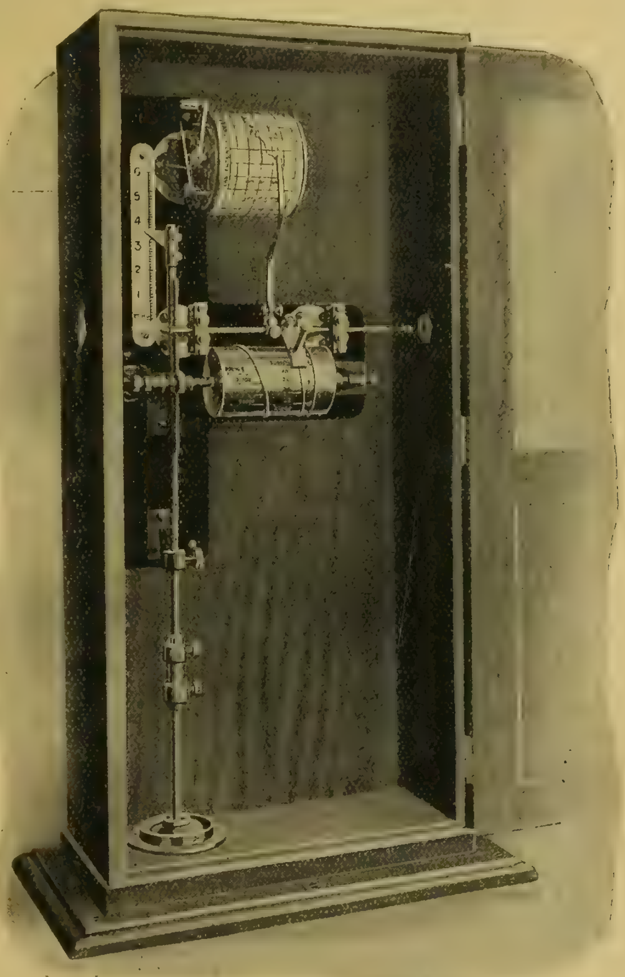


Fig. 1.

It is well known that in the generation of steam power from two-thirds to three-fourths of the total generating costs may be debited to the boiler house. It is also admitted, by the highest authorities, that the average "heat efficiency" of steam boilers throughout the country is very low. Mr. E. G. Constantine, in his presidential address to the Manchester Association of Engineers, January 17th, 1903, said "that he doubted whether the average efficiency was more than 55 per cent, and of the boilers and economisers combined 65 per cent, whereas 80 per cent could be obtained, with care, from the two combined."

In view of the above facts, the question at once arises: Why are boilers, generally speaking, so inefficient? There are many answers to the above question. One answer, however, is that it has been a somewhat difficult matter to measure and test efficiency at any time, since this necessitates the accurate measurement of the feed water, and this has been a difficult matter in many cases.

The function of a boiler is to produce steam. In other words, every boiler house may be regarded as a steam factory, the raw materials being coal, air, and water, and the finished product "steam." If, however, a boiler house is not provided with means for measuring what it produces, and what it has been built for, it is difficult for the engineer-in-charge to say whether his boilers are doing well or badly. He does not know. In other words, he is working in the dark, and hence, in many instances, the efficiency is very low. In the presidential address to the Association of Engineers-in-Charge, Mr. W. H. Patchell, M.Inst.C.E., said recently: "It is an unfortunate fact that in many cases an engineer-in-charge does not really know what his plant is doing, and all for the want of tests which he could carry out himself with very slight expense or inconvenience." It is obvious that if we knew each day, or each week, not only how much coal was burnt (for this is generally known), but how much steam was produced, we should be in possession of the main facts about out boilers, and it would be impossible for any serious loss of efficiency to occur without its being at once detected; or, as Mr. W. H. Patchell further remarks (in the address previously referred to): "These two measurements, coal and water, give sufficient data for checking the cost of evaporation, which is the most important factor in the works cost of private plants." It is not necessary to dilate further upon the great importance to be attached to the correct measurement of boiler feed water, or, what is the same thing, to the measurement of the main product of the boiler house, namely, steam. Our boilers may be doing well or they may be doing badly, but if we do not know how much steam they produce we cannot say what is happening.

In order to show the savings which may be effected by working boilers under the best conditions, some figures, given by Mr. Bryan Donkin, in "Heat Efficiency of Steam Boilers," might be quoted with advantage. In referring to the value of long-continued tests on boilers, at some factories in Germany, he says: "During these four years the evaporation of water per pound of coal increased in Rottweil 28 per cent, on the new boilers at Duneberg 14 per cent, and in the old boilers 25 per cent. The cost of evaporation fell 39 per cent in Rottweil, and 28 per cent in Duneberg, representing a gain for 1894 alone of nearly £6,000."

The Lea patent water recorder described and illustrated below is made by Messrs. The Lea Recorder Co., 28, Deansgate, Manchester. The instrument is not claimed to be the only instrument or meter which can measure boiler feed water correctly, but it certainly possesses advantages over some other types of meter, in certain cases, and especially in such cases where it is desired to have a continuous record of the "product" of the boiler house.

It is a well-known fact that when water is caused to flow through a V-shaped notch, it can be measured most accurately. This fact was pointed out by Professor James Thompson, of Belfast, in papers which he read before the British Association more than 50 years ago.

The object of the instrument under consideration is to measure and record graphically, in a convenient and simple manner, the variations in the "rates of flow" of water when flowing through such notches, the records being produced in such a way that it is easy to determine the total weight of water passed during any interval of time. It is actuated solely by the rise and fall of a float, immersed in (or connected with) the tank containing the notch.

The illustration, fig. 1, which shows a standard 6-in. recorder of the rack and pinion driven type, and fig. 2, which shows the method of arranging the apparatus for measuring boiler feed water, serve to make the action of the instrument clear. To the float previously mentioned is attached a spindle which passes through the bottom of the instrument case. Upon this float spindle is a rack which gears into a small pinion upon the axis of a drum, revolving between hardened pivot centres. Upon the body of this drum is a screw thread (either raised or sunk), the contour of which is the "curve of flow" for the V (or other shaped) notch, in connection with which the instrument is used; and, just as the flow through a notch increases rapidly with the depth, so the pitch of the screw increases in the same proportion.

Above this spiral drum is a horizontal slider bar, supported on small pivoted rollers, and carrying an arm, at

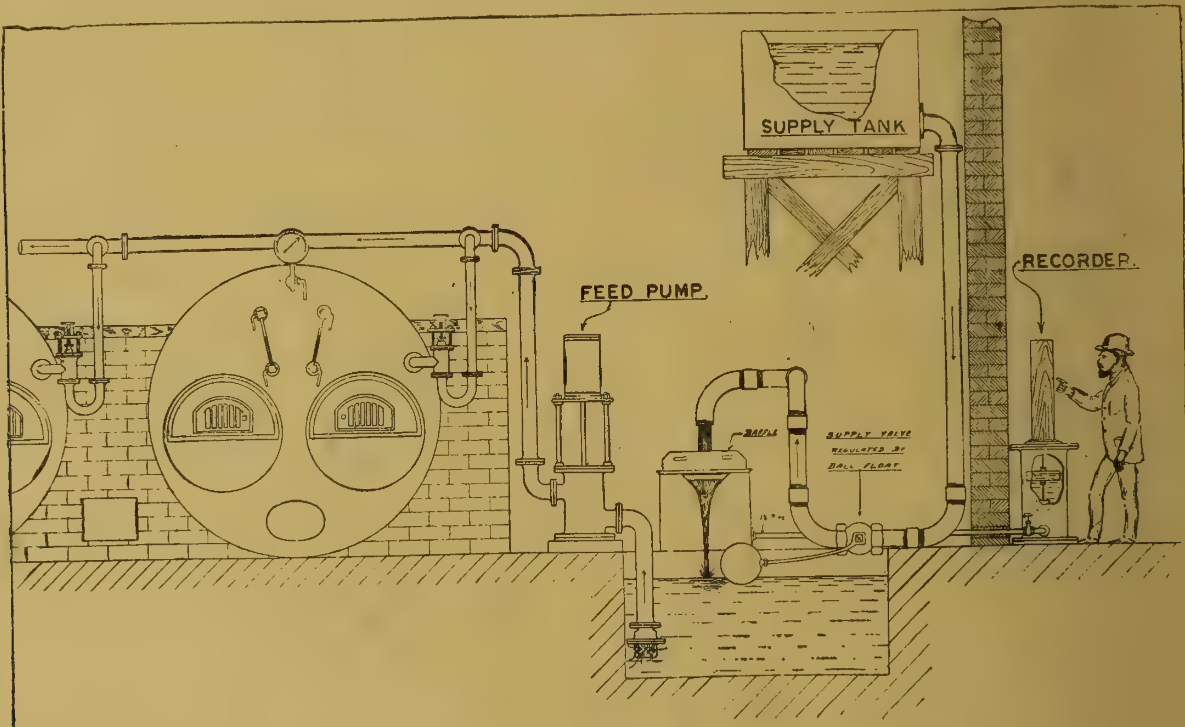


FIG. 2.

the upper end of which is a pen or pencil point, in contact with a chart paper upon a clock-driven recording drum, which, as a rule, revolves once in 24 hours. As the float rises, the spiral drum is rotated, and its motion is imparted to the slider bar (and pen arm) by means of a saddle arm projecting from the latter, and engaging at its lower end with the screw thread. On the body of the spiral drum is a graduated scale, adjacent to the screw thread, and marked out in pounds per hour. It will be thus seen that the spiral drum serves a double purpose, *i.e.*, it rectifies the motion of the pen so that it moves equal distances for equal increments in the rate of flow, and provides a magnified scale for making very accurate observations of the rate of flow at any moment.

A pointer also at the top of the float spindle moves along a vertical scale (marked in inches), seen at the left-hand side of the photo, and indicates, at any moment, the actual depth of water in the notch.

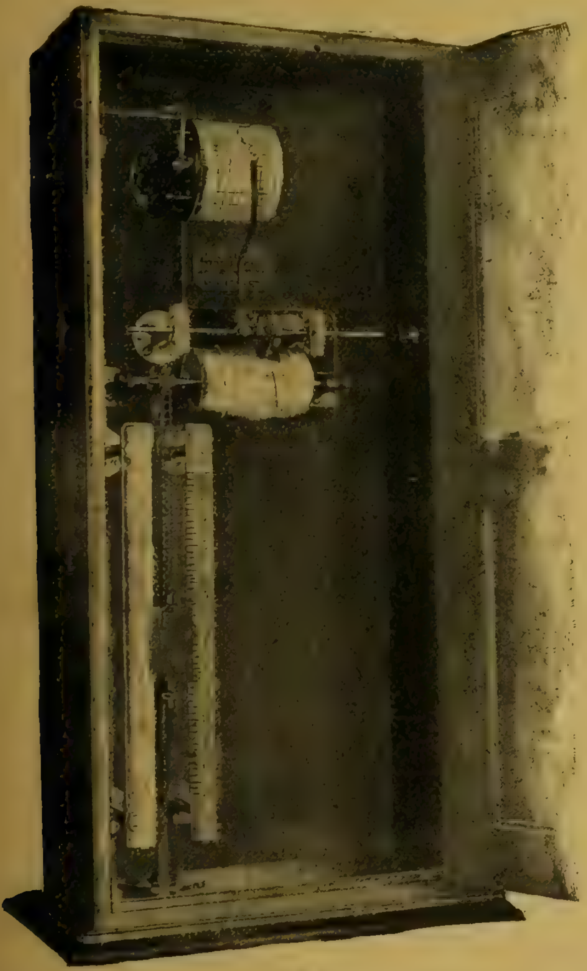


Fig. 3

To sum up the matter briefly, the main points embodied in the instrument are as follows: The actual depth of water in the notch can be observed at any time; the instantaneous "rate of flow" in pounds per hour can be seen with a high degree of accuracy; the recording pen, which moves in direct proportion to the flow, produces a diagram whose area is a measure of the total quantity passed, and this can easily be deduced by means of a planimeter.

Fig. 3 of our illustrations shows a standard 13-in. recorder of the chain-driven type. To the float, previously mentioned, is attached a spindle which passes through the bottom of the instrument case. From the top of this spindle, a chain is led over a sprocket wheel upon the axis of a drum, revolving between pivot centres, as shown. At the free end of the chain is a weight, which slides between two vertical scales. This weight not only keeps the chain taut, but is supplied with a pointer, which indicates, at any moment, the actual depth of water in the weir or notch. Upon the body of this drum is a screw thread (either raised or sunk), the contour of which is the "curve or flow" for the weir or notch, in connection with which the instrument is used; and, just as the flow through the notch increases rapidly with the depth, so the pitch of the screw increases in the same proportion.

Above this spiral drum is a horizontal slider bar, supported on small pivoted rollers, and carrying an arm, at the upper end of which is a pen or pencil point, in contact with a chart paper, upon a clock-driven recording drum, which, as a rule, revolves once in 24 hours. As the float rises, the spiral drum is rotated, and its motion is imparted to the slider bar (and pen arm) by means of a saddle arm projecting from it, and engaging at its lower end with the screw thread. On the body of the spiral drum is a graduated scale, adjacent to the screw thread, and marked out in gallons or pounds per hour.

The V notch is the most accurate, and, in many cases, the most convenient one to employ, therefore it might be well to describe it more fully. This form of notch possesses a property which no other kind does possess, viz., that the section of the flow through it is, at all times, of the same shape, viz., a triangle; and it is this fact which tends to simplify and to make more accurate the formula for the flow. The value of this form of notch was first demonstrated by Professor Jas. Thompson, of Belfast. He drew attention to the subject in papers read before the British Association in 1858, and again in 1861. After making very extended experiments, he said: "The results of my experiments are highly satisfactory. . . . I am confident of them being very accurate, ... I find them to be in close accordance with the law which had been indicated by theoretical considerations." Professor Thompson held firstly that the rate of flow at any instant should be proportional to the cross sectional area of the section, and therfore to h^2; secondly, that the rate of flow at any instant should be proportional to $\sqrt{h}$, from considerations as to velocity. He therefore concluded that the formula for expressing the flow at any time would be of the form:—

$$Q = h^2 \times \sqrt{h} \times \text{constant};$$

and this he proved to the case in a most conclusive manner.

The value of the constant, derived from his experiments, was 0·305, or

$$\text{Cubic feet per minute} = Q = h^2 \times \sqrt{h} \times {\cdot}305,$$

where h = height of water in notch in inches.

In fig. 2 is shown the method of arranging the apparatus for measuring boiler feed water.

It is easily seen, that by using a ball float to control the supply to the suction well, and by leading the water whilst on its way to the well ***first*** through the notch tank, the flow through the notch at any moment will represent what is being drawn out by the feed pump and sent to the boilers. In other words, if the pump is working slowly, the flow is small; if the pump is working quickly, the flow is large; if the pump stops, the flow stops. By this arrangement, the diagram produced by the instrument gives a daily record of what has passed through the notch into the boilers, and, therefore, not only is the total evaporation obtained, but also the times at which the greatest and least evaporation took place, are all written up and recorded. That is to say, a complete record is given each day of everything that takes place in the boiler house, so far as producing steam is concerned.

In the illustration, the recorder is shown set over a separate float chamber, at a distance from the tank, and connected with it by means of a pipe. It could, however, have been placed immediately over the tank, if it had been preferred, and this latter position is the "ideal" one, and as a rule the most convenient.

Fig. 4 is a reduced illustration of an actual boiler house record from an electric power station.

This recorder, when measuring hot water, possesses a compensative action, owing to the fact that when the temperature increases the density of the water is reduced, and consequently the float sinks slightly, and thus the instrument records less. On the other hand, when the temperature falls, the float rises, owing to the increased density of the water, and the instrument records more. This automatic action of the float tends to produce true records, by weight, over a large range of temperatures.

off, directly, upon counting dials, the total amount of water passed, over a weir or through a V notch, during an interval of time, in the same way as is done in the case of an ordinary gas or water meter.

In the case of the standard recorder the total amount or weight passed is obtained from the area of the chart record, by means of a planimeter, or otherwise. Whilst this is, of course, a very simple and accurate operation, and one which in very many cases is quite sufficient, there are, at the same time, many instances where it is a great convenience, and in some cases an absolute necessity for the total quantity passed to be read off directly and quickly. It is with the object of meeting the demand for an integrating or weir meter that this instrument has been devised, and already it has been most successfully employed in a number of cases.

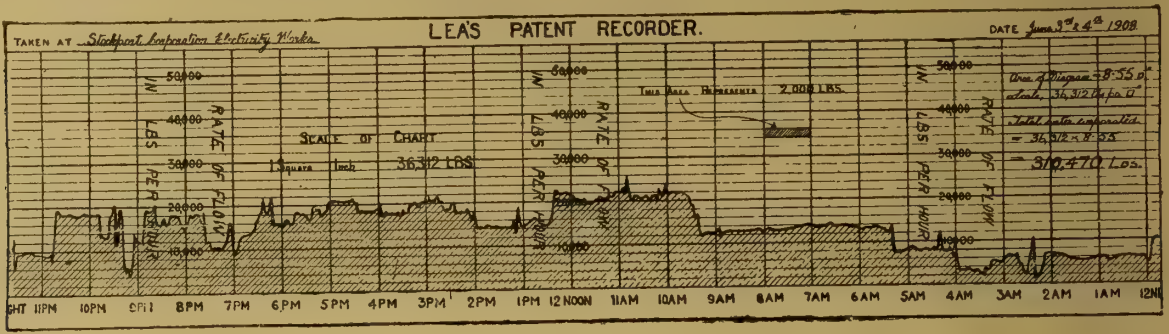


Fig. 4.

The advantages of the apparatus may be summed up as follows: Extreme simplicity; great accuracy where V-shaped notches can be used; no parts in contact with the liquid, except the float; the "rate of flow" can be observed at any time; a continuous record of the flow is obtained.

The applications are numerous; amongst the most important are: The measurement of streams, of compensation water, supplies to reservoirs, the discharges from pumps and pumping engines, boiler feed water, air-pump discharges, and circulating water for condensers.

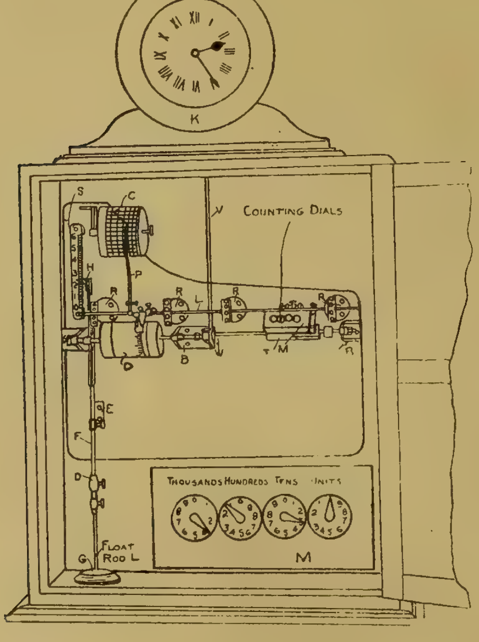


Fig. 5.

Figs. 5 and 6 show the Lea integrator. This machine (for it partakes more of the nature of a strong machine than of a delicate instrument) provides a means of reading

Fig. 5 shows a general view of the instrument. As the counting dials are comparatively small, they are shown, for greater clearness, and to an enlarged scale, at the bottom right-hand corner of the illustration. Fig. 6 shows an enlarged view of the toothed spiral drum and counting gear. Referring to fig. 5, it will be seen at a glance that the left-hand portion of the instrument is simply a reproduction of the standard recorder, and that

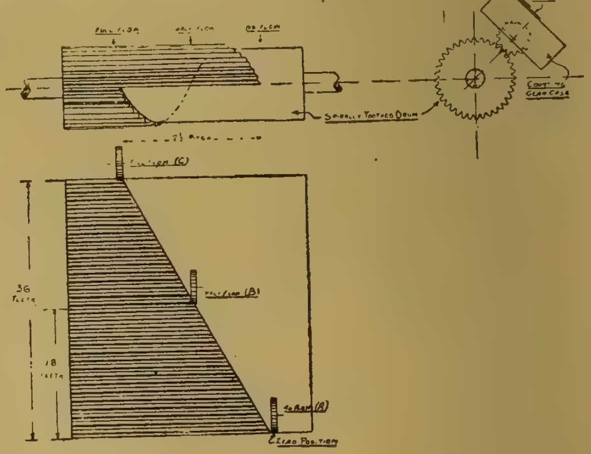


Fig. 6.

the integrating gear is at the right-hand side. The integration action may be described briefly as follows: K is a powerful eight-day clock, driven by a falling weight. This clock drives the vertical spindle V, and this spindle, by means of bevelled gearing, drives the horizontal (pivot-supported) shaft W at a constant speed. Upon the axle W there is a toothed or corrugated drum, the teeth of which, it will be noticed, are cut away in a regular spiral manner at the right-hand side. Above this toothed drum is the gear box M or case containing the counting train of wheels. This is driven by a pinion, which engages intermittently with a fewer or greater number of teeth upon the previously referred to toothed spiral drum according to its lateral position. This position of the gear box and pinion is determined by the amount of movement of the long horizontal slider bar L, to the left, from the zero position, the motion of this bar L having been "rectified" or made directly proportional to the rate of flow by means of the irregular spiral drum D described with reference to fig. 1.

When no water is flowing over the weir, and when the instrument is, of course, at zero, the toothed spiral drum is out of contact with the driving pinion of the counting dials. When the rate of flow is, say, half the maximum the driving pinion comes into contact with the toothed drum T over half its circumference (see fig. 6).

When the rate of flow is at its maximum, the pinion is driven continuously by T, and so on, for all intermediate rates of flow, between zero and the maximum, the counting pinion and the dials are driven in a proportionate manner, and thus, as the toothed drum T revolves continuously at a regular speed, the total quantity of liquid passed is integrated or counted up in a very simple manner.

It will thus be seen that the driving of the counter is absolutely positive, that there is nothing about the instrument in the nature of "slip," and that all water passed must be registered.

AN IMPROVED WHEELED CARRIAGE FOR FLYING MACHINES.

The wheeled carriage described in this article is intended for application to flying machines which are dependent upon attaining a certain speed through the atmosphere in order to effect flight, and comprises a wheeled carriage in combination with skids, which are employed for landing purposes, and in which combination the advantages incident to the use of both wheels and skids are maintained.

Wheels have been before combined with skids on flying machines, but the object of the present improvement is to provide a construction which shall be of great strength, light weight, shall not involve the employment of numerous or heavy parts, and which does not offer any considerable amount of head resistance, while the chassis or wheel framework is so constructed that it has great flexibility and is therefore capable of enduring the shocks and strains, to which it may be subjected to in use, without damage.

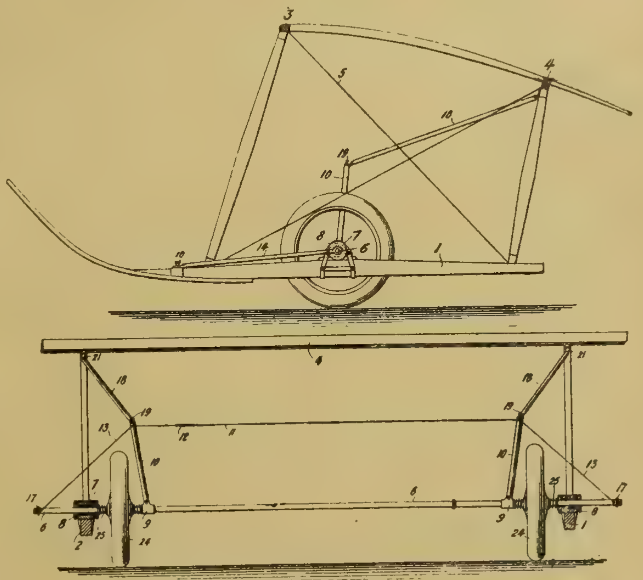
For this purpose a long tubular axle is employed, which passes transversely over and laterally beyond the skids about the central part of their length, and is held thereto by indiarubber bands or other flexible connections, the axle being non-revolvable and carrying two road wheels, which are free to revolve thereon and to have a certain amount of lateral or sideway motion against the action of helical springs located on the axle.

This long tubular axle is trussed or braced by means of struts, the lower ends of which are mounted upon the axle and extend vertically in a plane at about right angles to the ground and are connected at their upper ends by tension wires extending from strut to strut and to the extending ends of the axle. In order to support the axle against rearward motion, stays extend therefrom to the forward portion of the skids, and struts also extend from the upper ends of the vertically extending axle struts to the upper rearward portion of the framework of the skids, so as to maintain the axle struts in their vertical or approximately vertical positions.

The joints of the struts extending from the upper ends of the axle struts to the skid framework are loosely made or have the character of universal joints, as also where rigid stays are used extending from the ends of the axle to the forward ends of the skids. The jointing is also of a somewhat loose or flexible character, and when such forwardly extending stays are of flexible material, such as steel wire, the axle itself is free to have some endway motion.

This improved wheeled carriage, which is the invention of Messrs. H. L., A. E., and H. O. Short, Battersea Park, London, aeronautical engineers, is clearly shown in our illustrations, fig. 1 of which is a sectional end elevation of the skid framework with the wheel chassis combined therewith. Fig. 2 is a front elevation of the same, fig. 3 is a plan view of a portion of one of the skids and the wheel chassis adjacent thereto, fig. 4 is a sectional elevation showing a construction of loose joint connecting the rearwardly extending strut to one of the vertical struts, fig. 5 shows a construction of joint for the rearward end of the strut, and fig. 6 is a sectional plan view of the latter joint.

Referring to figs. 1, 2, and 3, the skids 1 and 2, which extend longitudinally of the machine parallel to each other and at a distance apart, are supported from the front spar 3 and back spar 4 of the machine, and are stayed in any suitable or well-known manner by, for instance, wire stays, such as 5. The axle 6 extends transversely of the machine, passing over and beyond the skids 1, 2, to which the axle is connected by an elastic connection composed of indiarubber bands 7, such as shown at figs. 1 and 2, held to the skids and passing over shouldered sleeves 8 (fig. 2), through which the axle 6 passes. Fixed upon the axle 6 at a comparatively short distance from the inner face of each sleeve 8 is a collar 9, and between lugs on each collar is pivoted a tubular strut 10 extending vertically upwards in a plane at about right angles with the ground, and the upper ends of these struts 10 are connected by a wire tie 11, which may be provided with any ordinary tensioning device, as at 12, fig. 2. From the upper end of each strut ties 13 extend to the adjacent overhanging end of the axle 6. In the construction illustrated at figs. 2 and 3 the ties 13 are double, and the connection of the ties 11 and 13 with the upper ends of the struts 10 may be of any convenient or well-known character, as, for instance, the wire tie can be threaded through a hole drilled in the upper ends of the struts 10 and through a hole drilled in the ends of the axle 6, and the whole structure can be brought to the requisite tension by means of the tensioning device 12.



Figs. 1 and 2.

To support the axle 6 against rearward motion, towards each end, the axle 6 is connected by stays 14, 15 to the forward part of the adjacent skids 1, 2, and where, as is illustrated, one of these stays, such as 14, is of rigid character, such as steel tube, the joints respectively to the skid at 16 and to the end of the axle at 17 are loose joints, so as to permit of some play; for instance, the joint at 16 may consist of a pin upstanding from the skid and passing through a hole in the end of the stay 14, which is of somewhat larger diameter than the pin, and it may be held on to the pin by a nut or by a split pin, or the like. Instead of making the stays 14 rigid, as shown, it may be composed of a flexible steel wire, whereby the axle 6 will be capable, under stress, of bodily having some lateral or endway movement. In the drawing, fig. 3, there is shown an additional single wire stay 26 from the end of axle to the forward part of the skid. The stays 14 and 15 prevent the tubular axle from moving backwards due to the force which the wheels are subjected to on landing, while also stays permit of the axle having an angular motion, during which latter the stays 14 and 15 serve as radius arms. The upper rearward struts 18, one of which extends from the upper end of each vertically extending axle strut to the upper and rearward part of the skid framework, are also loosely jointed to the respective parts to which their ends are attached, so as to permit of the movement of the wheel chassis and also so as to better resist damage due to shock.

FIG. 3.

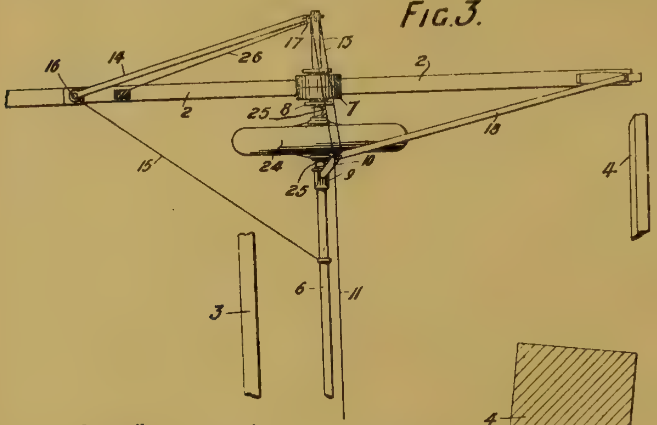


FIG. 4.

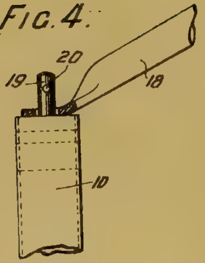


FIG. 5.

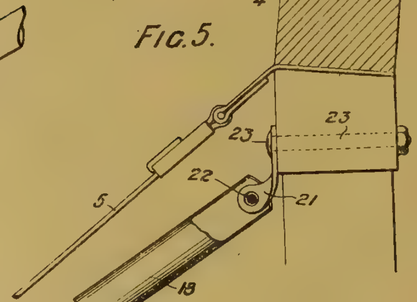
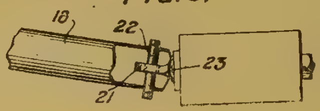


FIG. 6.



In fig. 4 is shown the joint of the upper strut 18 to the vertical axle strut 10, from which it will be observed that the end of the tubular strut 10 is plugged and has a projecting pin 19, over which fits the flattened end of the strut 18, the hole formed through the end of the strut 18 being larger in diameter slightly than the pin 19, and being prevented from leaving the pin 19 by a split pin or the like 20. Fig. 5 shows the joint of the rear end of the upper strut 18 to the framework 4, where a tongue 21 is loosely pivoted by a pivot pin 22 to the rear end of a strut 18, and this tongue 21 is hinged on a bolt 23 passing through the framework.

The wheels 24—which may be pneumatic tyred—are mounted so as to be free to revolve upon the axle 6, and each wheel is located between the collar 9 on the axle 6 and the sleeve 8 which is within the elastic connection, and the wheels are permitted to have endway sliding motions upon the shaft controlled by helical springs 25 in both directions.

The axle 6 is so resiliently held to the skids 2 by the indiarubber bands 7 that the weight of the machine will normally be supported upon the wheels 24 without the skids 1, 2 contacting with the ground, but upon the machine descending with some force or descending and passing over obstructions, such as ditches or gullies, the skids will come into action, and the shocks, which would otherwise damage a rigid supporting framework for the wheels, is taken up by the flexible construction.

Briefly, the novel features of the carriage may be said to consist in the combination with skids and a skid framework of a wheel chassis consisting of a tubular axle extending transversely over and laterally beyond the skids, means for connecting this axle to the upper surfaces of the skids to permit of resilient upward motion relatively to the skids, freely revolvable wheels carried upon the axle adjacent to the skids, struts extending from the axle and a tension tie connecting the ends of the struts to each other and to the extending ends of the axle, rearwardly extending struts to maintain the axle struts approximately perpendicular to the ground, and forwardly extending stays connecting the axle to the forward part of the skids to support the axle against rearward motion while permitting the latter to have upward motion relatively to the skids.

INTERNAL-COMBUSTION ENGINES FOR MARINE PURPOSES.

In the report of Lloyd's Register for the year terminating last June, it is mentioned that the use of internal-combustion engines for marine purposes has hitherto been confined to small vessels and yachts, but the possibility of the use of this description of engne as the motive power of large vessels is now becoming a question of immediate and practical importance. The internal-combustion engines in most general use on land and also those fitted in small vessels are worked upon the four-stroke cycle principle, and are single-acting, so that with each cylinder there is only one impulse for two revolutions of the shaft. With this type of engine there is considerable difficulty in effecting the reversal of the direction of rotation of the engine, and when these engines are used for marine purposes the astern motion of the screw has usually been obtained by the use of toothed wheel gearing.

Comparatively recently there has been a development in the Diesel oil engine for marine work. A two-stroke cycle has been successfully adopted, and the reversal is effected in the engine itself, the crankshaft being directly coupled to the screw shaft. The Diesel oil engine is now being fitted to three fairly large vessels being built on the Continent under the supervision of the surveyors of Lloyd's Register. One set is being constructed on the older principle of the four-stroke cycle with single-acting cylinders, and will be of about 450 I.H.P. Another set is being made on the two-stroke cycle, also single-acting, and is intended for a twin-screw vessel, the power being about 900 I.H.P. on each shaft. The third set is being made on the two-stroke cycle double-acting system, each cylinder providing two impulses per revolution; this also will be fitted in a twin-screw vessel, the total power being about 1,800 I.H.P. In each of these cases the engines will be directly coupled to the screw shafts.

In a set of internal-combustion engines, which is being constructed under the society's survey in this country for a vessel of about 260 tons, there are several novel features. The engines are intended to work with gas produced on board from anthracite coal. The cylinders are of comparatively small size, and the engines are intended to run at a high rate of revolution, and will not be reversible. The connection with the screw shaft will be made by means of a hydro-dynamic transformer, in which a turbine pump driven by the engine delivers water to another turbine coupled directly to the screw shaft. The arrangement is such that the screw shaft will rotate at a much less rate of speed than the engines, and provision is also made for reversing its direction of rotation.

New Cunard Liner.—The announcement has been made that the Cunard Co. has definitely approved the plans of Messrs. Swan and Hunter, Newcastle-on-Tyne, for a steamship 1,000 ft. long, 90,000 H.P., and to steam 25 knots.

NEW BUILDING OF THE INSTITUTION OF CIVIL ENGINEERS.

On Tuesday, the 25th October, the foundation stone of the new building of the Institution of Civil Engineers was laid by the President, Mr. Inglis. The formal inauguration of the work was witnessed by a number of members. The Institution of Civil Engineers was established in 1818, and 10 years later was incorporated by Royal Charter "for the general advancement of mechanical science, and more particularly for promoting the acquisition of that species of knowledge which constitutes the profession of a civil engineer." The number on its roll is at present 9,136, of whom about 2,500 members reside and practice in the Colonies and Dependencies of the Empire, or are engaged in engineering enterprises in foreign countries.

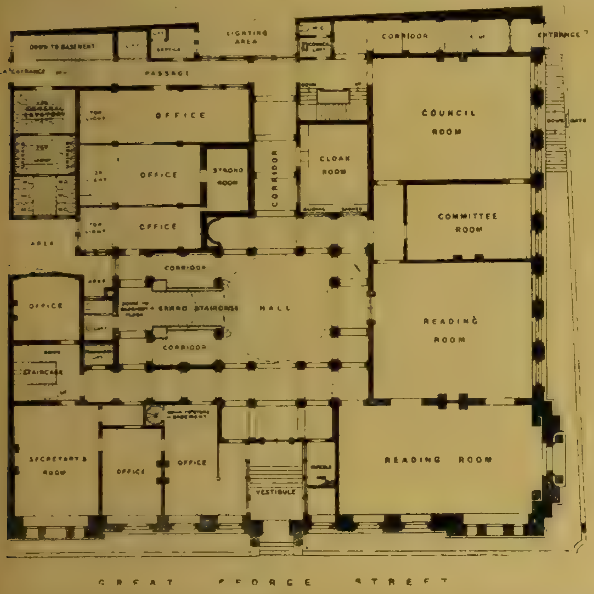


Fig. 1.—New Building, Institution of Civil Engineers. Ground Floor Plan.

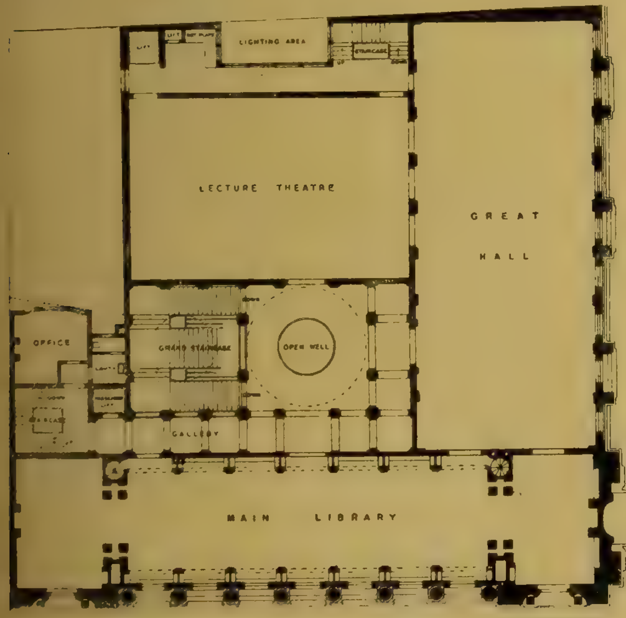


Fig. 2.—New Building, Institution of Civil Engineers. First Floor Plan.

The Institution is regarded as representative of the general body of British Civil Engineering, and—aided by advisory committees of its members in Australia, New Zealand, Canada, and South Africa—directs and controls at its headquarters varied activities which have devolved upon it and widespread interests which have been committed to its charge. Since 1838 its premises have been at 25, Great George Street, Westminster. The present building was erected in 1896, but the site being now required for the extension of the Government Offices, its reinstatement on a larger site affords an opportunity to meet and forestall in a comprehensive manner present and future needs, and to erect a building worthy of the importance and prestige which the Society has attained.

Our illustrations show the ground floor, first floor, and second floor plans of the new building, which has been designed by Mr. James Miller, F.R.I.B.A., and is in style a modern rendering of the later renaissance. The architect's design for the elevation and the main floors of the building, which will be situated at the corner of Great George Street and Princes Street, are appended. The premises will occupy an area of some 21,000 square feet, and will have frontages both to Great George Street and to Princes Street—an incident to their erection being the widening of the northern part of the latter thoroughfare, which will form a great public improvement.

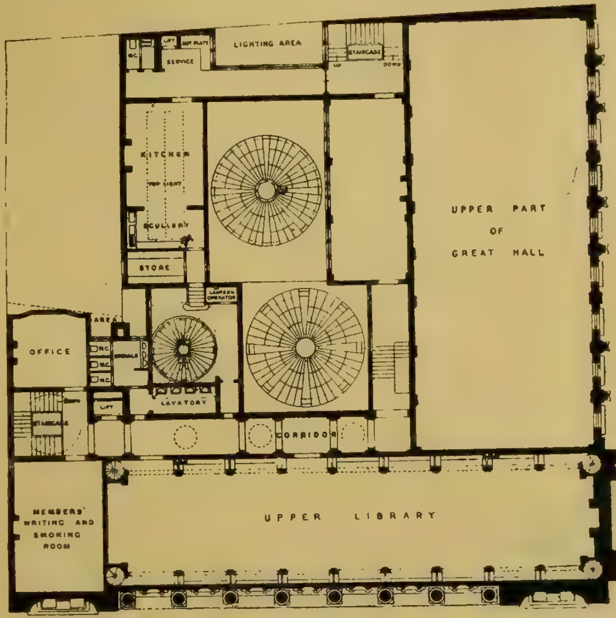


Fig. 3.—New Building, Institution of Civil Engineers. Second Floor Plan.

On the ground floor will be situated the Council and Committee rooms, the reading rooms, and general offices. The first floor will be occupied chiefly by the Lecture theatre, the great hall, and the main library—the apartments being arranged and connected together in a convenient manner for the reception of large numbers of people. Further library accommodation will be afforded on the second floor, where also will be a writing and smoking room for the members. Provision for the general service of the premises, including the heating and ventilating apparatus, extra cloak rooms, etc., and for storage, will be made in the basement and on the third floor.

It is confidently anticipated that the new premises will lend themselves satisfactorily to the purposes of the Society and the needs of its members; and an interesting feature in the construction of the building will be the introduction of the timbers and certain other products of various parts of the British Empire, which may serve to symbolise in some degree the close relationship of those who constitute the Institution of Civil Engineers in all parts of the world.

* * *

Statistics are published of the great progress of Krupp's works for the past year. These show that on July 1st the firm employed 68,726 officials, clerks, and workmen, who with their families made up the population of a large town. 37,761 were employed in the steel foundry and gun-testing grounds alone.

IMPROVEMENTS IN ELECTRIC SWITCHES.

THE improved electric switch described below is especially applicable to motor controllers of the type wherein the brush is carried by a vibratory or radial arm, and wherein a low voltage coil under the control of the operator is employed to limit through pawl and ratchet mechanism the operation of the switch. A special feature in the switch is the means by which the low voltage device may be rendered inoperative, at the will of the operator, while the switch is being moved, so that the switch may be moved freely without interference.

The construction of the switch is shown in our illustrations; fig. 1 is a front elevation of a controller, fig. 2 a section, and fig. 3 is a diagrammatic view of the circuit arrangement of the device. Referring to fig. 1, upon a base 2, preferably formed of slate or like insulating material, a contact member 3 is mounted, in the form of a semi-circular segment of brass. A second arc-shaped segmental contact 4 is mounted on the base, and in a continuation of the arc of the segment 4, a purality of contact buttons 6 are also secured upon the base between which the field resistance of the motor is connected. The armature resistance is connected with a series of contact segments 7 circularly mounted upon the base 2, and one terminal of the armature of the motor is arranged to be connected with an arc-shaped contact segment 8 mounted on the base in a continuation of the arc formed by the contact segments 7. A controller arm 9, pivotally mounted upon a stud 10 secured to the base 2, is provided with a brush 11 arranged to sweep over and engage the segment 4 and contact buttons 6, and a carbon brush 12 is arranged to sweep over and engage contact segments 7 and 8. The brush 12 is preferably held in close engagement with the contact segments by a spring arm 13 mounted upon the arm 9.

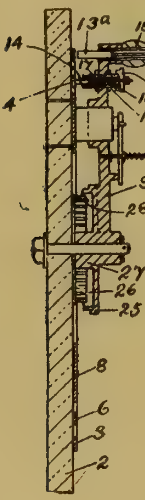


FIG. 2

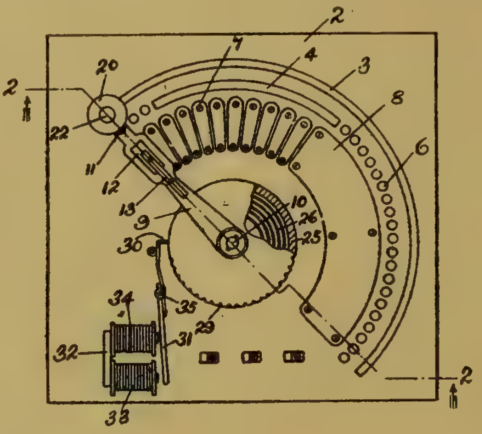


FIG. 1.

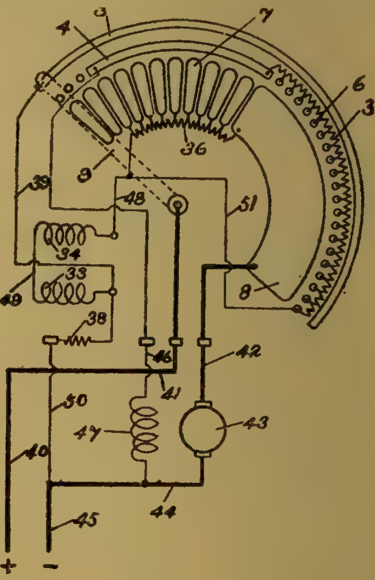


FIG. 3.

The construction of the brush 11 is more clearly shown in fig. 2. It will be noted that this brush consists of a copper pencil 14 mounted upon a rod 15 and operating in a sleeve 16 secured upon the arm 9. A coil spring 17, interposed between a cap 18 of the sleeve and the pencil 14, maintains the pencil in close engagement with the contact segment 4 and the buttons 6.

In addition to the above contacts, a third contact is provided on the arm 9, which, while normally out of operative position, may, at the will of the operator, be moved into engagement with the segment 3. This contact comprises a copper contact pencil 18^a operating in a metal cylinder 19 arranged in a central opening in the handle 20. One end of the cylinder 19 is secured to the arm 9, and, in addition to providing a cylinder for the contact 18^a, serves to stiffen the handle 20. The contact 18^a is mounted upon the lower end of a rod 21, which extends through the cylinder 19 and is provided at its upper end with a push button 22, whereby the contact 18^a is operated. A coiled spring 23, interposed between the button and a nut 24 secured on the upper end of cylinder 19, maintains the contact in its normal or raised position.

The switch arm 9 is secured to a drum 25, in which is arranged a flat spring 26, having one of its ends connected to the hub 27 of the switch arm, and its opposite end connected to a stud 28 mounted upon the base 2. The spring 26 has a tendency to maintain the arm in the "off" position. The outer periphery of the drum 25 is provided with a series of notches 29 adapted to receive a pawl 30 mounted upon the armature 31 of a low-voltage device 32. The low-voltage device 32, as illustrated in the drawing, comprises a pair of magnets 33 and 34, which, when energised, attract the armature 31 and force the pawl 30 into the notches formed on the drum 25. The armature 31 is pivotally mounted upon the base 2 by a stud 35.

In the diagrammatic view illustrated in fig. 3 it will be noted that one terminal of the armature of the motor is connected with one end of the segment 8, and that the armature resistance 36 is divided into sections connected with the contact segments 7. One terminal of the field of the motor is connected with the segment 4, and the field resistance 37 is divided into sections connected with the contact buttons 6. The switch arm 9 is connected with one side of the main line, and the windings of the magnets 33 and 34 are connected with the first of the live segments 7 on one side, and through a resistance 38 with one side of the main line. A short circuit for these magnets is provided by the conductor 39, which is connected at one end to the segment 3.

The operation of the apparatus is as follows: Assuming the switch arm 9 to have been moved to the first of the live contacts 7, a circuit for the motor is closed from one side 40 of the line by conductor 41, through the switch arm 9, through the first of the contacts 7, through the armature resistance 36, contact segment 8, conductor 42, through the armature 43 of the motor, by conductor 44, back to the opposite side 45 of the line. At the same time a circuit is closed from the switch arm 9, through the contact brush 14, to segment 4, by conductor 46, through the field winding 47 of the motor, and by conductor 44, back to the opposite side 45 of the line. There is also established a third circuit from the arm 9, by conductor 48, through the winding of the magnet 34, conductor 49, through the winding of the magnet 33, resistance 38, conductor 50, back to the opposite side 45 of the line. With the above circuits established, the motor is started with all the armature resistance in circuit, and the low voltage device 32 energised to cause the pawl 30 to engage the notches 29 on the drum 25. In the event of the operator desiring to leave the arm in this position, it will be held by the pawl 30, against the action of the spring 26. Assuming, however, that the operator desires to move the arm 9 to a position where the motor is operating with all the armature resistance cut out of circuit, in order that the handle may move freely and not be retarded by the pawl 30, the operator presses the push button 22, thereby causing the brush 18^a to engage the segment 3. This closes a short circuit around the winding of the magnets 33 and 34 as follows: From the arm 9 to the segment 3, by conductor 39, through the resistance 38, and by conductor 50, to the opposite side of the line. The low-voltage device is thus directly and without the intervention of any levers or other mechanical appliances short-circuited, whereupon the pawl 30 releases the drum 25, and the switch arm 9 may be freely moved to the desired position. When the switch arm has been moved to the position desired by the operator, by releasing the push button 22, the short circuit around the magnets 33 and 34 is again opened, and the magnets are energised to cause the pawl 30 to engage the notches 29, and thus to hold the arm in the position to which it has been moved. By a continued movement of the arm 9 in a clock-wise direction, after the armature resistance has been cut out, the resistance 37 may be inserted in the field circuit, and the field by these means so weakened that the speed of the motor will be materially increased. A shunt around the fields is provided by the conductor 51, which takes up the discharge of the motor when the circuit is opened.

This improved electric switch, which is the invention of Messrs. The Cutler Hammer Manufacturing Company, of Milwaukee, U.S.A., has been patented in this country by Messrs. Adams Manufacturing Company, of 106, New Bond Street, London, W., by whom it is being manufactured.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 20th October, 1910.

CARDIFF.—*First class :* L. R. Hugh, G. Iliff, W. G. Liley W. J. Heney, A. E. Rees. *Second class :* C. Lafrenais.

BARROW.—*First class :* T. Thomson, W. A. Hughes.

GLASGOW.—*First class :* A. Fraser, A. E. Simpson. *Second class :* C. N. Hunter, A. McA. Croll, J. M. Macleod.

LIVERPOOL.—*First class :* W. T. L. Lyne, L. P. Bradshaw, J. Cross, R. E. Jones. *Second class :* G. W. Hall, J. T. Hindle, S. J. McNally, T. Stopforth, G. A. Williams.

LEITH.—*First class :* W. Small, J. H. Cumming. *Second class :* R. P. Baxter, D. Redfern.

LONDON.—*First class :* W. S. Turner, S. Vlassopoulos. *Second class :* W. L. May.

NORTH SHIELDS.—*First class :* E. G. Jackson, G. D. Taylor.

PLYMOUTH.—*Second class :* R. J. Drew.

SOUTHAMPTON.—*First class :* B. J. Parker, H. O. Jones. *Second class :* C. N. Hunter.

WEST HARTLEPOOL.—*First class :* W. R. Watson. *Second class :* J. N. Drummond, B. J. Leigh, T. R. Story, L. T. Swanwick. E. A. Tindale, R. J. Vickers, S. J. Wheatley, W. J. Whittaker

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ORDERS FOR CLYDE SHIPBUILDING.—According to the *Shipping World* orders to £250,000 have been received for the following vessels: For the Argentine service, a steamer of 4,000 tons; two first-class passenger steamers, each of 1,200 tons, for Paraguay and Parana; four barges of 1,000 tons each; four steam tugs; and six small barges.

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"Elementary Treatise on Physics: Experimental and Applied." By E. Atkinson, Ph.D. Translated from Ganot's "Elements de Physique." Eighteenth Edition. Edited by A. W. Renold, M.A., F.R.S. London: Longmans, Green and Co. Price 15s. net.

THIS is the new edition of a treatise which has long held a leading position on the literature of physics.

The fact that the revision and added matter is from the pen of a late professor of physics in the Royal Naval College, Greenwich, is a guarantee that the portion retained is thoroughly reliable and that new matter is up to date.

The subjects have been re-aranged, and a more systematic division into chapters has been adopted. The size of the book, containing as it does 1,225 pages, is evidence of the mass of information to be found within the covers.

The general arrangement is firstly into 10 books, these being divided into 74 chapters. As to subjects, these comprise the mechanics of matter, force and motion, gravitation, the physics of liquids, gases, sound, heat, light, magnetism, frictional and dynamical electricity. The chapters on telegraphs and telephones, direct and alternate current dynamos, electric oscillations and wireless telegraphy, have been extended. Also among other subjects new matter will be found in connection with gyroscopes and their application in modern inventions, aerial navigations, colour photography, turbine engines, refrigeration, radiation, and radio-activity.

Both the authors are experienced lecturers in the subjects dealt with, and hence, as the contents of the book indicate, are alive to the needs of elementary students and others attending trade schools and evening continuation classes. The object kept in view has been the revised requirements of the Board of Education.

Modern methods of calculation are adopted, the fundamental principles are explained, and the introduction to the various branches of the subjects have received special care, and when it is stated that the treatment is sufficient to meet the needs of Stage 1 in practical mathematics and practical plane and solid geometry, the scope of the book will be fully understood.

We cordially recommend this text book to one and all, and a digest should undoubtedly place a student in an advantageous position. We anticipate an early call for the new edition or reprint.

"Our Home Railways."—The continuing numbers 10 and 11 of this series comprise articles upon the Lancashire and Yorkshire Railways, Great Central Railway, the Underground Electric, and the Caledonian and Glasgow and South-Western. The two numbers fully maintain the interest already inspired by the numbers already referred to. There now only remains No. 12, which takes in the three North of Scotland railways—the North British, Great North of Scotland, and the Highland. The 12 numbers are intended for binding into two volumes. They will constitute a unique publication of considerable interest to all who are attracted to the working of our railway systems.

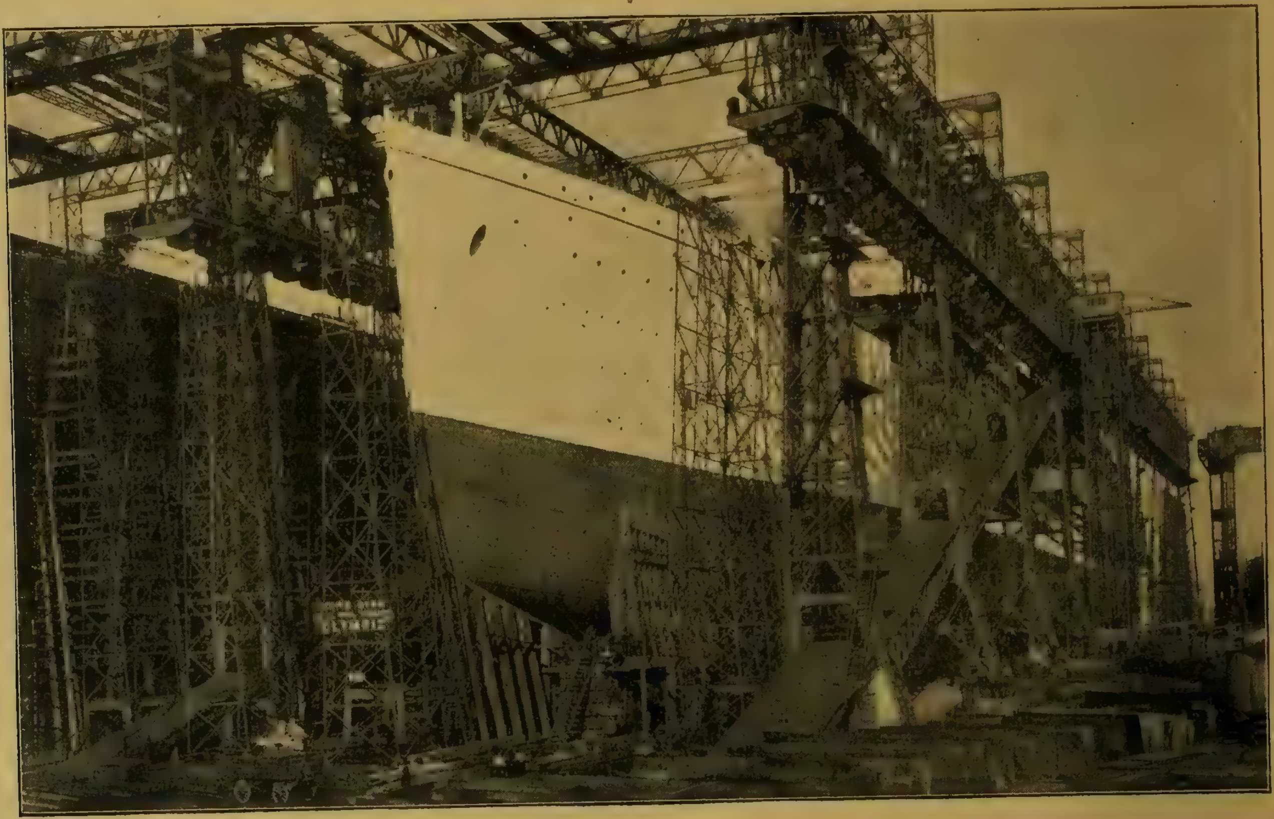
BOOKS RECEIVED.

"How to Use the Electric Light with Economy." A Simple Instruction Book. By F. H. Taylor. London: Percival Marshall and Co. Price 6d. net.

THE NEW WHITE STAR TRIPLE-SCREW STEAMER OLYMPIC.

On the 20th October the new Royal Mail White Star triple-screw steamer Olympic was successfully launched from the yard of Messrs. Harland and Wolff Ltd., at Belfast. Our illustrations show the vessel on the stocks just before launching, and the actual launch, showing the vessel taking the water. The vessel is nearly 900 ft. long, 45,000 tons gross register, and 66,000 tons displacement.

The name Olympic is well chosen, as it stands for excellence and triumph, and this vessel follows a long line of predecessors, each marking an advance on the other, and every step that has been taken has been based on actual knowledge of its practical possibilities, conjoined with a firm belief in the future of steam navigation, that has been amply justified.



THE WHITE STAR TRIPLE-SCREW STEAMER OLYMPIC ON THE STOCKS.

The Olympic, as an instrument of commerce, will represent the highest skill and perfection yet reached in naval architecture. Her principal dimensions are as follows: Length over all, 882 ft. 6 in.; breadth over all, 92 ft. 6 in.; breadth over boat deck, 94 ft.; Height from bottom of keel to boat deck, 97 ft. 4 in.; height from bottom of keel to top of captain's house, 105 ft. 7 in.; height of funnels above casing, 72 ft.; height of funnels above boat deck, 81 ft. 6 in.; distance from top of funnel to keel, 175 ft.; number of steel decks, 11; number of watertight bulkheads, 15.

These particulars give some idea of the vastness of the structure; but, although she is the lagest vessel ever built, her mere size is not impressive to the accustomed eyes of those who are concerned with modern shipping. Like all the White Star ships, the Olympic is very graceful, and only by contrast with other ships can her magnitude be appreciated.

The launching weight, about 27,000 tons, was the heaviest weight ever transferred from land to water, and this operation, always (in spite of long experience) a matter of anxiety to those responsible, was naturally, in the case of such a vessel, an undertaking of unusual importance. The method of launching, however, was one of the simplest imaginable, the vessel being held on the ways by hydraulic triggers, only requiring to be released by the opening of a valve in order to let the vast structure glide into the water.

Besides being the largest and heaviest vessel ever launched, the Olympic is undoubtedly also the strongest. Both in design and workmanship this has been kept in view, and the most approved structural arrangements suggested by the ripest experience have been adopted, and every mechanical device requisitioned to secure this end. The double bottom, extending the whole length of the vessel, 5 ft. 3 in. deep (increased under the reciprocating engine room to 6 ft. 3 in.), the massive beams and close framing, the large shell plates, the steel decks and watertight bulkheads combine to make a structure of exceptional strength and rigidity. The hydraulic riveting in the vessel is also an important factor, the whole of the shell plating up to the turn of the bilge being riveted by hydraulic power, and an immense amount of this riveting having also been carried out in other parts of the vessel—shell, top sides, decks, stringers, etc. The rivets were closed by means of the powerful 7-ton riveting machines suspended from the travelling frames on the gantry. As illustrating the importance of the riveting in this vessel, there are half a million rivets in the double bottom alone, weighing about 270 tons, the largest rivets being $1\frac{1}{4}$ in. in diameter; and in the complete ship there will be something like three millions, weighing about 1,200 tons.

The following particulars will also be found interesting: The largest shell plates are 36 ft. long, weighing $4\frac{1}{2}$ tons each; the largest beam 92 ft. long, the weight of the double beam being 4 tons; the stern frame weighs 70 tons; the after boss arms $73\frac{1}{2}$ tons, the forward 45 tons;

The Engineering and Machinery Exhibition, Manchester.

[CONTINUED.]

Messrs. J. Marse and Co., 44-46, Imperial Buildings, Ludgate Circus, E.C., show on their stand a "post" high-speed drilling machine, with a range of drilling from $^1/_{32}$ in. to 2 in., and capable of boring up to 4 in. in cast iron; a "Piat" hydro-electric riveting machine; "Piat" machine-moulded cast gears; and a "Lerba" machine and engine counter. These counters register, when worked in either direction, both reciprocating and rotating movements, and are fitted with a patented device for setting back to zero, even when the machine is in motion.

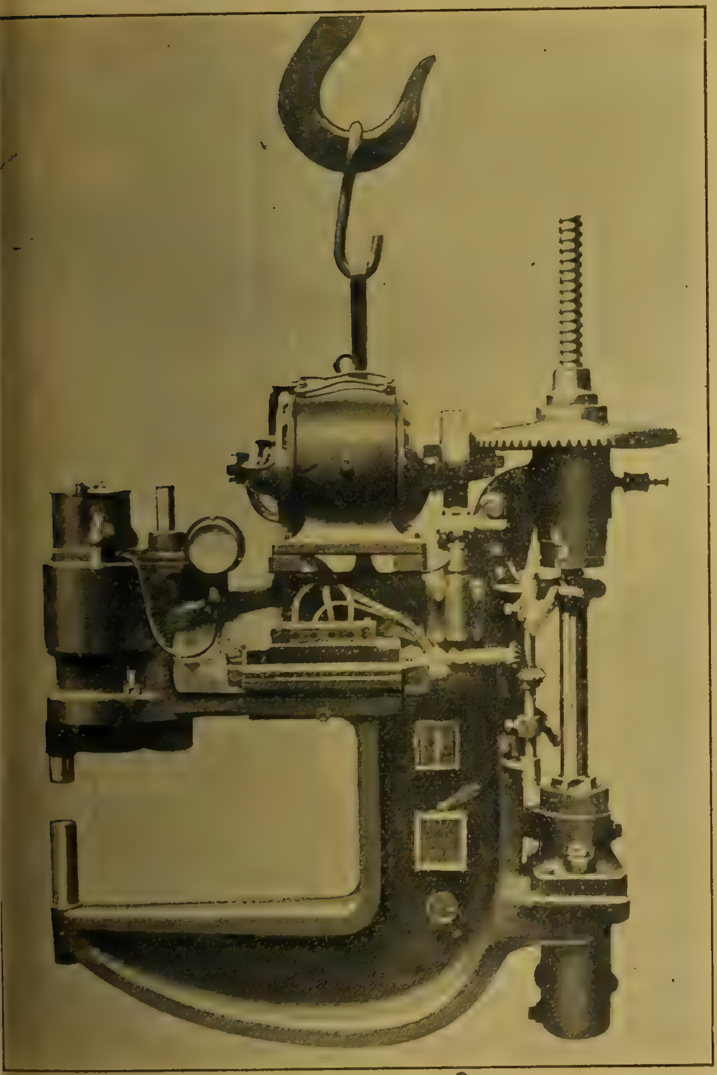


Fig. 1.—"Piat" Electro-Hydraulic Riveter. Portable Type.

Our illustrations show several views of the "Piat" hydro-electric riveting machines, for which Messrs. Marse are the sole agents in Great Britain. These machines are divided into two classes, viz., the direct-acting and the indirect-acting. In the former the two jaws are rigid and the compression cylinder placed immediately above the two snaps. There are two types in this class, the stationary and the portable. In this latter type there are several different ways of suspending the machine according to the work to which it is to be put. In the case of the indirect-acting class, the two jaws are hinged in the centre. In this type the compression cylinder is placed at the opposite end of the frame to the snaps, so that the machine is really formed of two double levers.

The actual working of the hydro-electric riveter is the same for all the types, and they differ from one another only in design. Taking as an example one of the direct-acting portable type, closing rivets up to $\frac{7}{8}$ in. diameter (see fig. 3), the main frame C is cast steel, the two snaps A and B being at the outer end of the frame; B is fixed and A is fitted on the end of a ram sliding within the cylinder D, while a smaller return cylinder E, in which is fitted a spiral spring for the return motion of the ram, is located behind D. The water is poured into the cylinder D connected by a copper pipe M to the compression cylinder F, which receives the piston G, having a square-thread H cut in the upper part.

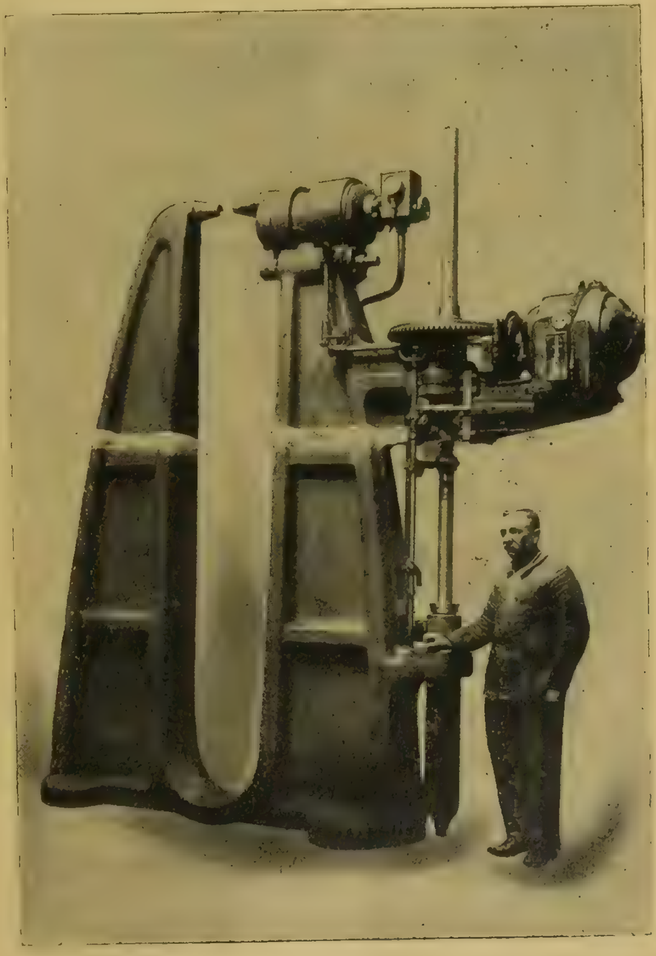


Fig. 2.—"Piat" Electro-Hydraulic Riveter. Stationary Type.

The electric motor is mounted on the main frame, and by means of a pinion K it turns the wheel L, mounted on roller bearings and screw cut inside to fit the thread H. The piston G being forced down, the water in F passes through the pipe M to the cylinder D and brings the snaps together. An adjustable stop *h* is fitted for regulating the stroke of the ram A. A small reservoir *a* is fitted to the top of the cylinder D for making good any loss, communication between the cylinder and the reservoir being established by the valve N. A gauge O indicates the pressures obtained.

The electric motor is controlled by a switch at P, which has a handle Q fitted to a shaft going through the switch box, filled with oil to preserve the contacts. In moving Q in an upward direction, a brake band round the wheel R, on the motor shaft, is released, the current is turned on, and the motor is set in motion. As soon as the handle Q is brought back to the central position, the current is turned off and the brake applied. The reverse movements are obtained by depressing Q. In order to work the handle Q at the proper time, an automatic trip gear is fitted to a vertical shaft connected by mitre gears S to the shaft of Q. Two cams T T can be clamped in any position on the vertical shaft, according to the pressure required in the cylinder D. The inclined faces of these cams stand in the path of a small wheel on the guide collar U; on the ram descending, the small wheel encounters the bottom cam and puts handle Q into the central position, cutting off the current and applying the brake. At this stage the snaps are closed on the rivet, and to release them the handle Q is depressed, thereby releasing the brake and starting the motor in the reverse direction. The motor continues running till the small wheel encounters the top cam and again places Q in the central position, cutting off the current and applying the brake. To facilitate handling, the machine is suspended by a hanger V fitted with ball bearings.

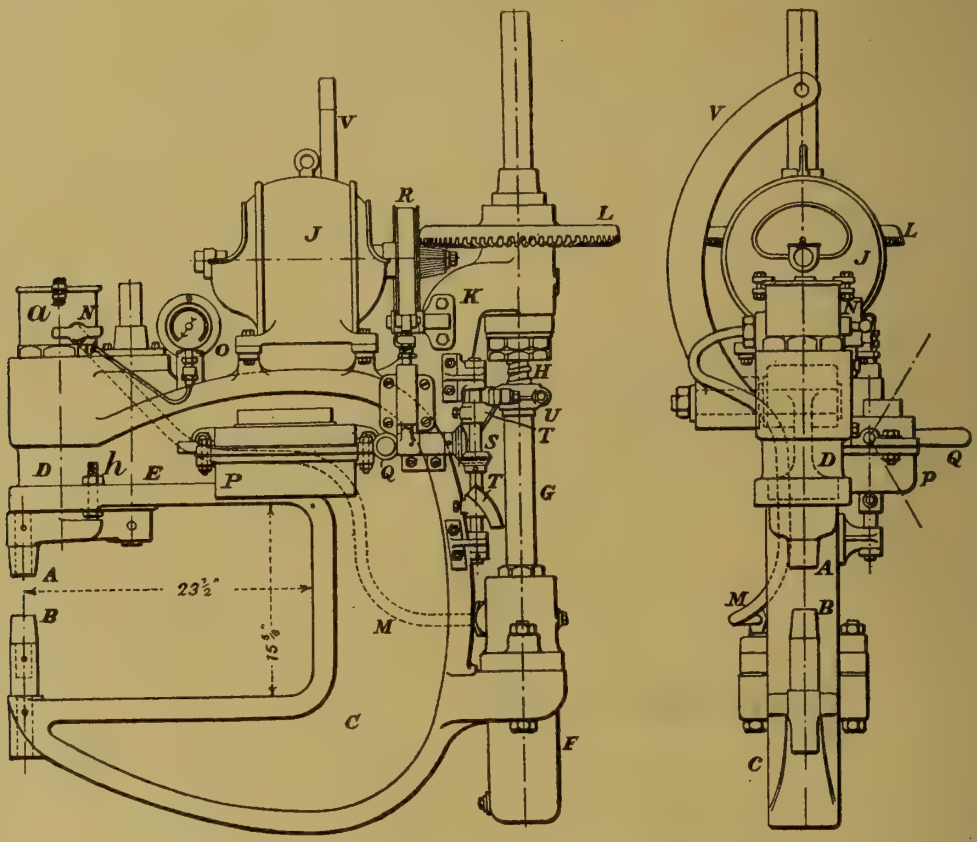


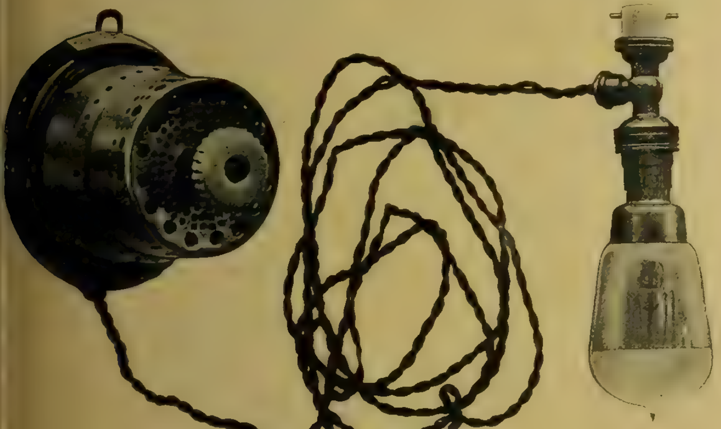
Fig. 3.—PRINCIPLES OF "PIAT" ELECTRO-HYDRAULIC RIVETER.

The time occupied in closing a $\frac{7}{8}$ in. rivet is from five to six seconds, and 400 can be closed with ease in an hour, a man and two boys being all the labour required. The motor is 2½ H.P., the total weight of the machine complete 15 cwts., and the total pressure on the rivet 30 tons. No skilled labour is required, as the machine is automatic in its action, and being of very simple construction, cannot get out of order. Again, the small quantity of water required to work the machine can be replaced at very little cost by a non-freezing mixture. The great advantages in saving of labour, and the fact that the machine can be transported to practically anywhere and worked in any temperature, are at once apparent.

Messrs. W. T. Nicholson and Clipper Co., Limited, King Street, Salford, show samples of belt fasteners, and in addition to the original "Clipper" belt tools and hooks, several new forms of belt fasteners. The "Klincha" tool and fasteners provide a quick means of making the joint, the hooks being connected together by means of a serrated metal strip. The firm also exhibit samples of Nicholson's special composition wire belt lacing, "Drednort" flexible belt fasteners, "Klincha Cable" belt fasteners, the most handy fastener for top drives; indestructible file or tool handles, a novel handle is shown which prevents the splitting of handles, and no danger of the tang of the tool running into the operator's hands; "Klincha" belt shifter, an improved tool for fixing belts on pulleys without danger; and "Grisol," a specially-prepared anti-corrosive paste paint for all metal work, cheaper than red lead, stands acids and ammonia fumes, and prevents oxidation.

Messrs. Snowdon, Sons, and Co. Ltd., whose sole agents for the Lancashire district are Messrs. Walsh and Dick, 7, Pall Mall, Manchester, have on their stand a very representative exhibit of their specialities, including their mechanical and automatic lubricators for crank pins, crankshafts and other bearings, eccentrics, slides, etc., and for the "Sinal" system of cylinder lubrication. Samples of the "Snowdrift" lubricant, which is made in five consistencies to suit various temperatures and for many special purposes, "Snowdene," an amber lubricant made in three qualities for shafting and open shell cap bearings, "Sinol," a cylinder lubricant for high speed enclosed vertical, horizontal, beam, and marine, and other engines. The "Huhn" patent metallic packing for steam, water, acids, gas, ammonia, CO_2, brine, oil, tar, spirit, varnish, etc. This packing consists of a white-metal shell, in which flake graphite is carried in receptacles so that as the packing is compressed the graphite is forced out against the rod.

Ferranti Ltd., Hollinwood.—The exhibit of electrical switch gear and similar appliances put forward by Messrs. Ferranti is striking evidence of the remarkably fine degree of "finish" to which this firm has attained in the design and production of their specialities. As a distinct novelty which will attract widespread interest, is to be mentioned a new class of variable resistance or rheostat. The conductor consists of a mixture of pulverised mica and graphite arranged in a series of cells or containers, the number and size of which depends upon the nature of the intended service and current handled. To the general user of electric light the compact regulator illustrated is particularly interesting. The insertion or reducing of the resistance is brought about with absolute and definite gradation by varying the compression of the graphite-mica conductor. It will thus be seen that the new variable resistance is no more than a fine perfection of the old-fashioned carbon plate or cloth resistances, by which a high range of resistance values can be secured and which permits of a fine and uniform degree of adjustment which was not possible with the old apparatus, whose great drawback was its small range and erratic changes of value. The regulator illustrated, which is suitable for use with incandescent lamps, small fans, etc., is supplied complete with fifteen feet of flexible cord and adaptor, as shown, and, at a list price of half a guinea, will doubtless meet with a ready sale. The regulator gives a complete adjustment from full brilliance to total switch-off, and this without the introduction of any contacts or sparking in the apparatus. Thus it is practically everlasting and free from wear and tear.



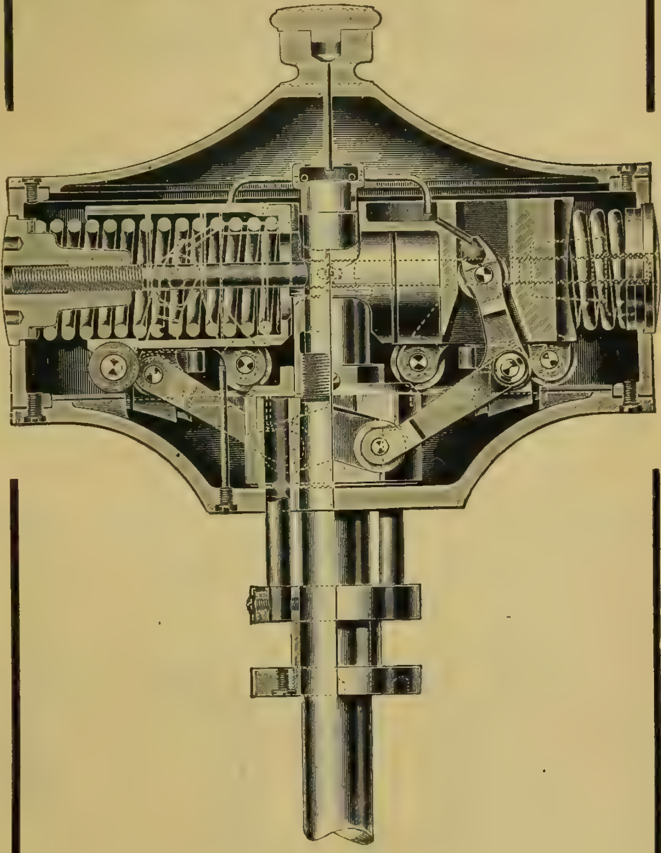
Ferranti Electric Regulator for Use with Incandescent Lamps, Fans, etc.

Not only is this class of resistance used for light and fan adjustments, but it is altogether suitable for large power service, and a regulator pillar for generator field control, etc., is exhibited, in which a column of several sections under compression by an ordinary hand-wheel and introducing no electrical contacts whatever is shown.

The company have also a representative show of their specialities in instruments, motor starters, and minor switch gears; the latter are particularly worthy of attention.

Messrs. Jens Orten-Boving and Company, 9½, Union Court, Old Broad Street, London, E.C., have a most interesting exhibit, including a collection of various types of governors constructed on the Jahns patents, and operating upon the centrifugal, inertia, and combined centrifugal and inertia principles; extreme sensitiveness,

THE
JAHNS
GOVERNOR.



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as well as steadiness in running, is obtained by guiding all moving parts on oil-immersed rollers. Tachometers, designed by Dr. Horn, on the spring pendulum principle; tachographs on the same principle, and capable of registering the most minute variations in speed; these instruments are constructed either for taking continuous records or for special tests of speed. They are stated to be specially suited for this last purpose, and can be adjusted to suit various ranges of speed, being largely used for testing gas and oil engines, as well by electrical or textile engineers. The flexible coupling of the Zodel-Voith type transmits power through a continuous leather belt resting on lugs in the inner and outer half, and acts as a cushion against shocks, and also as a means of remedying disalignment of shafts. It is very widely used in cotton machinery and woodworking machinery, to mention only two of its uses. The "B. B." coupling acts in a similar way to the "Zodel-Voith," but is constructed to suit speeds above 1,200 or 1,300 revolutions per minute.

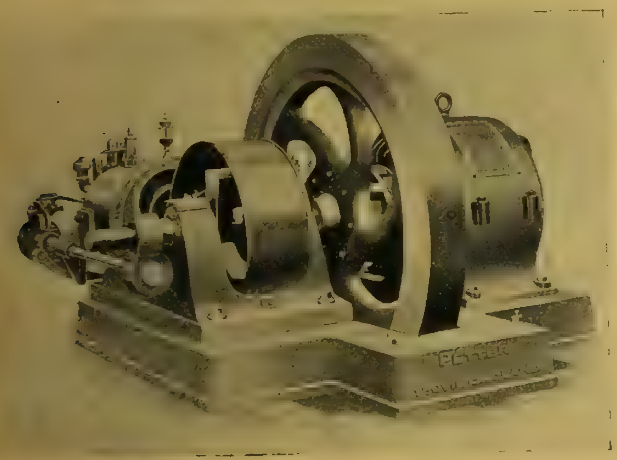

Fig. 1. The Zodel-Voith Patent Coupling.

The Zodel-Voith patent coupling of the standard type consists of four parts, an outer and an inner disc with suitable bosses, a rim bolted to the outer disc so that it can be detached in order to obviate the necessity of unlacing the belt if either shaft is to be removed, and a leather or cotton belt connecting the rim and the inner disc. The advantages resulting from the employment of this coupling are evenness in running, insulation, avoidance of strain to machinery from change of load, the counteracting of trouble from faulty alignment, the preservation of bearings, and absorption of variations in angular velocity.

The Zodel-Voith patent coupling of the flywheel type consists of the inner half, the belt and outer rim only, and can be fixed without further alteration to a specially-prepared flywheel, or to a flat ring fixed to the surface or spokes of an ordinary flywheel. The result is compactness and economy of space with reduction in cost. This arrangement is specially suitable for air compressors and combined lighting sets (fig. 1).

The B. B. coupling for high speeds consists of two flanged half couplings into one of which bolts are fixed. The bolts are fitted with specially-compressed leather washers, and engage easily in corresponding holes in the other half coupling. This coupling is specially suitable for machinery running at speeds above 1,200 or 1,300 revolutions per minute, and at high speeds gives a greater smoothness of running than the Zodel-Voith type. It is said that thousands are already in use on turbines, centrifugal pumps, etc.

The design of the Jahns governor is practically and carefully thought out. The mechanism is enclosed in an oil-tight polished cast-iron casing consisting of three parts—the bottom, the cylindrical centre casing, and the cover. The cover and bottom are fixed to the centre by means of screws with packing rings of hard paper. The tapered end of the shaft is fixed into the bottom casing and clamped by a nut. The governor weights move absolutely radially in straight lines on steel rollers, which carry the weight as well as the side pressure, and springs act directly on the weights themselves, without the intervention of any pins or levers. The straight line movement of the weights ensures a straight line law for the travel of the weights, and is a feature not possessed by any other governor; while in nearly all other governors the springs control the weights through a system of levers and pivots, and thus introduce a serious amount of friction. The springs are kept in position by a bolt and two nuts; the nuts are set tight against the centre casing, tightness being ensured by rubber rings. One or several adjusting rings are

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inserted to set the springs for the correct engine speed. The bolt passes through the spindle and is secured against turning or coming out by a pin. This arrangement of bolts and springs is another important feature, since it enables the two sides of the governor to be adjusted independently. The sleeve consists of two parts, an upper part inside the casing, and a lower part which acts on the lever of the throttle or valve gear. These two parts are connected by rods which slide up and down in corresponding holes in the bottom casing, thus avoiding the friction due to the more usual arrangement of feathers.

All parts move in an oil bath, and the upper levers are lubricated through oil pipes fed from a common oil cup. Bell cranks transmit the motion of the weights to the sleeve, and are fitted with rollers to minimise friction.

The Jahns governor is one which can be adapted to give the finest degree of special control under any conditions, whether for steam, gas, or oil engines, steam turbines, or any class of power plant or machine.

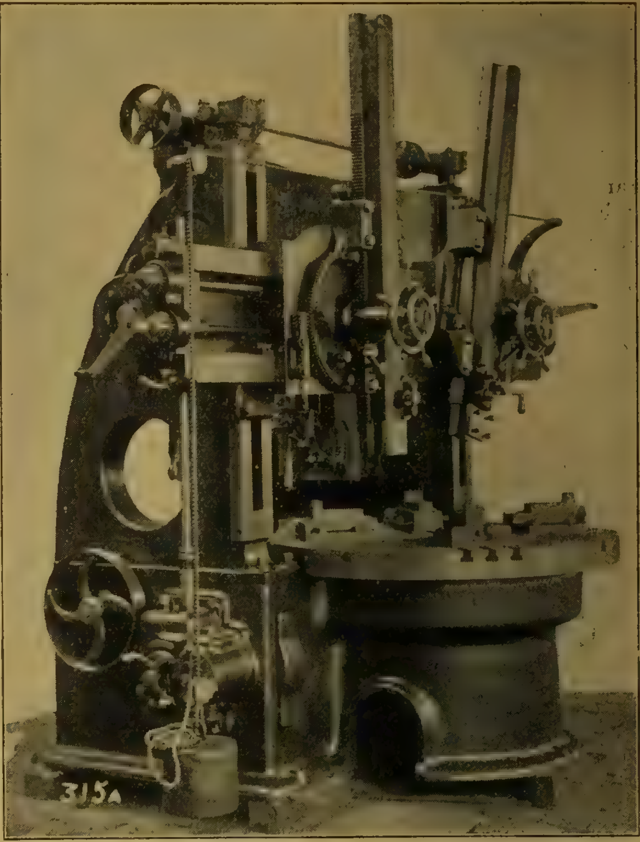

Fig. 1.—Stirk 48 in. Boring Mill, with Automatic Electric Control.

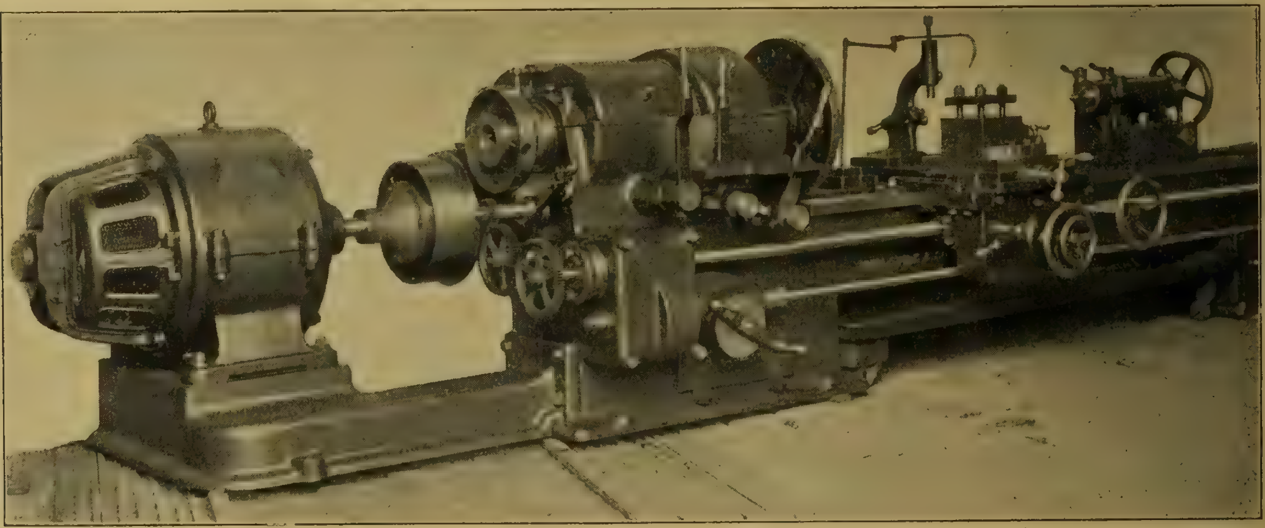

Fig. 2.—STIRK 12 IN. ALL-GEAR LATHE.

Messrs. John Stirk and Sons Ltd., Halifax, exhibit one of their 48 in. vertical boring and turning mills with all gear drive, and with their patent automatic controller for either belt drive or direct motor couple; a 12-in. all gear abnormal high-speed lathe driven by direct 30-H.P. electric motor, and a 30-in. vertical boring and turning mill with their patent self-contained motor drive. All the above machines are shown in operation. Amongst the above tools the 30-in. vertical boring and turning mill shown in our illustration deserves very special attention. The machine is fitted with all gear drive, and all fast running gears and the final table gear, also the anti-friction bearing on which the table revolves, are immersed in oil. Table speeds and feeds are changed with the utmost facility, and amongst other unique features is the fine hand adjustment on each saddle which is fitted to the larger sizes. Conversion from belt to motor drive is provided for in all cases, so that such a change may be made with a minimum of cost and trouble.

There is a general consensus of opinion that large machine tools should be motor driven wherever possible, and vertical boring and turning mills are specially suitable for electric driving. Messrs. Stirk have recently designed a new "auto controller" for these machines, which provides for the automatic variation of speed according to the diameter being worked, and the use of this controller can be highly recommended in conjunction with a variable speed motor, where direct current is available.

As the amount of surface work that can be done on these machines is vastly in excess of that which can be done on any type of lathe, the great advantage of this device is obvious. The reason the idea is not in regular use is that hitherto there has been no controller which would give the automatic variation, and at the same time protect the motor from being started on weak field. The auto controller ensures the starting of the motor on full field every time, and for the automatic acceleration to the correct speed corresponding to the diameter being worked.

The controlling device consists essentially of a bevel wheel fitted on the feed screw inside the ordinary hand wheel. This bevel wheel meshes with another bevel wheel on one end of a spindle which carries at its other end a chain wheel, which operates through a chain, another chain wheel connected with a pinion operating a rack rod moving contacts over a field resistance.

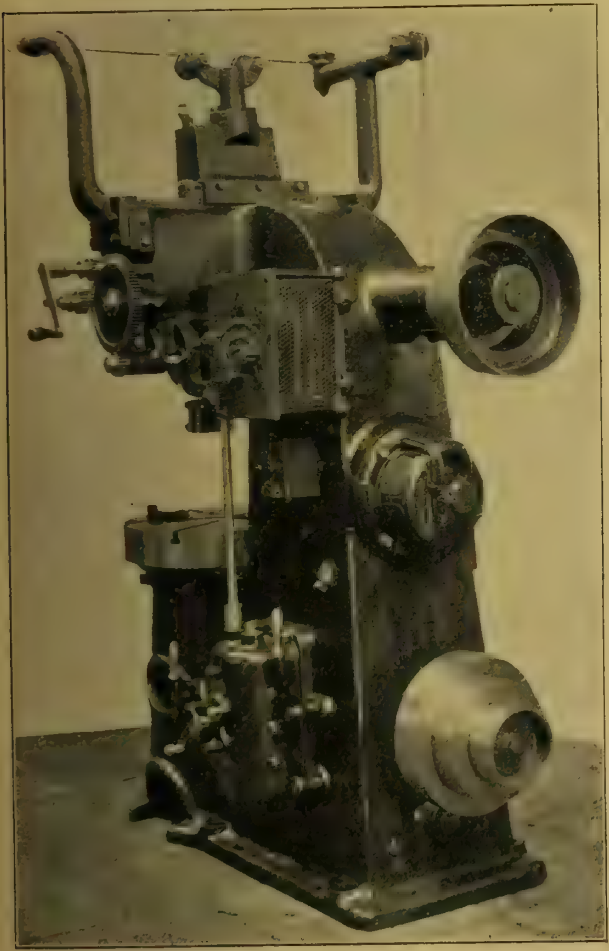

FIG. 3.—Stirk 30 in. Electric Boring Mill.

An automatic switch comes in on stopping the machine, so that the motor always starts up normally at full field, and when running the auto switch throws in the field resistance corresponding to position of tool and table diameter.

The entire starting and stopping is independent of the mechanic. A push button for start and a push button for stop; these are on the main column of the tool.

On C. E. Lugard's stand is a Stirk planer direct driven through Lugard S.M. magnetic clutches. A feature of this machine is that by means of a hand wheel stops can be set over the field resistance whereby definite cutting and return speeds can be set to suit the work in hand.

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45-6, IMPERIAL BUILDINGS,
LUDGATE CIRCUS, LONDON, E.C.

Messrs. Robert S. Allan and Co., Victoria Buildings, Gateshead-on-Tyne, show one of their patent comprehensive woodworker and universal milling machines for pattern making and general joinery, etc. This machine, which our illustration depicts in back view with circular work table, consists of two complementary parts, one fixed, the other movable, both supported on a common bed plate.

The part fixed at one end on a pedestal carries a powerful spindle running in long cone bearings horizontally, and is driven on the outer end by a belt on the pulley shown in the illustration.

The opposite end of the spindle is provided with a chuck attachment for holding the cutting tools, and the extension shafts used for cutting interior work.

The movable work carrier consists of a stand with four feet, which rests on vee guides raised on the bed plate, and is controlled by a hand wheel and powerful screw, which provides for the adjustment of the machine for large or small work. The upper part of the stand is formed with guides which carry a compound slide, which operates parallel to the axis of the spindle by means of hand wheels and gear, shown between the legs of the stand. This movement provides for the most delicate adjustment of the machine towards the cutting tools, and for feeding the work.

Resting on the compound slide is a table fitted on the side facing the spindle with a vertical quadrant. On the edge of this quadrant a set of teeth are cut, and a con-

OSRAM·LAMPS

centric slot runs parallel with the teeth to accommodate a locking bolt. The movement of this table is at right angles to the axis of the spindle, and is operated from either side by the screw and hand wheels shown at the side. The movements can be regulated by adjustable stops if necessary.

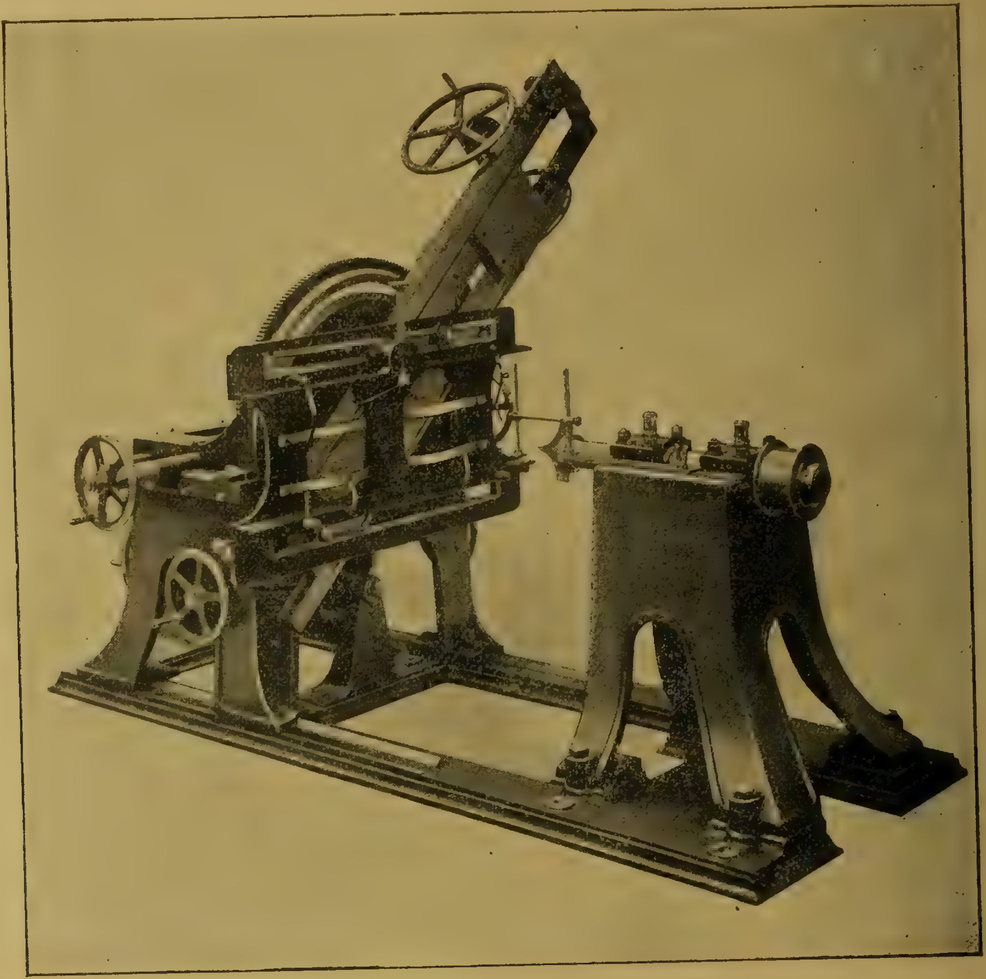
Pivoted on the face of the quadrant is a long rectangular member or frame, which forms one of the principal features of the machine. This frame is operated by a worm and hand wheel, and can be inclined to the right or the left of the perpendicular through an arc of about 130 degs. This allows work, of no matter what length, to be fixed in the work table and cut or grooved at the angle to which the frame is set. There are pointers at the side which indicate the various inclinations which are marked on the face of the quadrant.

and shelving, etc., these stops are useful, and save marking off the work. Tenoning, half-lapping, and moulding can be quickly done at various angles.

The circular work table is adapted for cutting core boxes or patterns and for curved or circular grooves, mouldings, etc.

This table has a set of cut teeth on the flange which are engaged by a worm operated by the small hand wheels shown on either side in front of the frame. A spring plunger or stop is fitted for setting or stopping the table at different positions when revolving. The table can be revolved completely in either direction. Powerful independent cramps are provided for holding the work.

The machine has undoubtedly a great range of usefulness, and with the right kind of cutter will do almost any description of work.



UNIVERSAL WOODWORKER AND PATTERN MAKER. R. S. ALLAN AND CO.

The frame is fitted with guides which carry a long slide, which can be operated and adjusted in any position along the length of the frame by means of a long screw and the hand wheels shown on either side at the top of the frame.

Two kinds of interchangeable work holders are provided, which are bolted to the face of the slide and operate with it.

One is a horizontal table so constructed that it can always be held horizontal, no matter what inclination the slide and frame are placed at. The table is fitted with powerful cramps for holding the work, also with guides, springs, etc. On the lower member or bracket of the table adjustable stops are arranged for marking or setting off the distances when cutting grooves, and enable a number of parallel cuts to be accurately set without previously marking off. In making stair-stringer boards,

In General.—As to the general progress of the Exhibition, it can unquestionably be deemed a success. There are features other than a large and representative series of exhibits, which are essential and necessary for attracting the visitor time and again. The provision of comfortable cafés and restaurants, club rooms and writing rooms, music, etc., have all been adequately attended to. Visitors and exhibitors have nothing to complain of in this respect, the exhibitors' club room in particular is worthy of mention as being furnished luxuriously, handsomely lighted with the latest Osram lamps and electric radiators arranged in artistic manner. The music throughout the day is provided by leading military bands. Indeed, the general arrangements have been so well organised that one is hardly surprised to learn that no less than 10,000 people visited the hall on Saturday last.

(To be continued.)

the rudder 100 tons; the engine crankshafts 118 tons each; bedplate 195 tons; columns 21 tons each; the heaviest cylinder, with liner, 50 tons; wing propellers each 38 tons—finished weights. The castings for the turbine cylinder weighed 163 tons, and for the centre (turbine) propeller, which is of solid bronze, 22 tons.

The arrangements in connection with the launch of a ship do not end with the release of the vessel, so that she may slide down the ways into the water; they include provision for checking the way on the vessel when in the water, as most launching rivers or basins are more or less limited in breadth, and in the case of a gigantic fabric like the Olympic the means adopted will doubtless be found interesting. In the bed of the river were placed three heavy anchors on each side of the ship, each anchor being connected by a 7-in. steel-wire hawser to eyeplates riveted to the shell plating. There were also placed in the bed of the river two piles of cable drags, each weighing over 80 tons, connected in a similar manner with an 8-in. steel-wire hawser. These were all arranged so that when the vessel was nicely clear of the end of the slip the drags and anchors acted simultaneously in bringing the ship to a standstill. As a further precaution the ship's own bow anchors were stowed in the hawse pipes, ready for letting go in case of emergency.

As already announced, the machinery decided on for the Olympic is the combination of reciprocating engines with a low-pressure turbine, this arrangement having proved the most satisfactory from an engineering point of view, and at the same time the most beneficial to passengers, retaining for them the most highly perfected reciprocating engine on the "balanced" principle, eliminating vibration, and thus securing the utmost comfort by the smooth working of the ship. There will be accommodation for about 2,500 passengers in all, besides a crew of 860, and some idea of the extent of the accommodation will be realised when it is mentioned that there will be over 2,000 sidelights and windows in the ship.

The launch of the Olympic brings the tonnage of the White Star Line up to 418,907 tons, a fleet remarkable for its efficiency and modern character; twin-screw or triple-screw steamers of the latest type, and one fine sailing ship, the Mersey, employed in the important work of training officers.

The Olympic will, of course, be employed in the White Star Line's mail and passenger service between Southampton, Cherbourg, Queenstown, and New York.

THE WHITE STAR TRIPLE-SCREW STEAMER OLYMPIC. THE VESSEL TAKING THE WATER.

SOURCES OF POWER IN MODERN STEEL WORKS.

In large, modern, steel works, says a writer in the *Stahl und Eisen*, Düsseldorf, the two sources of power should be gas engines and steam turbines. The gas disposable after the service of blast furnace blowers and of the steel works can be used for driving dynamos, for the rolling mills, other power being obtained from steam by means either of piston or of turbine engines communicating power by mechanical or electrical transmission. The blowing engines should be duplicated by the installation of gas generators or steam boilers, to cope with any contingencies that may occur in connection with the blast furnaces. The factors that should influence the choice of power are the utilisation of caloric and the cost of the installation. The most advantageous results, as regards the cost of the installation, is obtained by the use of gas engines; it is only when, however, turbines are employed for the primary dynamos and steam for the reversible rolling mills that a real improvement in cost is effected; in that case all the disposable heat being utilised, whilst only about half is made use of in the first case.

WATER-TUBE BOILERS.*

So many excellent treatises have been published which deal with the principles governing the structural details of water-tube boilers that it would be a waste of time to again lay before this association general information concerning the design of the various water-tube boilers now in use.

The writer's aim will rather be, not to treat of how boilers are made, as to consider the present position of the water-tube boiler and its application to the various branches of industry.

On land the increasing popularity of the water-tube boiler has no doubt been materially influenced by its wide selection for the largest and most modern electrical power plants throughout the world, and, having in mind the fact that coal represents the raw material in the generation of electricity, and bears such a large percentage of the total cost, it is interesting to note that 60 per cent of the boilers used in electric power stations are of the water-tube type.

The writer has taken the case of electric power plants as a basis because of the accurate data which is available, due to the fact that the Board of Trade regulations have necessitated the keeping of accounts in one specified form, thus allowing a correct comparison to be made of the working results from a very large number of installations.

Further, the publicity which has been given to the working results of these undertakings has naturally stimulated close competition amongst the stations to secure the lowest production cost possible.

During the past ten years there has been a very marked advance made in scientific control of the boiler plant in electric generating stations, and now that most station engineers appreciate that the boiler plant is equally, if not more, important than the engine room plant, the cost of production has come down to a figure which is having a very far-reaching effect in the development of the electrical industry. In making this statement, the writer has in mind, and gives full credit for, the reduction which has automatically followed the adoption of improved steam engines or turbine plant, increased load factor, etc., but is convinced that in those stations, both in this country and abroad, where very low production costs are established, the boiler plant must be very efficient in every sense.

In considering, therefore, the present position of the water-tube boiler, we cannot do better than take a modern electric generating plant as a standard, and after discussing the results there obtained we can consider how far they are influenced by the nature of this particular industry, and how far they can be extended to other industries.

The writer has had many opportunities of testing water-tube boilers under a variety of conditions, and has often obtained efficiencies as high as 78 per cent and over where the boilers have been fitted with mechanical stokers and superheaters.

The following are the results as regards efficiency of two tests carried out by the users themselves:—

London County Council Tramways Power Station, Greenwich: Date of test, March 26th, 1909.

Efficiencies.—Efficiency of boiler

$$\frac{9{\cdot}26 \times 966 \times 100}{11{,}449{\cdot}79} = 78{\cdot}13 \text{ per cent.}$$

Combined efficiency of boiler, superheater, and economiser

$$\frac{1198{\cdot}83 - (107 - 32) + (107 \times {\cdot}6) \times 8{\cdot}19 \times 100}{11{,}449{\cdot}79} = 84{\cdot}97 \text{ per cent.}$$

Amsterdam Electricity Works. Test on two water-tube boilers: Date of test, May 8th, 1910.

Efficiency.—Boiler superheater and stoker, 78·78 per cent.

Repairs and Maintenance.—An argument which is sometimes raised against the water-tube boiler is the supposed increased cost of repairs and maintenance, but whatever the opinion may have been in the past there is no doubt that the majority of engineers using water-tube plant agree that this increased cost has been very much exaggerated.

The writer has had under his charge an installation comprising 46 water-tube boilers and 16 cylindrical boilers and did not find that the water-tube boilers cost any more in respect to repairs and maintenance than the cylindrical boilers.

In the days when water-softening plant was not so extensively used, the detrimental effect of scale was more quickly seen in water-tube than in shell boilers, but this could not be considered altogether an evil in so far that the relative prominence of the scale induced the engineer to give this problem the attention it merited, and it is now generally admitted that any boiler should be used only for the generation of steam and not for purifying water.

At the West Ham Corporation Electricity Works, where the plant is worked continually at full rating, the boiler repairs and maintenance costs, including all brickwork charges, average £7 per annum per boiler of 4,900 square feet H/S.

At the Hackney Corporation Electricity Works, £7 10s. per annum per boiler of 3,000 square feet H/S, and at the Lots Road Generating Station of the Underground Railways Co., London, one of the largest water-tube boiler plants in the world, containing an installation of 64 water-tube boilers, £10 per annum per boiler of 5,212 square feet H/S.

Tube Failures.—This is a trouble, the importance of which has also been very much exaggerated, and in the writer's opinion water-tube boilers in a modern power plant can be run even at a considerable overload without any tube failures. He does not deny that it has been a trouble in some cases, but in every case which he has investigated the cause has been found either in scale formation or the presence of oil.

At Lots Road Generating Station they have only replaced 65 tubes out of 15,360 since the station was started, seven years ago.

At the Marylebone Electricity Works they have only replaced six out of 5,750 since the station was started, five years ago.

At the Wood Lane Station of the Kensington and Notting Hill Electric Lighting Co., where they habitually run the boiler plant at heavy overloads, they have not replaced any tubes since the station was started, ten years ago.

A number of similar records in other branches of industry could be given.

In all the above cases the boilers are of the same design, and surely if this question of tube failures were an inherent defect in water-tube boilers, apart from the presence of scale or oil, it would have made itself evident in the above cases, which are only a few of many which could be instanced.

Space Occupied.—In a paper read before your association in 1904, Mr. Hobbs gave the saving in space of the water-tube plant as against cylindrical plant as 30 per cent.

Mr. Hobbs was content, however, to consider the respective boilers at their normal rating only, but it is well known that water-tube boiler plant is capable of much heavier overload working than cylindrical boiler plant. In the case taken by Mr. Hobbs of four 30 ft. × 8 ft. Lancashire boilers covering a total ground space of 1,535 ft., the normal evaporation from and at 212 deg. Fah. per square foot of ground space would be 19 lbs., and in the case of water-tube boiler plant covering 1,058 square feet, say, 43 lbs.

If we assume a 10 per cent overload as a maximum for the Lancashire boilers, and 25 per cent for the water-tube boilers, the first figure is increased to 21 lbs. per square foot of ground space ,and that for the water-tube boilers to 53 lbs. per square foot of ground space. It will also be agreed that this question of ground space has become even more important since the advent of the steam turbine, so much so, that in some of the most modern stations it has been necessary even with water-tube boiler plant to arrange the boilers at right angles to the engine room, and in the Lots Road Station of the Underground Railway Co. to arrange the boilers on two floors, in order to keep this section of the plant within the same bounds as the turbines.

Efficiency.—The increasing popularity of the water-tube boiler has brought many new designers into the field, and you have no doubt had before you illustrations of the various types which have been introduced.

The arrangement of tubes and drums has been twisted and distorted until we have every variety, from that resembling the octopus to that looking like a beehive, each with its own claim to increased efficiency, etc., over its predecessor, and these various claims would lead the uninitiated to assume that there was still a big margin of loss to work upon.

Now if we accept the efficiencies which have been given in this paper as representing figures which have been actually established at the present time, without taking into account the further recuperation resulting from the use of an economiser, we can determine what margin there is for improvement, and in so doing it is again necessary to take test conditions in order to eliminate many obvious variables which would otherwise come in.

Now it is only necessary to glance at the heat balance of a properly conducted test on a well-designed plant to appreciate the extent of the loss which is available for further reduction.

Let us take the test carried out at the generating station of the London County Council, in which the gases were leaving the boiler at a temperature of 526 deg. Fah., the volume of carbonic acid gas was 12 per cent, and the efficiency 78 per cent, the heat balance then becomes:—

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* Abstract of a paper by Mr. D. Wilson, read before the Manchester Association of Engineers, 22nd October, 1910.

Heat absorbed by boiler	78 per cent.
Heat lost in flue gases	15·5 per cent.
Heat lost in radiation and unaccounted for	6·5 per cent.
	100·0

The total loss on which any reduction would be possible is therefore 22 per cent, but unfortunately we can only attack a small portion of this in the boiler itself, for it is obviously impossible to reduce the temperature of the flue gases below that of the boiler water, which in water-tube plants corresponds to the steam pressure.

Repairs and Maintenance.—The only charges under this head worthy of consideration are those incurred by tube renewals, cleaning, and brickwork repairs.

Tube renewals can be practically eliminated by using pure water, and as there is plenty of evidence available to confirm this, the writer will not offer any further argument.

Cost of Cleaning.—The actual boiler cleaning costs which the writer recently obtained from two of the modern electric power stations—*i.e.*, the Underground Railway, Lots Road, and the Marylebone Corporation Electricity Works, are in the former case £7 per annum, the H/S of boiler being 5,212 square feet; and in the latter case £6 per annum, the H/S of boiler being 6,182 square feet.

Brickwork.—Experience has proved that in order to obtain the best efficiency when burning ordinary bituminous coal, such as is usual in the Manchester district, it is necessary to effect combustion inside a firebrick-lined chamber as the refractory nature of this material promotes a high temperature, and ensures a thorough burning of the light hydrocarbon gases with a minimum admixture of air. Again, as we are dealing more particularly with boilers mechanically fired, the additional brickwork necessitated with the more generally used type of stoker on water-tube boilers the revolving chain grate has also to be considered.

The question of cost of brickwork must therefore take into account the extra advantages obtained, but the additional brickwork does not increase the repairs and maintenance charges to any serious extent.

Space Occupied.—In referring to this point in a previous part of the paper, the writer considered only normal output with a maximum of 25 per cent overload, but engineers who have used water-tube boilers are well aware that the overload can be increased to a very much higher rate even than that.

The ideal design of plant for enabling the maximum power to be obtained on a minimum of ground space is that in which the whole of the ground space covered by the boiler is utilised as grate area, and this condition is entirely fulfilled by the design of water-tube boiler employed for marine purposes.

Application to other Industries.—If such results, as indicated in this paper, can be maintained at electric power plants where the load is more or less varied, it should be more easy to establish them in other branches of industry, such as textile mills, etc., where the load is more or less constant throughout the day, and the writer believes this is being done.

The idea that the only use of the water-tube boiler was for the electric generating station, and only there because of its quick steaming properties, has long since been abandoned, and the fact that it is now used successfully in practically every industry is sufficient proof of this change of opinion.

Marine Water-tube Boiler.—The question of the most suitable type of boiler for naval purposes is of such vital importance to us as a nation—for on it, at some time or other, our fate may largely depend—that no excuse is needed for referring to the final report issued by the Boiler Committee appointed by the Lords' Commissioners of the Admiralty. In this they say: "Experience obtained has confirmed the committee in the opinion expressed in their interim report, namely, that the advantages of water-tube boilers for naval purposes are so great that, providing a satisfactory type of water-tube boiler be adopted, it would be more suitable for use in His Majesty's Navy than the cylindrical type of boiler." The quick steaming properties of the water-tube boiler are naturally of the greatest importance in the navy, and in this connection the remarks of Admiral Melville, the Commander-in-Chief of the United States Navy, are of interest:—

"The fact that water-tube boilers raise steam quickly is of the greatest importance. I have stated elsewhere that I consider the battle of Santiago to have developed the necessity of the use of water-tube boilers, whether it taught us anything else or not. It would have been of the greatest advantage to have had during the blockade of Santiago boilers capable of raising steam in less than half an hour. Coal need not have been used to keep the boilers under steam all the time; the Massachusetts might have shared in the glories of the fight if she had been fitted with water-tube boilers; the Indiana would have kept up with the Oregon, the New York would have developed at least three knots more speed, and the navy would have been spared a controversy. I think the Colon would not have got so far away as she did. But we did not have water-tube boilers."

Efficiency.—Here again the published figures of tests carried out by the Admiralty engineers show that 80 per cent has often been established, and this high efficiency is further confirmed by the other details given. So satisfactory, in fact, has the water-tube boiler proved that the cylindrical boiler is no longer considered for naval purposes.

As regards water-tube boilers applied to the mercantile marine, the first advantage cannot be more briefly explained than in a statement made by one of the largest firms shipping ore from Lake Superior: "We can load our vessels at the rate of 1,000 tons an hour and unload them almost as quickly. This means that our stay in port is only a little over six hours. In that time we can blow a boiler down, make a joint on boiler steam piping, grind in a leaky safety valve, or renew a tube; can refill and have full steam and be ready for sail for destination as soon as the ship is loaded, and yet have no fear of straining the boilers from unequal expansion in getting steam quickly. With our old cylindrical boilers we would just about have them cooled off ready to work upon by the time the ship was loaded, and the rest of the time occupied upon the repairs, refilling, and slowly raising steam meant detention of the ship and loss to us."

The fact that this type of plant is being adopted by the mercantile service is in itself proof that the advantages of quick steaming, reduced gross weight, and increased capacity per square foot of space occupied have been fully established, and the writer feels sure that the time is not far distant when water-tube boilers will be used by all the large modern ocean-going liners.

TRADE CATALOGUES.

We have received from **Messrs. The Bolton Lubricating Co.,** lubricating specialists, Albion Works, Central Street, Bolton, Lancashire, a copy of a publication illustrating and describing the R. Wood's patent lubricator, the patents of which they have lately acquired.

We have received from **Messrs. W. P. Butterfield Ltd.,** Galvanising Works, Shipley, a list of the extensive selection of riveted cisterns galvanised after manufacture which they had in stock on October 1st.

We have received from **Messrs. Rudge-Whitworth Ltd.,** Rudge Works, Coventry, a copy of their catalogue and other printed matter relating to their detachable wheels, samples of which were shown at the late Machinery Exhibition at Olympia. The catalogue and pamphlets are nicely printed and fully illustrated, and contain a mass of interesting and useful information.

We have received from **Messrs. The Pattern Making Machine Co.,** of 16, 18, and 20, Cambridge Street, Glasgow, a copy of their catalogue of the semi-auto pattern maker, universal wood-milling machine (Wadkin and Scott-King patents). The publication is nicely got up, and contains a number of excellent illustrations; the text gives a very full description of these most useful tools and is prefaced by an interesting treatise on the subject.

We have received from **Messrs. Thorn and Hoddle Acetylene Co. Ltd.,** of 151, Victoria Street, Westminster, London, S.W., an interesting illustrated catalogue giving particulars of the "Incanto" oxy-acetylene system of autogenous welding and cutting. Messrs. Thorn and Hoddle Acetylene Co. Ltd. will be glad to send on application a copy of this catalogue post free to any who are interested in systems of autogenous welding.

We have received from **Messrs. Escher, Wyss, and Co. Ltd.,** engineers, 109, Victoria Street, Westminster, S.W., a copy of a publication describing the hydro-electric power station Brusio at Campœologno, Grison, Switzerland. The pamphlet is well printed on art paper and profusely illustrated with excellent drawings. It contains a most interesting description of the installation.

We have received from **Messrs. Mather and Platt Ltd.,** of Manchester, Salford, and London, a copy of a recent catalogue brought out by them of the electrical, mechanical, and hydraulic machinery for collieries, which they manufacture. Besides descriptions and illustrations of the above specialities, the publication contains an illustrated description of their Park Works at Newton Heath, Manchester, which have lately been largely extended. Particulars and illustrations of various installations put up by the company are also given. The catalogue is well printed on art paper and is profusely illustrated.

TRADE NOTES.

Messrs. Macbeth and Co., shipowners, Glasgow, have contracted for a steamer to be built by **Messrs. Macmillan and Co.,** Dumbarton, with a tonnage of 8,500. The vessel will be a duplicate of the previous ship built by the same company, the Crosshill.

Messrs. William Hamilton and Co., Port Glasgow, have received the contract to build for a well-known Liverpool firm a passenger and cargo steamer of 500 ft. in length and of 12,000 tons dead weight. The new steamer will be the largest ever built by Messrs. Hamilton, and will be constructed on the Isherwood system of longitudinal framing.

Messrs. Yarrow and Co., Scotstoun, have received an order to build a high-speed motor boat for service at Buenos Ayres. She will be 60 ft. long by 9 ft. beam, and will be propelled by five sets of internal-combustion engines of the Yarrow-Napier design of approximately 300 total horse power designed to give a speed of 25½ knots. The vessel will be practically similar to Mercury II., built by the same firm for the British Admiralty.

Railway and Tramway Material.—The *Feuille Fédérale Suisse* of 5th October contains notices of the following concessions: (1) To Colonel Waldmeyer, of Munf, and Monsieur Beck, Wittnau, for the construction and working of a standard gauge railway, six miles long, from Frick to Kienberg; the cost of the work is estimated at 742,000 francs (about £29,700), and the concession is for a period of 80 years; (2) to Mr. Alfred Meyer, engineer, of Chexbres, for a narrow gauge railway, three miles long, from Jor on the Montreux-Bernese Oberland railway to Caux on the Glion-Naye line; the cost is estimated at 830,000 francs (£33,200), and the concession is for a period of 80 years. The *Diario Official*, Brazil, publishes a decree approving the plans and the estimates submitted by the Government of the State of S. Paulo for the construction of a 47-mile section of the Tibagy line, an extension of the Sorocabana railway. The cost of the work is assessed at 3,571,000 milreis (about £268,000). The *Diario Official*, Mexico, notifies a contract between the Ministry of Communications and Public Works and the National Railways of Mexico for the construction of a railway in the State of Michoacan. The line is to run from Penjamo, on the Irapuato—Guadalajara railway, to Zacapú, a distance of 168 kiloms. (about 104 miles); it may be extended to Ajuno or to Ario, provided that the contractors give notice to the Ministry to that effect within three years from the present time. The gauge of the line is to be 1·435 metres. The railway is to be completed as far as Zacapú within four years and a half, and construction material, etc., may be imported free of duty for a period of five years. H.M. Trade Commissioner reports that a firm in the Dominion manufacturing highway crossing signals desire to obtain agencies for British manufacturers of railway supplies and equipment. The name of the firm may be obtained by British firms on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C. The *Bulletin Commercial*, Brussels, of 8th October states, on the authority of the Belgian Consul at Batavia, that the "Nederlandsche Indische Spoorweg Maatschappij" has recently sent three engineers to Sourabaya to make a survey for a steam tramway which it is proposed to construct between that place and the district of Grisee. It is also stated that the "Samarang Cheribon Stoomtramweg Mattschappij" has decided to increase its capital with a view to extending and improving its Samarang-Cheribon line.—*Board of Trade Journal.*

Machinery, Piping, etc., for Sanitary Works.—The *Boletin Oficial* states that tenders are to be invited for the carrying out of sanitary works at Mar del Plata at a cost of 3,431,350 pesos (about £300,000). The "Dirección General de Obras de Salubridad de la Nación," Buenos Ayres, is authorised to obtain the necessary piping and other materials of foreign manufacture by private contract, and the necessary machinery through the Argentine Legation in London.—*Board of Trade Journal.*

New Passenger Steamers.—The Royal Mail Steam Packet Co. is reported to have placed orders with **Messrs. Harland and Wolff,** of Belfast, for five large passenger steamers for the South American trade. Three of these will be built in Belfast, the others probably on the Clyde. The statement that the Hamburg-Amerika Line has placed an order with Messrs. Harland and Wolff for a steamer larger than the Olympic, which was recently launched, is officially announced to be untrue.

Messrs. Mackie and Thomson Ltd., Govan, have contracted to build a steam trawler for an Ostend company, for whom they have already built several vessels of this type.

LAUNCHES AND TRIAL TRIPS.

Olympic.—The White Star triple-screw steamer Olympic was launched at Belfast on the 20th October. Her launching weight was 27,000 tons, and when completed she will have a gross tonnage of 45,000 and a displacement of 66,000. Her length overall is 882 ft., and her breadth overall over 92 ft. The double bottom, extending the whole length of the ship, is 5 ft. 3 in. deep, increased under the reciprocating engine rooms to 6 ft. 3 in. The decks are of steel, and there are 15 water-tight bulkheads. There will be no fewer than 11 steel decks, and the distance from the funnels to the keel will be 175 ft. The machinery decided upon for the boat, and for her sister ship the Titanic, which is now on the stocks, is the combination of reciprocating engines, with a low-pressure turbine. A full description and an illustration of this vessel will be found in a separate article.

Escrick.—On the 20th October Messrs. William Gray and Co. Ltd. launched the steel screw steamer Escrick, which they have built for the London and Northern Steamship Co. Ltd. (Messrs. Pyman Brothers, London, managers). The vessel is of the shelter deck type, and will take the highest class in Lloyd's Register. Her dimensions are: Length overall, 395 ft.; breadth, 53 ft. 6 in.; and depth 25 ft. 5 in. The hull is built with deep bulb-angle frames, dispensing with hold beams, and leaving large clear holds, cellular double bottom, and fore and aft peak ballast tanks. Ten steam winches, derrick tables and outriggers and double derricks, steam steering gear amidships, hand screw aft, patent direct steam windlass, large horizontal multitubular donkey boiler, fresh water distiller, steel grain divisions, stockless anchors, telescopic masts, boats on deck overhead, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 25 in., 41 in., and 68 in. diameter, with a piston stroke of 48 in., and two large steel boilers for a working pressure of 180 lbs. per square inch.

Elisabethville.—Messrs. Alex. Stephen and Sons, Linthouse, launched on October 20th a twin-screw passenger and cargo steamer, built to the order of Messrs. Elder, Dempster, and Co., Liverpool. The dimensions of the vessel are: Length, 430 ft.; breadth, 55 ft.; depth, 37 ft. She has been constructed in accordance with the rules of the British Corporation. She is designed to accommodate a large number of passengers and to maintain a high speed on service with a considerable dead weight on board. The machinery has been constructed by the builders.

Syndic.—The Blyth Shipbuilding and Dry Docks Co. Ltd. launched on the 19th October from their shipbuilding and graving dock works the fine steel screw steamer Syndic, built for Messrs. Isaac B. Pearson and Co., of Glasgow. This vessel, which measures 326 ft. in length with a beam of 45 ft. 10 in., has been constructed under Lloyd's special survey for their highest class. She is of the single-deck type, having poop, bridge, and top-gallant forecastle, and is specially adapted for the general cargo and wood trade, having large hatches and clear holds, together with the best and latest design of deck machinery, including five cargo winches for the quick and economical working of the cargo. Triple-expansion engines of good power will be supplied by Messrs. The North-Eastern Marine Engineering Co. Ltd., of Wallsend.

Francisco.—An important addition has just been made to the fleet of Messrs. Thos. Wilson, Sons, and Co. Ltd., of Hull, in the fine steel screw steamer Francisco, which was launched from the yard of the Northumberland Shipbuilding Co. Ltd., Howdon-on-Tyne, on the 19th October. The vessel has been specially designed for this trade, and built to the highest class in British Corporation. She is built on the deep frame and girder system, rigged as a two-masted schooner, and is fitted with all the latest improvements and up-to-date appliances to make her in every way a first-class liner. She is about 425 ft. in length with three complete steel decks, including the shelter deck all fore and aft, with a cargo-carrying capacity of about 9,000 tons. A large quantity of water ballast is carried in the cellular double bottom and after peak tank, which, with the bunkers, will put the vessel in excellent trim irrespective of cargo. Loading and discharging facilities are considerably in excess of usual. The steamer has 12 derricks and 10 powerful steam winches with extended shafts by Messrs. John Lynn and Co. Ltd., Sunderland, to ensure the most expeditious handling of cargo. Powerful combined steam and hand steering gear on the Wilson-Pirrie principle, by Messrs. Donkin and Co., Newcastle, will be fitted in steel house on shelter deck aft and actuated from amidships by telemotor gearing, and a powerful steam windlass of the latest type by Messrs. Emerson, Walker, and Thompson Bros. The vessel has been built to a fine model and to include the most modern improvements, including

Board of Trade regulations. Triple-expansion machinery of special design and construction will be supplied by Messrs. Earles Shipbuilding and Engineering Co. Ltd., Hull, with extra large pressure boilers, the indicated horse power being about 3,000, the working pressure 180 lbs., and the boilers fitted with Howden's forced draught.

Peewit.—Messrs. Wm. Simons and Co. Ltd., Renfrew, launched from their works on the 18th October with steam up and ready for work the twin-screw hopper barge Peewit, which they have constructed to the order of the Bombay Port Trustees. This hopper steamer has a hopper capacity of 600 tons, and will be employed in connection with the port improvements now being carried on at Bombay. The vessel will be propelled at a speed at 10 knots per hour by two sets of compound surface condensing engines supplied with steam from two steel boilers. All modern auxiliaries will be provided in the engine room. The Peewit is the eighth dredging vessel that Messrs. Wm. Simons and Co. Ltd. have constructed for the Bombay Port Trust.

Baron Renfrew.—Messrs. A. Rodger and Co., Port Glasgow, launched on October 17th the steel screw steamer Baron Renfrew, which they have built for Messrs. Hugh Hogarth and Co., Glasgow. The principal dimensions of the vessel, which has a carrying capacity of 3,100 tons dead weight and is fitted with a complete shelter deck, are: Length, 275 ft.; breadth, 40 ft.; depth moulded, 29 ft. The vessel will be engined by Messrs. D. Rowan and Co.

Valparaiso.—Messrs Murdoch and Murray, Port Glasgow, launched on October 17th another of the steamers which they are building for service on the Amazon for South American owners. The vessel is one of 400 tons. She will be engined by Messrs. Muir and Houston, Glasgow.

NAVAL NOTE.

CRUISERS FOR THREE COLONIES.—It is announced that three of the five cruisers ordered recently from Clyde and North of England builders are for the colonies—one each Australia, New Zealand, and Canada. The Admiralty is responsible for the New Zealand ship, but the Australian and Canadian Governments will pay the builders direct.

CORRESPONDENCE.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only; and if accompanied by sketches, these should be neatly drawn, and forwarded on a roll, to prevent creasing. We cannot undertake to return rejected communications, or to reply to inquiries by letter. In all cases letters must be accompanied with the name and address of the writer.

We do not hold ourselves responsible for the opinions of our Correspondents.

THE OUTPUT OF GRADUATES IN ENGINEERING.

To the Editor of "The Practical Engineer."

SIR,—I read your leading article in *The Practical Engineer* of October 7th with much interest, but I fear you fail to indicate why there are no openings for college graduates. Is it not because they have no practical knowledge of work, although they are brim full of paper knowledge?

Now, if we take two equally clever men, one passed through a college course only, and the other passed through a large works and very largely doing in practice what the first one does on paper, we shall find a great difference in value. The paper man has to get practice before he can carry out work, while the practice man can start on a job and carry it through right away, and yet there is no doubt that one is as clever as another.

The paper man—I am not speaking at all disrespectfully—has no experience in the handling of men or machinery as they exist in a large works, and he is not elastic enough to adapt himself and his material to the end in view, and this simply because he has not had the chance to learn anything outside one groove, but the practice man is elastic enough to adapt means to an end, and, as a rule, he can handle men with success. For this reason the practice man is at first preferable to the paper man, as he is worth a good wage at the start, while the paper man is not worth anything as a pretty general thing.

But against this, if the paper man will give his time to finishing his practical education by going into some works at a low wage for one or two years and learn how to handle men and how to adopt the means at hand to the securing of a given result, although such means are not theoretically or practically the best to secure what is required, then he will, if progressive, find that his services will have a real money value.

The chief fault with the collegiate training is that it is not practical, and under ordinary conditions it cannot be made practical from a commercial standpoint. At the same time much could be done by arranging that half the time should be spent in purely college work and the other half in some factory where actual practice is carried out in the ordinary way by ordinary workmen. The last two years of the college course spent in this way would enable the student to make himself commercially valuable if he cared to take notice of things, but to get through the work he would have to work far longer hours than at present, which probably many students would object to. Probably, if the factory practice was from, say, 6-30 a.m. till 12 noon, and the college work from, say, 2 p.m. to 6 p.m. with a Saturday half holiday, the student on graduating would find that he could start right away on leaving college, subject of course to there being available vacancies, and he would obtain a fair starting wage, as he could carry out a job with little supervision—or *should* do so—but even then he would not be allowed to "run the show" right away, or take a place as manager. Everyone has to show what he is made of before he can obtain his captaincy in industrial pursuits, although perhaps this is different in other states of life. In any case, you have to show what you can do before you become "captain" or even "lance-corporal" in engineering work, although social position is of no great value.—Yours, etc.,

WALTER J. MAY.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2252. **Converting Gas Engine to Oil Engine.**—I should be glad of the assistance of any reader as to the best method of converting a 10 H.P. gas engine into an oil engine, giving place where I can get the extra fittings required, and giving sketches of same.—GAS ENGINE.

Answer.—Your correspondent does not give any particulars as to the make of engine or the date, so that it will be an impossibility to give a correct estimate of what is wanted. However, if the engine is not too old, and the cylinder is in good condition, it will be possible to convert it from gas to oil in a few hours. The chief difficulty lies in getting a reliable vaporiser to suit the engine, and I would refer him to the Capel Gas Engine Company, who make a very good type of vaporiser for this purpose. For a little further information I refer "Gas Engine" to W. C. Runciman's book on "Gas and Oil Engines," which gives much useful information and a complete set of sketches of the apparatus.—A. P.

Answer No. 2.—We understand that Messrs. Wm. Priestley Ltd., Gloucester, undertake to convert Gas Engines to Oil Engines, and no doubt "Gas Engine" could obtain all the particulars he requires from that firm.—THE ED.

2257. **Welding by the Electric Arc.**—I should be glad to hear of a practical book on the subject of welding by electric arc. In the absence of such a book, would any reader say whether a rotary transformer or a storage battery would be the better means of reducing a voltage of 220 continuous to the proper voltage for welding plates up to, say, $\frac{3}{4}$ in. thick, and what current would be required?—DYNAMO.

Answer.—I should advise the use of accumulators for transforming the voltage down to a lower pressure. The electric arc or Bernardos system is used for repairing defective castings, also for making various kinds of joints in pipes. The two pieces of metal to be treated are connected to the positive pole of a dynamo or set of accumulators, and a carbon rod of from 13 mm. to 25 mm. in diameter forms the negative pole. The pressures used in this system range anywhere from 70 to 80 volts at the arc, and in this case the accumulators will be arranged to be charged in series and discharged in three sets in parallel, as in fig. 1. It is, however, a good idea to supply current at twice the above value, and to absorb half the voltage by resistance coils placed in series with the arc; this is very useful for steadying the current, and in this case the accumulators will be arranged as in fig. 2. The carbon or negative pole is clamped in a hand grip or holder, which is, of course, insulated. When not in use this carbon is placed out of contact of the metal forming the positive pole, and to start the arc the circuit is closed by placing the tip of the carbon in contact with the metal, and an intense current flows. The carbon is then instantly pulled away a short distance from the metal; volatilisation results, and an arc of from 2 in. to 5 in. in length, and about 1½ in. in diameter, is maintained, and in a few minutes the metal fuses. In practice it is a very easy matter to maintain a correct length of arc, and at the same time to move the carbon rod about wherever the heat is required.—A. P.

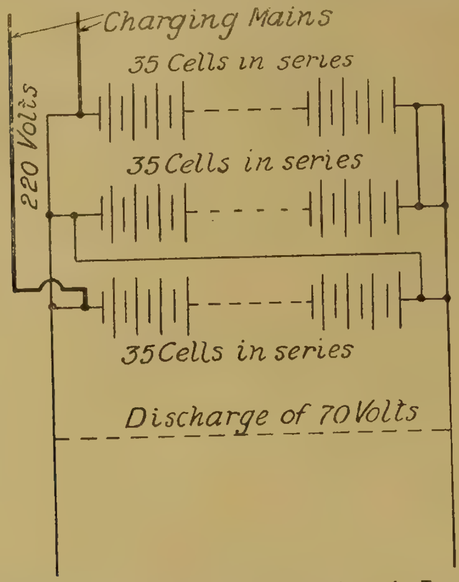


Fig. 1.—Diagram showing Arrangement of Accumulators for Transforming 220 volts down to 70 volts. There are three sets of cells, 35 in each set. They are then joined in parallel across the mains.

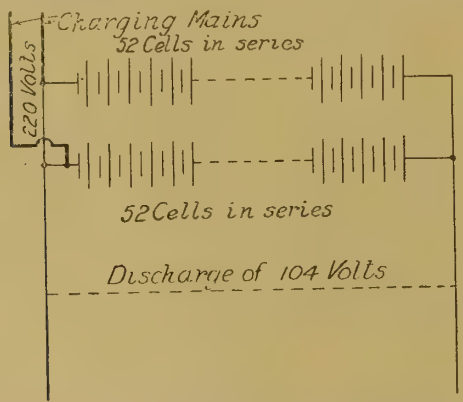


Fig. 2.—Diagram of Accumulators showing how to Transform 220 volts down to 104 volts by means of two sets of Accumulators, each set consisting of 52 cells put across the mains in parallel.

2285. **Wrought-iron Chimney.**—I shall be obliged if some reader will assist me with particulars to design a self-supporting wrought-iron chimney, 6 ft. dia. by 120 ft. high. Diameter at bottom and diameter bed-plate? Weight in concrete foundation? Number and stress in holding down bolts, thickness of plates, etc.? Would it be necessary to line with fire-brick, and if so, to what height? What factor safety is usually allowed in such chimneys? If chimney is not self-supporting, what difference could be made in above particulars when using guy ropes and ground anchors? How many guy ropes? Complete information in this will be of much assistance.—Worker.

Answer.—The design of a wrought-iron chimney does not prevent any difficulty to the capable draughtsman. In the case presented in the query much assistance could doubtless be obtained from Messrs. Babcock and Wilcox Ltd., who are experts in this class of construction.—H. F.

["Factor" will doubtless find answer as above meet his requirements.—Ed.]

2286. **Conical Steel Tubes.**—Could any reader inform me where I could obtain conical-shaped steel pipes as follows: Inside from 6 in. to 14 in. diameter, ⅜ in. thick, with flanges 12 in. and 18 in. diameter; length of pipe, flange to flange, 12 in.?—A Reader of your Paper.

2287. **Balance Ring Slide Valves.**—I should be glad if some reader would explain the nature, object, and applications of balance ring slide valves; what are the advantages and disadvantages of same, and how far are they used?—M. T.

MISCELLANEA.

Less Unemployment.—A better condition of employment is shown by the official return relating to the administration of the Unemployed Workmen Act for the year ending March 31st last. As compared with the previous 12 months, the proportion of applicants registered fell from 11·7 to 7·8 per thousand of the population, the total number of applications received being 127,066, as against 196,757 in 1908-9.

Cunard Liners and Queenstown.—The members of the All Ireland deputation who have been asking the United States Postmaster-General to use his influence to induce the Cunard Co. to resume the Queenstown call by the Mauretania and the Lusitania on their east-bound passages have returned, and the hon. secretary of the committee reported that the mission was highly satisfactory.

"The London Matriculation Directory" for September, 1910, can now be had from the University Correspondence College, Red Lion Square, W.C. It contains full information on the requirements and regulations for matriculation, recent examination papers, particulars of the classes held by the above college, the principal's report, and recommendations for the general method of work.

Awards for Turning in Wood and Metal.—On October 21st the Lady Mayoress distributed the prizes at the Mansion House, London, E.C., awarded by the Worshipful Company of Turners. In the absence of the Lord Mayor, the chair was taken by Alderman Pound, supported by a distinguished gathering. The work submitted for competition was of a high order, and the master of the Turners Company commented upon the results obtained by the apprentices.

Graving Dock Accommodation at Greenock.—A conference was held recently between representatives of Greenock Corporation, the Harbour Trust, and the Chamber of Commerce on the question of improved graving dock accommodation at the port. The meeting was adjourned after about an hour's discussion, and will be convened again for an early date. It is understood that the Chamber of Commerce will make a further representation to the Admiralty on the subject of a subsidy.

Mersey Dredger for the Clyde.—The Clyde Lighthouse Trust, with a view to the satisfactory dredging of the channel-way of the River Clyde from Ladyburn to Prince's Pier, have arranged with the Mersey Docks and Harbour Board to hire one of their largest sand-pump dredgers for use in such operations. The vessel, which is one of the largest owned by the Mersey Board, is fitted with centrifugal pumps with suction pipes 18 in. in diameter, and capable of dealing with 4,000 tons per hour.

Large Graving Dock.—The recent decision of the Clyde Navigation Trustees to construct a large graving dock at Elderslie appears to have put the Mersey Docks and Harbour Board on their mettle, and in order to keep Liverpool as the premier port with regard to such accommodation they are reported to have decided to add a length of 50 ft. to the new combined wet and dry dock which they are constructing at a cost of £2,000,000 on the Seaforth foreshore. The Board can, if necessary, add at least another 50 ft. to their new Gladstone Dock, as there is plenty of land available at the site.

Shipbuilding Boom in Belfast.—Messrs. Harland and Wolff, Belfast, after the launch of the giant White Star liner Olympic, are about to lay the keels of three steamers in the building berth which will thus be vacated. The reason advanced for this experiment is that every other slip in both north and south yards is already occupied. In addition, one of the three 12,000-ton Hamburg-American steamers ordered from Belfast is being built at Clydebank. Three new vessels just laid down are two White Star tenders and a fast express steamer for the Belfast-Liverpool service.

Some tests which have recently been made on the new alloy duralumin, now being brought out by Messrs. Vickers, Sons, and Maxim Ltd., have given the following results: The specific gravity is rather less than one-third that of cast iron, whilst the tensile strength is equal to that of good mild steel. The ductility is fairly good in moderately thick plates, but falls off in thinner sheets. There is also a yield point which in the softer material takes place at about half the maximum stress, but rises to nearly the maximum stress in thin sheets. The alloy is said not to be suitable for castings.

PATENTEES' CHRONICLE

OF

Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

OCTOBER 17th, 1910.

23953 Internal-combustion engine. Burt.
23954 Cycle brake. Hopper.
23955 Bottle carrier. Huxley.
23956 Coal conveyor. Baillie.
23957 Electric driving apparatus. Anderson.
23958 *Electric motor control. Milch.
23959 Clutch. Cribbes.
23960 Grading small coal, etc. Reid.
23961 Displaying lantern slides. Brown.
23962 Fire escape. Richardson.
23963 Coupling. Hirst.
23964 Projecting transparenceies. Brown.
23965 Gas flasher. Gunning.
23966 Bedsteads. Evans.
23967 Footballs. Strachan.
23968 Map measurer. Steel.
23969 Nursery convenience. Jones.
23970 Ticket printing. Regina Machine Co.
23971 Aerial flight apparatus. Bell.
23972 Motor cars. Hobson.
23973 Electric switch. Cox.
23974 Sex determining device. Kay.
23975 Coal conveyor. Riddell.
23976 Electric lamp. Goodwin.
23977 Lead lap joint. Ferguson.
23978 Door knob. Roberts.
23979 Puzzle. Theodore.
23980 Carding engine. Cook.
23981 Screw clamp. Kelvie.
23982 *Flying machine. Carey.
23983 Targets. Barnett.
23984 Sewer tubes. Smith.
23985 *Table vessels. Wagner.
23986 Fireplace. Holmes.
23987 *Flying machine. Carey.
23988 *Ironing stand. Feick.
23989 Railway lines. Goodyear.
23990 Taxi-cab lamp. Cuninghame.
23991 Separating slate and coal. Wetter.
23992 Tyres. Turner.
23993 Internal-combustion engine. Roberts
23994 *Veneer presses. Kuttner.
23995 Spanner. Roots.
23996 *Self-propelled vehicles. Quinlivan.
23997 Shoeing horses. Bennett.
23998 Handle bars. Evans.
23999 Rail milling, etc. Marshall.
24000 *Reinforced concrete. Turner.
24001 Propulsion. Tesla.
24002 Propellers. Gross.
24003 *Relays. Siemens Bros. Ltd.
24004 Engines. Pavitt.
24005 *Washing machines. Henrice.
24006 Radiators. Kernan.
24007 Airships. Vickery.
24008 Letter boxes. Lucy.
24009 *Smelting process. Dedolph.
24010 Opthalmoscopes. Gowland.
24011 Extraction of precious metals. Lockwood.
24012 *Moulding walls. Stanbrough.
24013 *Steam generators. Reinhardt.
24014 *Bottle caps. Crown Cork Co. Ltd.
24015 *Steam generating apparatus. Kihn.
24016 Cramp. Allington.
24017 *Rat trap. Worthington.
24018 *Furnaces. Westphal.
24019 *Brushes. Thornton.
24020 *Multi-colour printing machine. Rochstroh.
24021 *Printing machine. Rochstroh.
24022 *Boring. Legrand.
24023 Telephones. Evans.
24024 Jointing device. Feske.
24025 *Production of ultra violet radiators. Daguerre.
24026 *Collar support. Holdheim.
24027 Variable speed app. Allyn.
24028 *Releasing nut lock. Miller.
24029 *Auto pianos. Marks.
24030 Filters. Marks.
24031 Bottle filling machines. Marks.
24032 Bottle holders. Hymans.
24033 Gum applying device. Hymans.
24034 *Hatches. Hudson.
24035 Treatment of gas. Wilton.
24036 *Gas analysis. Baillet.
24037 Extensible frame. Graddon.
24038 Water heaters. Gray.
24039 Looms. Vogel.
24040 *Stoppering device. Maldberg.
24041 Lamp. Booker.
24042 Leggings. Chamberlain.
24043 Lotion. Dunlop.
24044 *Cabinets. Krom.

OCTOBER 18th, 1910.

24045 Oil feeder. Bladon.
24046 Liquid fuel. Griffin.
24047 Fire escape. Horner.
24048 Hydrochloric acid manf. Perkin.
24049 Coal cutter. Spence.
24050 Printing machine. Luffman.
25051 Lamp. Kitchen.
24052 *Extraction of iron. Martin.
24053 Aeroplane tanks. Wildeblood.
24054 Piston rod packing. Lees.
24055 Bedsteads. Adie.
24056 Tobacco cutter. Roepke.
24057 *Furniture. Ritchie.
24058 *Coupling.
24059 Wheels. Crawley.
24060 Wheels. Mundy.
24061 Gas burners. Kunick.
24062 Cane chair. Day.
24063 Axles. Clifton.
24064 Games. Jameson.
24065 Brake gear. Ireland.
24066 Heel pads. Lahey.
24067 Gear cases for cycles. Watson.
24068 Gear cases for cycles. Watson.
24069 Fluid pressure engine. Teage.
24070 Washing plants. Greaves.
24071 Tram lines. Hoyle.
24072 Lavatory basin. Quine.
24073 Chair cases. Murray.
24074 Wheels. Marshall.
24075 Aeroplanes. Brown.
24076 Aeroplanes. Brown.
24077 Aeroplanes. Brown.
24078 Aeroplanes. Brown.
24079 Aeroplanes. Brown.
24080 Aeroplanes. Brown.
24081 Fire guards. Thomas.
24082 Envelopes. Jameson.
24083 Cycles. Milward.
24084 Electrical condensers. Bayles.
24085 Engine starter. Cummings.
24086 Coke oven. Mackenzie.
24087 Fishing rod. Thomas.
24088 Gardening machine. Davis.
24089 Fire grates. Battle.
24090 Shirt tops. Stafford.
24091 *Pipe coupling. Forth.
24092 Sash fastening. Fretwell.
24093 Aeroplane wheels. Wildeblood.
24094 Level indicator. Kelly.
25095 Machine for folding all-over nets. Cupitt.
24096 Summer arbours. Bayliss.
24097 *Safes. Conacher.
24098 *Photo printing cabinet. Mouzon.
24099 *Vehicle spring. Cluskey.
24100 *Carburetter. Blackburn.
24101 Ironholder. . Gray.
24102 Water heater. Austin.
24103 Cigar, etc., rest. Fitz-Maurice.
24104 Game. Humphreys.
24105 Motor cycles. Mayo.
24106 Arc lamp. Angold.
24107 Speedometer. Hamilton.
24108 Wire fencing. Booth.
24109 Tyres. Anns.
24110 Powder box. Talbot.
24111 Oil extracting Evans.
24112 *Gang planks. Bidlake.
24113 Buckle. Wethered.
24114 Carburetter. Withers
24115 Tube scaling tool. Gilman.
24116 Looms. Smith.
24117 Letter box. Smith.
24118 Pumps. Miller.
24119 *Life preservers. Klint.
24120 Racquet frames. Altman.
24121 Coin freed hat peg. Carrvill.
24122 *Flexible conductor.
24123 *Electrical insulation.
24124 Pistons. Lamplough.
24125 Pump. Lamplough.
24126 Sleeve links. Mahon.
24127 *Sanitary closets. Tickell.
24128 Amusement. Harris.
24129 Tyre. Genth.
24130 *Snow removal. Friedman.
24131 Condensers. Riemer.
24132 Core boxes. Dickinson.
24133 Rock drills. Rayner.
24134 *Windows. Whitfield.
24135 Vessel for travelling on water. Piercy.
24136 *Advertising device. Flachaire.
24137 *Turbines. Ljungstroms.
24138 *Ammonium sulphate manf. Dreochmidt.
24139 *Rakes.
24140 Rotary engine. Stevenson.
24141 Draw-off cock. Heale.
24142 Road vehicles. Hopper.
24143 *Frequency apparatus. Sanchez.
24144 *Acid tanks. Cross.
24145 *Tent. Lod.
24146 Brackets. Schärer.
24147 *Smoke masks. Heinr.
24148 *Airships. Crepar.
24149 *Overhead trolleys. Wood.
24150 *Heels. Evans.
24151 *Friction clutch. Daimler.
24152 Gas burner. Podmore.
24153 *Bottle cleaner. Boult.
24154 *Cam. Busche.
24155 *Water heater. Curtis.
24156 Photo apparatus. Whitehead.
24157 *Speed varying device. Bosch.
24158 *Signalling device. Siemens.
24159 *Water meter. Siemens.
24160 *Jointed pipes. Germany.
24161 Speed gear. Griffin.
24162 Treatment of milk. Mollinger.
24163 *Embroidery machine. Reents.
24164 *Watch movement. Kummer.
24165 *Tobacco pipe. Fairweather.
24166 *Cycle hubs. Rogers.
24167 *Parachute apparatus. Ulmer.
24168 *Storm coats. Barker.
24169 Necktie holder. Isle.
24170 Steam radiator. Marshall.
24171 *Milking device. Sharples.
24172 *Road manf. Hamloch.
24173 Sleeve links. Bolt.
24174 Bureaus. Pither.
24175 Hand brake. Weddle.
24176 *Paper balls. Parr.
24177 Cycle attachment. King.
24178 Motor car testing. Lowe.
24179 Ball holder. Ritson.

OCTOBER 19th, 1910.

24180 Lever for tyres. Williams.
24181 Rifle backsight. Parker.
24182 Lubricating device. Chapman.
24183 Electric alarms. Brown.
24184 Cutting tools. Gainsford.
24185 *Grain drying. Wertenbruch.
24186 Cinematographs. Messter.
24187 Mine cage control. Lishman.
24188 Pump. Poore.
24189 Key. Adamson.
24190 Flushing cistern. Merriman.
24191 Belt fastener. Mowbray.
24192 Liquid meter. Jack.
24193 Carding engine. Smith.
24194 Umbrella, etc., securing device. Walker.
24195 Letter box plate. Rigby.
24196 Guard for shafting, etc. Palfree.
24197 Extracting zinc from tailings. Beauchamp.
24198 Safes. Bowater.
24199 Clutch. Clegg.
24200 Books. Chappell.
24201 Electric fuse. Colcutt.
24202 Picture hooks. Hewitt.
24203 Motor car tyres. Carmouche.
24204 Cotter pins. Dickinson.
24205 Cigar, etc., holder. Dee.
24206 Cycle support. Flower.
24207 Blouse and skirt clip. Williamson.

24208 Riveting boilers, etc. Thompson.
24209 Apparatus for feeding papers, etc. Jamieson.
24210 *Ruling machine. Labbe.
24211 Rock drills. Shepherd.
24212 Thatch fastening. Wethered.
24213 Burnishing, etc., machine. Ferrabee.
24214 Boot manf. Keats.
24215 Cash registers. Clarke.
24216 Lamp cap. Mayers.
24217 Ball castors for furniture. Smart.
24218 Aeroplane. Landon.
24219 Valves. Crichley.
24220 Cases, etc. Goodwin.
24221 Railway carriage. Page.
24222 Wheel rim. Tomlinson.
24223 Valve operating gear. Roots.
24224 Blackleading machine. Kochler.
24225 Faucets. Thompson.
24226 Pulleys, etc. Jones.
24227 *Removing metallic coverings. Kochs.
24228 Book stand. Weiss.
24229 Variable gears. Thackhall-Browett.
24230 Woven material. Philpin.
24231 Venetian blind. Warren.
24232 Guns. Dawson.
24233 Computing apparatus. Clybouw.
24234 Drinking fountain. Morgan.
24235 *Reinforced blocks. Mitchell.
24236 Production of isoprene. Heinemann.
24237 Production of isoprene. Heinemann.
24238 Heating apparatus. Hirst.
24239 Cycle saddle. Hanman.
24240 *Pharmaceutical preparations. Ault.
24241 *Firearms. Imray.
24242 Gramophones. Exshaw.
24243 Golf bag carrier. Bartleet.
24244 *Mirrors. Giesler.
24245 Fishing reels. Hardy.
24246 Golf balls. Evans.
24247 Match striker. Bellow.
24248 Vacuum cleaner. Johnston.
24249 *Emptying superphosphate chambers. Thorssell.
24250 *Hoisting apparatus. Liebgott.
24251 *Ticket dating. Klein.
24252 *Knitting machine. Wirth.
24253 *Toned printing plate manf. Droitcour.
24254 Oil distributing. Spivey.
24255 Guns. Dawson.
24256 *Manf. of hydrogen. Pictet.
24257 *Stone polishing. Ratcliffe.
24258 *Extensible mast. Jaeger.
24259 Pen nib manf. Bissell.
24260 Pen nib manf. Bissell.
24261 Helicopters. Brougham.
24262 Hoists. Hartley.
24263 Roving frames. Mackie.
24264 *Aeroplanes. Belin.
24265 Lifting jacks. Dixon.
24266 Stamp mills. Nissen.
24267 Roof ventilation. Lynes.
24268 Coal-washers. Benson.
24269 Coal washers. Benson.
24270 *Food warmer. Casagranda.
24271 Tyres. Cooke.
24272 Magnetic armature. Kilroy.
24273 Lanterns. Sturgess.
24274 Explosives. Pierce.
24275 *Sterilising milk. Labouré.
24276 *Production of ingot iron. Marten.
24277 *Drilling tools.
24278 Transmission of sounds. Evershed.
24279 Tyres. Hill.
24280 Tyres. Messenger.
24281 Boot manf. Care.
24282 *Measuring instrument. Clarke.
24283 *Gas producer. Ernst.
24284 Measuring instrument. Edmunds.
24285 Pipe, etc., lighter. Oldridge.
24286 *Magnetic separators. Kraus.
24287 Cranes. Wiehe.

OCTOBER 20th, 1910.

24288 Ventilation device. Ridler.
24289 Spinning machine. Stell.
24290 Gun mountings. Mathews.
24291 Ignition plug. Longford.
24292 Motor car dash board. Brown.
24293 Rolling mills. Lambert.
24294 Arc lamp. Williams.
24295 Axles. Harrison.
24296 Rifle sight. McCubbin.
24297 Friction clutch. Nicholls.
24298 Gun sights. Merrick.
24299 Gramaphones. Moore.
24300 Tyres. Barker.
24301 Door fastener. Flavell.
24302 *Flushing cisterns. Barton.
24303 *Pocket case. Wright.
24304 Cupola tuveres. Gallon.
24305 Fare indicator. Rennie.
24306 Cutting machines. Stone.
24307 Soap holder. James.
24308 Looms. Hollingworth.
24309 Looms. Hollingworth.
24310 Spinning machines. Hollingworth.
24311 Tyres.
24312 Boot heel. Taylor.
24313 Furnace. Taylor.
24314 Fuel feeding device. Provans.
24315 Clips. Cogger.
24316 Telegraph circuits. Gorton.
24317 Paint, etc. Pybus.
24318 Punch balls. Tarr.
24319 Gas purification. Ledoux.
24320 Taps. Goebel.
24321 Window blind. Power.
24322 Tin opener. James.
24323 Desks. Bradford.
24324 Emptying tanks, etc. Bates.
24325 Treatment of rubber. Gillespie.
24326 Bucket. Lenox.
24327 Rifles. Wallace.
24328 Time recorder. Llewellen.
24329 Furnace. Stock.
24330 *Washing machine. Taylor.
24331 *Tube joints. Hess-Honegger.
24332 Leather cleaner. Rhodes.
24333 Cycle stands. Brown.
24334 *Coupling. Hughes.
24335 Wheels. Wright.
24336 Looms. Ward.
24337 Piston rings. Fleming.
24338 Rail key. Ley.
24339 Gas burner. Hersey.
24340 Cleaning device. Morfitt.
24341 Pit cages. Lester.
24342 Tyre remover. Hartridge.
24343 Drilling apparatus. Köhuk.
24344 Automobiles. Charles.
24345 *Cycle seat pillars. Bayliss.
24346 Map indicator. Chitty.
24347 *Telephone device. Perotti.
24348 Gas burners, etc. Upton.
24349 Wind screens. Reeve.
24350 Curtain suspending device. Humphreys.
24351 Aeroplanes. Ure.
24352 Aeroplanes. Ure.
24353 Dress baskets. Hanman.
24354 Post boxes. Kurtz.
24355 Carriage windows. Völkel.
24356 Wearing apparel fastener. Gasser.
24357 *Securing glass. Knoere.
24358 *Cleaner. Howell.
24359 *Mail pouch exchanging device. Knapp.
24360 Disinfecting apparatus. Paton.
24361 Sponge, etc. Clerc.
24362 Furnace. Cousins.
24363 Advertising device. Huckle.
26364 Game. Freeman.
24365 Envelope opener. Lappin.
24366 Blinds. Marsden.
24367 Rotary motion converter. Dallmeyer.
24368 Telegraph poles. Dognall.
24369 Organ pedal action. Bruggenkate.
24370 Music rolls. Maxfield.
24371 Talking machine. Dennison.
24372 *Paper manf. Kurtz-Hähnle.
24373 *Carburetter. Mackenzie.
24374 Cape cart hood. Wall.
24375 Engraving in printing rollers, etc. Dejey.
24376 *Sewers, etc. Lloyd.
24377 *Projectiles. Klaner.
24378 Photo toning. Triepel.
24379 Treatment of nitric acid. Hale.
24380 Skirt clip, etc. Anderson.
24381 Mechanical power. Suchostawer.
24382 *Treatment of acids. Ellis.
24383 Tyres. Russell.
24384 Boots, etc. Ward.
24385 *Coin freed meters. Palmer.
24386 Door catch. Wynne-Jones.
24387 Tyre securing. Hindley.
24388 Time switch. Bell.
24389 *Rail welding device. Goldschmidt.
24390 *Telephonic transmitters. Holt.
24391 Internal-combustion engine. Watkins.
24392 *Weighing machine. Burkholder.
24393 *Valve. Neustadter.
24394 Meat cover. Swainston.
24395 Washing machine. Readwin.
24396 Internal-combustion engine. Harrison.
24397 *Switching yards. Prenoszil.
24398 Electric lamp fittings. Weedon.
24399 Fountains, etc. Challis.
24400 *Aeroplanes. Korwin.
24401 *Internal-combustion engine. Korwin.
24402 Stencil manf. Parkinson.

OCTOBER 21st, 1910.

24403 Prevention of sea sickness. Gibson.
24404 *Cycle crank. Fitzsimons.
24405 Belt fastener. Johnston.
24406 Gas retorts. Masters.
24407 Steam superheater. Bolton.
24408 Boiler. Willoughby.
24409 *Top starting whip. Kowsky.
24410 Tobacco pipe. McClean.
24411 Fencing. Purser.
24412 Billiard table cover. Dempsey.
24413 *Separation of nitrogen from air. Heys.
24414 Leggings Hill.
24415 Friction clutch. Seaman.
24416 Radiators. Mitchell.
24417 Velocipede pedal. Greid.
24418 Concrete slabs. Glenday.
24419 Valve. Moriceau.
24420 Internal-combustion engine. Bate.
24421 *Wireless telegraphy. Smith.
24422 Bronzing, etc. Midwood.
24423 Ignition device. Swaine.
24424 Gas lamp ignition control. Keith.
24425 Wheel. Baxter.
24426 Carding engine. Holland.
24427 Wood screw. Carlton.
24428 Pocket knives. Priestman.
24429 Coal cutters. Bumpstead.
24430 Lifebuoy. Lacey.
24431 Lace machine carriage. Creassey.
24432 Furnace. McGee.
24433 Panel varnishing. Midwood.
24434 Dye manf. Ashworth.
24435 Lubricator. Hughes.
24436 Turbine. Rees.
24437 Golf links. Mayo.
24438 Hat fastener. Brightman.
24439 *Electric switch. Hope.
24440 Mattresses. Whitfield.
24441 Sanitary buckets. Smith.
24442 Motor tyres. Taylor.
24443 Lamp burners. Hoxton.
24444 Pencil, etc. Green.
24445 Paper receptacles.
24446 Paper receptacles.
24447 Caps. Poulton.
24448 Phonograph horn. Abrahams.
24449 Tooth brush. Gillilan.
24450 *Coin-freed machine. Barrett.
24451 Slam lock. Ilott.
24452 Can closing. Waller.
24453 Can closing. Waller.
24454 *Gully grates. Adams.
24455 Boot manf. Boult.
24456 Machine for inserting fasteners. Boult.
24457 Electric apparatus. Peake.
24458 *Vacuum cleaner. Matchette.
24459 *Shirt. Vineberg.
24460 Filters. Ionides.
24461 Pumps. Ionides.
24462 Neckties. Poulton.
24463 Speed gear. Brown.
24464 Clutch. Watts.
24465 Easel. Vosper.
24466 Gas lighter. Mattock.
24467 *Steam nozzle. Lehmann.
24468 *File cutting. Peiseler.
24469 *File cutting. Peiseler.
24470 Steam generator. Hales.
24471 Weather screen. Finkelstem..
24472 Chimney. Hahn.
24473 Evaporating apparatus. Lillie.
24474 *Printing press. Lake.
24475 Electric traction system.
24476 Internal-combustion engine. Appleton-
24477 Wheel. Dixon.
24478 *Lamp wick. Grierson.
24479 *Gleaning refuse collecting, etc. Böving.
24480 *Amino-oxyarylarsenoxides manf. Meister.
24481 *Road breaking tool. Allen.
24482 *Speed recorder. Perman.
24483 *Impregnation of timber Haltenberger.
24484 Boot manf. Bennion.
24485 Electrical resistance. Field.
24486 Colouring matter. Johnson.
24487 *Boot manf.
24488 Hanging cabinet. Mandeville.
24489 *Electric car plough. Samaia.
24490 Buckles. Whitby.
24491 *Furnace. Veeckmans
24492 Wheels. Giles.
24493 Gas lamps. Anderson.
24494 *Aerostat. Zlobinsky.
24495 *Electric shutter indicator. Zickel.
24496 Shaving soap. Ferguson.
24497 Coat hooks. Taylor.
24498 Electric machine. Lodge.
24499 Internal-combustion engine. Taylor.
24500 Working of superphosphate chambers. Freudenthal.
24501 *Acid production.
24502 Targets. Rose.
24503 Carburetting air. Currey.
24504 *Stamping press. Jones
24505 Wheel spokes. Keegan
24506 Golf club. Coldwell.
24507 *Anchor arms. Thackray.
24508 *Shafts. Terrazo.
24509 *Gas purification. Pearce.
24510 Piston rod packing. Jakeman.
24511 Electric motor. Rosenberg.
24512 *Speed mechanism. Barreau.
24513 Tar macadam manf. Thompson.
24514 Tooth powder. Barron.

OCTOBER 22nd, 1910.

24515 Bagatelle, etc., tables. Hepton.
24516 Reducing vegetable fats, etc. Henderson.
24517 Cycle saddle. Brooks.
24518 Chair. Bird.
24519 Friction clutch. Jeffares.
24520 Carburetter. Hewitt.
24521 Treatment of ores. Russell.
24522 Gear wheel cutting. March.
24523 Amusement. Lear.
24524 *Point shifting. Piacani.

24525 Cycle saddle. Blagg.
24526 Artificial teeth. Callender.
24527 Internal-combustion engine. Turner.
24528 Screening slag, etc. Paton.
24529 Sewing machine. Brown.
24530 Superheating steam. Bolton.
24531 Cycle driving belt. Yoxall.
24532 Pulley block. Macgregor.
24533 Electric striking mechanism. Parsons.
24534 Ships' steering. Macgregor.
24535 Ladies' hair clip. Fraser.
24536 Egg poacher. Vaughan.
24537 Washing machine. Mitchell.
24538 *Punching machine. Myers.
24539 Bearing manf. Hanna.
24540 Winding machines. Boyd.
24541 Advertising device. Huckle.
24542 Gear cutter. Greenwood.
24543 Filter. Podmore.
24544 Hammer. Blacker.
24545 Trucks. Wilcox.
24546 Horse shoes. Bonson.
24547 *Metallic frame construction. Foxcraft.
24548 *Lamps. Krause.
24549 Lamp. Skanpy.
24550 Coating iron, etc., with zinc. Cowper-Coles.
24551 Hot galvanising. Cowper-Coles.
24552 Talking machine records. Seymour.
24553 *Kitchen gas range. Allford.
24554 Couplings. Wilkes.
24555 Casement fastenings. Sanders.
24556 Wheels. Taylor.
24557 Rulers. Daines.
24558 Ratchet spanner. Ditchfield.
24559 *Internal-combustion engine. Kilburn.
24560 *Pistons. Brandt.
24561 Trimming insoles. Boult.
24562 Manf. of floors. Bäckström.
24563 Cinematograph films. Madaler.
24564 Insulating compound. Mosley.
24565 Paint. Mosley.
24566 Tank. Kidd.
24567 Medicine. Wynn.
24568 Purification of air. Stone.
24569 Dye manf. Imray.
24570 Shelves. Craig.
24671 *Dye manf. Rahtjen.
24572 *Wheel. Brailey.
24573 Water heaters. Nesbit.
24574 *Pipe bending. Klarwasser.
24575 *Paper pulp manf. Butterfield.
24576 Bassinette. Headley.
24577 Water distilling. Nesfield.
24578 Vehicle springs. Glover.
24579 *Gold-coated metal. Kammerer.
24580 Train stopping device. Clegg.
24581 *Addressing machine. Hughes.
24582 Furnace. Thompson.
24583 Wheel. Nisbet.
24584 Electric switch. Batstone.
24585 Clutches. Garrad.
24586 Spanner. Pinney.
24587 Explosives. Zulloch.
24588 *Internal-combustion engine. Oherhausli.
24589 Shafts. Wells.
24590 *Cupola furnace. Anderson.
24591 *Aeroplane. Filiasi.
24592 *Wheel. Kelly.
24593 Water-proofing materials. Stevenson.
24594 Dies for brick moulding. Smith.
24595 Heel pads. Hammond.
24596 Hat fastener. Nash.
24597 *Cuff links. Heissler.
24598 Concrete, etc., floors. Thomsen.
24599 Valves. Garvie.
24600 *Tobacco cartridges. Thorbecke.
24601 Pneumatic tyres. Hamilton.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

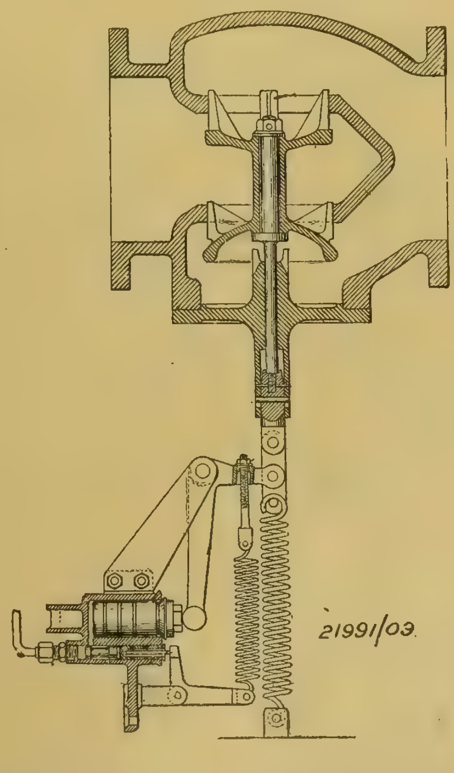
Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to November 28th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

14090 Kitchen: Portable cooking ranges. 14173 Kohnle: Machine for marking, delivering, and wholly or partly detaching adhesive or other labels or the like. 14433 Kohnle: Machines for making and attaching tickets to textile fabrics. 15227 Coussell: Form of carburetter for internal-combustion engines. [Post-dated December 29th, 1909.] 17017 Bedford and Williams: Catalytic synthesis of methane. [Cognate Application. 22219, 1909.] 18817 Hommell and Durant: Treatment of complex zinc ores. 18893 Abrahams and Abrahams: Bedsteads. 18899 Hicks: Aerial machines. 19832 Long: Motor-propelled vehicles. [Post-dated February 28th, 1910.] 21141 Cowap: Variable-throw cranks or the like. 21147 Pattinson: Drawing boards or the like. 21151 Scott: Exhaust silencer for revolving cylinder internal-combustion engines. 21191 Royer: Mode of and apparatus for igniting the combustible charge in two-stroke cycle internal-combustion engines. [Date applied for under International Convention, September 16th, 1908.] 21212 Becher: Locks. 21216 Fitz: Percussive apparatus. 21221 Spyker: Construction of elastic wheels with pneumatic chambers. [Application for Patent of Addition to 11079, 1909.] 21238 Victoria Spinning Co., and Black: Spinning and twisting of vegetable or animal fibres and the like. 21253 Benson, and Head, Wrightson, and Co.: Coal washer. 21286 Poupard: Weighing machine. 21299 Dawson and Buckham: Elevating and sighting apparatus of high angle ordnance. 21311 Martin: Fasteners for connecting together bands or parts of driving bands for motor cars and machinery. 21315 James: Means for heating water or generating steam rapidly. 21316 Scott-Snell: Carburetting and compressing apparatus. 21330 Grant and Chadburn's (Ship) Telegraph Co. Ltd.:—Speed and direction indicating mechanism. 21350 Bassano: Driving and stopping of spring motors of gramophones and the like. [Application for Patent of Addition to 1799, 1908.] 21351 Reeves: Smut catcher and consumer for the head of a lamp or the like. 21357 Heap: Switching devices for alternating-current circuits. [Cognate Application. 22141, 1909.] 21383 Berthier: Automatic firearms. [Date applied for under International Convention, September 19th, 1908.] 21387 Doillet and Faure: Apparatus for feeding boilers and furnaces. [Date applied for under International Convention, September 21st, 1908.] 21394 Pearce, and Evershed and Vignoles Ltd.: Production of sound waves by means of forced vibrations. 21457 Bauer: Preparation of soft soap. 21484 Bett: Advertising apparatus. 21503 Taylor, and John Taylor and Co. (Waterfoot) Ltd.: Machine driving belting. 21509 Mackintosh and Walton: Trenching tools, axes, pickaxes, hammers, and the like. 21513 Hollingworth (Crompton and Knowles Loom Works): Filling transferring mechanism of automatic weft-replenishing looms. 21535 Lundeberg: Manf. of artificial plates or slabs, more particularly of wood. 21582 Pritchard, and United Alkali Co.: Apparatus for the utilisation of heat from liquors discharged from stills or other apparatus. 21588 Adams: Photographic cameras of the type known as reflecting or reflex cameras. 21638 Lang: Method of and coating for protecting iron and rust. [Date applied for under International Convention, September 23rd, 1908.] 21640 Holmes: Basins, bowls, sinks, and the like. 21641 Keller: Door locks. 21645 Knight: Apparatus for controlling the admission and exhaust of internal-combustion engines. 21656 Burt: Billiard or pool balls. 21661 Nicolas: Method and apparatus for testing or analysing lubricating oils or the like. 21662 Varty: Lever mechanism. [Application for Patent of Addition to 3611, 1909.] 21683 Burdick: Coin-counting machine. 21698 Williams and Muir: Means for use in locating price lists, catalogues, and the like for ready reference. 21744 Gallaher: Coin-handling device. 21745 Jones and Still: Means for washing plates and the like. 21750 Firm Th. Goldschmidt: Apparatus for use in butt-welding the ends of rails. [Date applied for under International Convention, April 8th, 1909.] 21752 Blos:



21991/09.

Tele-selectors. 21761 Boult (United Shoe Machinery Co.): Shoe-upper lacing machines. 21762 Long: Speed alarm mechanism. 21783 Senior: Lawn roller. 21787 Cook: Enclosed double-acting reciprocating pump. 21797 Gordon: Machines for cutting leather or other materials. [Date applied for under International Convention, September 25th, 1908.] 21803 William Beardmore and Co., and Sykes: Means for automatically controlling the reversal of electrically-driven machine tools. 21830 Dunlop: Tobacco pipes. 21860 Ewing: Paper mugs or receptacles for containing milk or cream. 21876 Tyrrell: Locking stays for doors. 21883 Wren: Light camp bedstead and valise. 21902 Hodgkinson: Method of and means for discharging into atmosphere the products of combustion of the furnaces of steam generators on war and other vessels. 21908 Bates, and British United Shoe Machinery Co.: Tack-supplying and inserting mechanism for pulling-over and like machines. 21909 Jerram, and British United Shoe Machinery Co.: Chain-stitch shoe-sewing machines. 21985 Princess Anne of Lowenstein Wertheim: Self-levelling cots, bunks, couches, and the like for use on ship board.

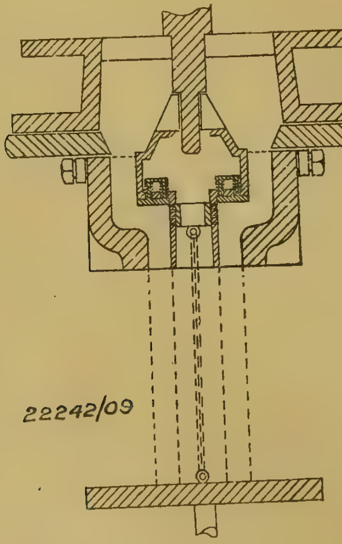
21991 Bellis and Morcom Ltd., and Walshe: Governors operated by fluid pressure.

This invention relates to improvements in contrivances such as are used for regulating the rate of operation of a motor-driven pump in such a manner that, with a varying demand, the mass of fluid delivered by the pump may be maintained equal to the quantity required with a relatively small fluctuation of pressure. According to the present invention the control valve is loaded by a helical spring, which spring serves also to load the plunger of the relay cylinder in such a manner that the displacement of the plunger resulting from the admission of air to the relay cylinder by the prior displacement of the control valve augments the load on the control valve and tends to close it. Thus the control valve which brings about the regulation of the output of compressed air through the medium of the plunger of the relay cylinder is itself controlled by the plunger in a manner which will prevent spasmodic action of the regulating contrivance.

22018 Walker, Walker, and Walker: Controlling devices for automatic weft-replenishing looms. 22074 Alexander (Fischer): Incandescent gas-burnings lamps of the inverted type. 22109 Foster: Recreation track. 22137 Leask: Refuse destructors. [Cognate Application. 7548, 1910.] 22141. *See* 21357, 1909. 22215 Gissemann and Frederiksen: Water tap with a valve arranged in a perforated cap. 22219. *See* 17017, 1909.

22242 Sabine: Machines for making sanitary pipes and the like.

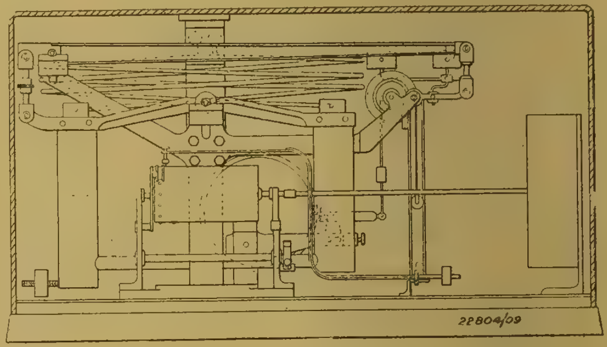
This invention relates to improvements in the type of sanitary pipe machine in which the pipe or the like issues from the die spigot end first and the socket thereof is formed last. According to this invention the centre in the cylindrical part is perforated immediately below the shoulder of the socket, and inside the centre is arranged a ring sufficiently deep to cover all the perforations until nearly the full length of pipe has been made. The ring is then drawn downwards by any suitable means and the air having a tendency to pass inwards through the perforations causes the clay to fill up and form the square shoulder of the pipe; this ring is afterwards returned by hand or other suitable means. A loose flat horizontal ring is also arranged in the shoulder of the centre to fall slightly upon pins or studs and so assist in loosening the pipe socket from the centre when the pipe is being removed from the machine; this ring may also assist slightly in forming the square shoulder of the socket.


22242/09

22258 Cousans: Apparatus for blowing pipe organs, harmoniums, or the like musical instruments. 22272 Barnfather: Inflating devices for the pneumatic tyres of road vehicles and the like. 22383 Estler: Means of supporting shelves for books, packages, and goods of all descriptions. 22408 Anger: Suspension of railway and tramway vehicle trucks. 22410 Bodenheimer: Protection of pneumatic tyres. 22438 Gold: Pneumatic tyres for wheels. [Post-dated April 4th, 1910.] 22493 Shepherd: Sliver cans. 22509 Whyte: Manifold copying books. 22544 Brandt: Air valves for internal-combustion engines. 22606 Scholz: Process for obtaining pure caoutchouc, gutta, balata, and the like. 22659 Rose, Bellamy, and Dolphin: Inverted incandescent gas burners. 22679 Boult (Troy Laundry Machinery Co.): Centrifugal extractors. 22792 Abbott and Johnson: Tables, particularly adapted for containing and carrying typewriting and other machines. [Cognate Application. 27322, 1909.]

22804 British Thomson-Houston Co. (General Electric Co.): Fluid meters.

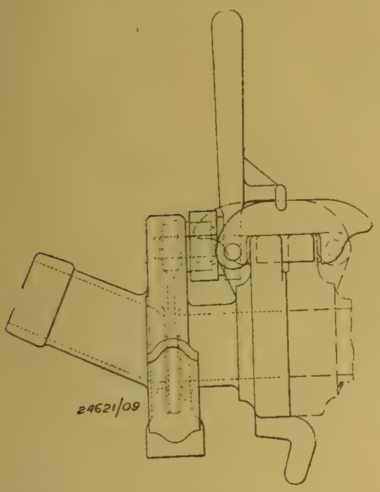
This invention relates to meters for indicating and recording the flow of fluid through a main, and more especially the flow of an elastic fluid such as steam, air, or other gas, but it is not necessarily limited thereto. The invention consists essentially in a fluid meter comprising a pivoted U-shaped vessel containing a column of mercury adapted to be displaced and cause movement of the vessel in accordance with changes in the rate of flow of the fluid to be measured, a beam supported by the vessel and connected at one end to a bell crank lever carrying an indicator or recording device, a suspended weight adapted to bear on the bell crank lever and exercise a progressively increasing effect against its movement from the normal inoperative position, and a coiled tube subjected internally to the pressure of the fluid and arranged to alter the length of the suspension of the weight in accordance with changes in pressure of the fluid.


22804/09

22808 Hudson: Curtain poles, and runners and guides for curtain-suspending devices. 22905 Kayser and Robinson: Clutches. [Request under Section 19 of the Act not granted.] 22917 Headley: Folding or collapsible hoods for children's and invalids' push-carts. 23093 Kimber: Operating the stamps of stamp mills. 23172 De Colombier: Pneumatic tyres for wheels. 23368 Bottomley: Burner for gassing frames. 23395 Wanklin: Roller skates. 23484 McGregor, Swinburne, and Bradley: Warp heddling and reeding machine. 23597 Sellers and Connold: Steam boiler and like furnaces. 23762 Powley, Powley, and Powley: Apparatus for delivering measured quantities of liquid. 23768 Colzi and Bardelli: Telemeters. [Date applied for under International Convention, October 17th, 1908.] 23846 Ward: Apparatus for automatically indicating and recording the percentage of carbon dioxide gas contained in the combustion gases of furnace flues and the like. 23870 Potter: Feed regulators for cotton opening and other cotton-working machines. 23883 Graber and Kaesser-Muller: Looms having revolving shuttle boxes. 24096 Martin, and Martin's Motors Ltd.: Crank chambers for steam, air, gas, and other engines. 24115 Ellison: Time lag devices for electric circuit breakers and other electrical apparatus. 24312 Stibbe: Circular knitting machines. [Cognate Application. 27022, 1909.]

24621 McLaren and Hibberd: Pipe couplings and valves.

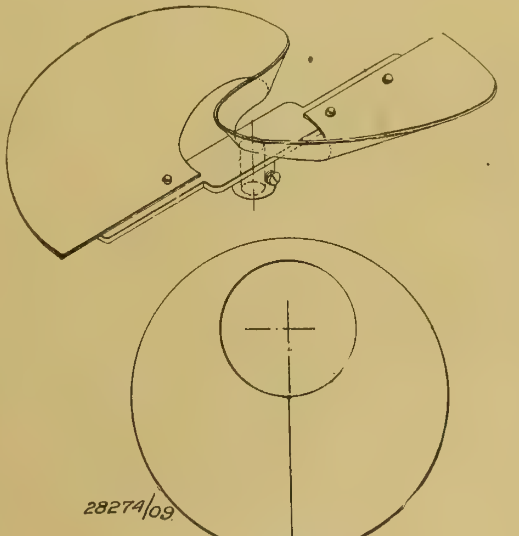
This invention relates to couplings and valves chiefly intended for use in connection with apparatus for the steam heating of trains for connecting the flexible pipes between the carriages and to that class of coupling provided with manually operated cocks or valves for closing the passage through the coupling before the two members are disconnected. According to the invention is arranged in connection with each member of a coupling, of the type wherein the members are connected on one side by interlocking tongues and on the other side by hooked arms or locking levers, a valve having an external operating lever, and this operating lever is arranged in such relation to the locking levers that it shall be impossible to disconnect the coupling parts without first moving the operating lever to close the valves.



24746 Hollingworth (Crompton and Knowles Loom Works): Filling detector mechanism for automatic weft-replenishing looms. 24752 Hollingworth (Crompton and Knowles Loom Works): Means for holding and guiding the loose ends of filling extending from the magazines in weft-replenishing looms. 24754 Hollingworth (Crompton and Knowles Loom Works): Weft carrier magazines for automatic weft-replenishing drop-box looms and means for actuating same. 24760 Hollingworth (Crompton and Knowles Loom Works): Weft carrier magazines for automatic weft-replenishing looms and means for holding and guiding the loose ends of filling extending therefrom. 24777 Hollingworth (Crompton and Knowles Loom Works): Filling carrier magazines for automatic weft-replenishing looms. 24849 Brewer and Emden: Trunks. 24867 Brown: Means or apparatus for shaping garments or articles of wearing apparel, or portions thereof. 24884 Fairbank: Window sashes and frames. 24999 Wilkinson and Wilkinson: Guillotine paper-cutting machines. 25002 Kehrhahn: Leather-treating machines. 25046 Glenn: Heating stoves. 25177 McVean: Three-horse yoke. 25182 Parker, Winder, and Achurch Ltd., and Winder: Roller bearings for axle pulleys. 25205 Barker (Welch and Parkman): Electric motor and controlling systems. 25243 Deutsche Abel-Postwertzeichen-Automaten Ges.: Roller-conveying device for strips of material. [Date applied for under International Convention, November 2nd, 1908.] 25255 Balke and Bartholome: Serviette holders. 25394 Garsed: Apparatus for operating planes or wings and rudders of aerial machines. 25441 Parr: Devices for the prevention of bursting of reservoirs and vessels containing inflammable liquids. 25604 Hollingworth (Crompton and Knowles Loom Works): Harness motions of looms for weaving. 25632 Redlich: Aeroplanes. 25822 Myer: Metallic conduits for electric conductors. 25918 Hipkins and Parsons: Regulating devices particularly applicable to weighing or like apparatus. 25936 Whyte: Mariner's compass. 25947 Hilborne: Valve for pneumatic tyres, air cushions, air beds, and the like. 25950 Hollingworth (Crompton and Knowles Loom Works): Filling detecting mechanism for weft-replenishing looms. 26028 Daniell and Hebden: Supports for use in dyeing yarn or the like. 26064 Eckersley and Creswick: Cutter boxes or cutter holders for coal-cutting machines. 26073 Hoyle: Means for lighting gas burners and the like. 26105 Arrighi: Manf. of instruments for foretelling changes of weather. 26115 Prince: Melting of metal chips. [Date applied for under International Convention, November 13th, 1908.] 26160 Neale: Kettles and the like and the manf. thereof. 26232 Joslin: Glass constructions for lighting purposes. 26272 Stevens: Tubular latches. 26287 Birmingham Railway Carriage and Wagon Co., and Foster: Railway hopper wagons. 26305 Edge: Apparatus for locking the hinged covers connected with the main cylinders of carding engines. 26325 Wardell: Stuffing boxes. 26396 Brooks: Combined seat and cabinet or box for use in motor and other vehicles. 26459 White: Gas-generating apparatus. 26730 Callaway: Taps or cocks for liquids or gases. 26798 Gorstige: Extension ladders. 26857 Hilton: Locking devices for the doors or covers of carding engine cylinders. 26949 Clay: Gun clips and carriers and means for attaching and securing same to bicycles. 26980 Haley: Machines for shaving, whitening, buffing, and performing similar operations upon leather, hides, skins, and the like. 27022. *See* 24312, 1909. 27116 Tanne and Oberlander: Process of separating solid hydrocarbons from residues of mineral oil and tar. 27166 Mulholland and Coakley: Internal-combustion engines. 27322. *See* 22792, 1909. 27344 Ges. fur Verwertung Chemischer Produkte: Bunsen burner with automatic air regulation. [Date applied for under International Convention, February 2nd, 1909.] 27393 Baumgaertner: Apparatus for recording rest or motion for use on road vehicles. [Date applied for under International Convention, December 9th, 1908.] 27482 Metal Jointing Co., and Harden: Expansion device for lead pipes. 27568 Willett: Card shufflers. 27602 Hellwig, Klotzbucher, and Klotzbucher: Apparatus for cleaning and boiling fruit and the like. 27645 Pauchot, Pauchot, and Pauchot: Reinforced concrete and like structures. 27693 Sandow: Device for measuring spinal deformation. 27717 Armstrong: Adjustable clip or fastening for detachable non-skid bands and the like for pneumatic tyres for road vehicles. 27809 Morgan and Morgan: Valves of internal-combustion engines. 27860 Bannister and Coultas: Baskets, skeps, and the like. 27867 Chavasse: Rollers for roller skates. 27925 Schmidt: Method of charging air with radio active emanations for ventilation purposes. [Date applied for under International Convention, December 1st, 1908.] 28215 Savours: Time indicator used in conjunction with a timepiece. 28228 France: Appliance for use in locating punctures in pneumatic tyres.

28274 Midgley and Vandervell: Construction of fans.

This invention relates to the construction of fans, and consists essentially of a circular plate of metal or other flexible material having an eccentrically disposed hole of about one-third of the diameter of the plate and being cut along the main portion of the diametrical line passing through the centres of the plate and hole, the severed parts of the plate being then bent through 180 deg. and rigidly secured at the severed parts to two supporting arms attached to or forming a part of a boss or other equivalent rotary support.

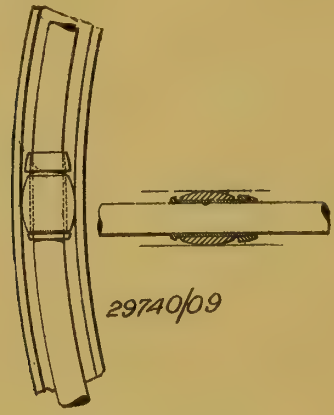


28288 Kinney: Bed-bottom fabric. [Date applied for under International Convention, December 3rd, 1908.] 28333 Hunt (Swan): Electric ceiling fans. 28411 Watson: Portable sketching easel. 28631 Sheath: Method of and apparatus for teaching music. 28716 Newton (Farbenfabriken vorm F. Bayer and Co.): Manf. and production of new azo dyestuffs. 28819 Sayers and Humphreys: Sash fasteners. 28867 Logan: Water meters of the positive type. 28885 Nixon: Bottle stoppers. 28888

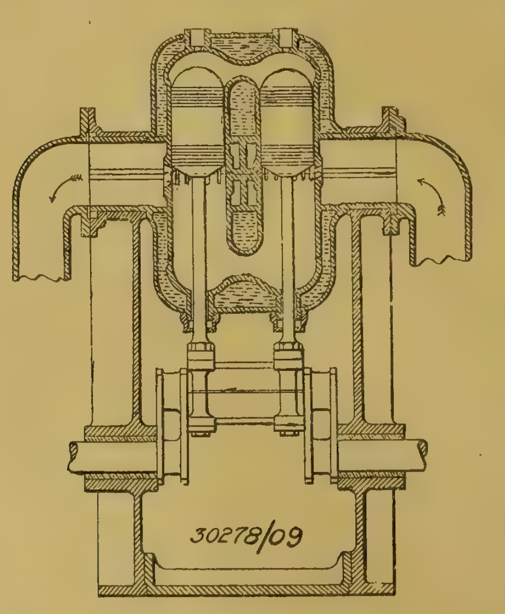
Mellor and England: Milling or fulling machines for treating textile fabrics. 28915 Morison: Means for putting up complexion powders, scented powders, and the like. 28928 Associated Portland Cement Manufacturers (1900), and Whiteman: Machinery for trussing casks and the like. 28971 Henderson: Hatches for sea-going vessels or other constructions requiring temporary but water-tight covers. 29013 Bynoe: Superheaters for heating purposes. 29052 Saunders: Apparatus to be used in connection with the milling or grinding of flour and such like. 29113 Muller: Manf. of soap. 29159 White: Construction of loom weft forks. 29317 Campbell: Rotary engines. [Post-dated January 26th, 1910.] 29356 Walker: Files, temporary binders, loose-leaf books, and the like. 29367 Light: Revolving cylinder internal-combustion engines. 29380 Wood: Travelling trunks. 29578 British and Colonial Lighting Co. (Pitner): Caps or closures for petrol and other containing vessels. 29706 Luckow: Method of regenerating storage batteries.

29740 Bambridge: Flexible driving shafts or the like.

This invention relates to flexible driving means employed for transmitting power and motion, and consists essentially in the combinations with flexible driving devices of means to rotatably support the driving cable or rope within the flexible outer case, the means comprising one or more bearings, each consisting of an outer member to engage the interior of the flexixble case, and an inner member to fit upon the driving cable or rope and adapted to rotate within the outer member.


29740/09

29762 Anderson, Boyes, and Co., and Anderson: Coal-cutting machines. 29807 Moores: Cigarette, cigar, and like cases.


30278/09

29938 Nisbet and Kirkpatrick: Coal face conveyors. 29992 Simpson: Telescopic calliper gauges. 30150 Mlitz: Covers for vessels for holding lubricating oil and other substances. [Date applied for under International Convention, December 24th, 1908.] 30188 Andersen and Andersen: Apparatus for electrically transmitting images of natural objects to a distance. [Date applied for under International Convention, December 24th, 1908.]

30278 Beardmore and Stokes: Double-acting two-stroke cycle internal-combustion engine. [Post-dated May 31st, 1910.]

This invention has for its object to provide an improved arrangement of double-acting two-stroke cycle internal-combustion engine of the type comprising as a unit integer a pair of cylinders side by side axially parallel and closely adjacent. Their ends are interconnected, and circumferentially about their centres there is in the one cylinder a manifold inlet port and in the other a manifold exhaust port. In each cylinder is a piston of a length substantially equal to the stroke less the axial length of the manifold port, and each piston is carried on a piston rod passing out through stuffing boxes in the cylinder heads. The invention comprises piston rods directly connected to a crank or to two coincident cranks and trunnions formed upon the cylinders and upon which they oscillate, the trunnions having internally inlet and exhaust passages.

30362 Duxbury and Lemmon: Means for and method of filling coke skips. 30495 Starck: Swinging saw.

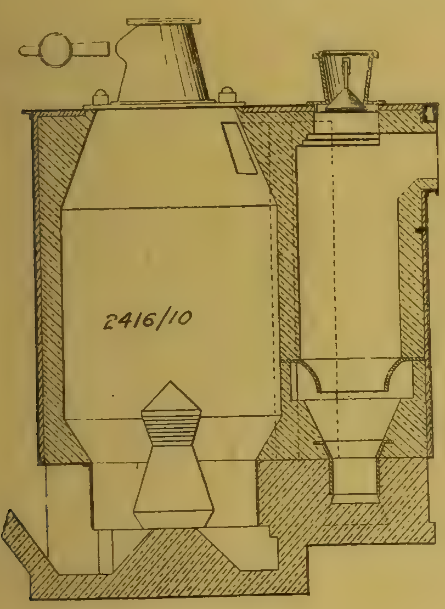
1910.

90 Linderman: Means for feeding lumber to wood-working machines. 124 Marks (International Marine Signal Co.): Method of preserving calcium carbide in use and preventing over generation of gas. 128 Akbari: Combined shaving mug and toilet soap box. 133 Soc. pour L'Industrie Chimique a Bale: Manf. of new vat dyestuffs of the anthracene series and intermediate products. [Date applied for under International Convention, January 4th, 1909.] 276 Schmidt and Thomsen: Steam superheaters for locomotives. 313 Rodman: Production of materials for case hardening or cementation purposes. 342 Merrick: Gas washers. 442 Sauvageot: Process for obtaining mineral fat or grease from coal tar. [Date applied for under International Convention, January 20th, 1909.] 644 Peter: Cleansing and disinfecting fluid and method of using same. [Rights under Section 91 of the Act not granted.] 730 Rietsch: Means for interlocking points and signals on railways. 789 Arnold and Benwell: Blind roller fittings. 822 Smith: Attachment for fixing hats in hat boxes. 1014 Griffiths and Griffiths: Stoppers for bottles, jars, and the like. 1097 Johnson and Gadney: Steam or other turbines. 1146 British Thomson-Houston Co. (General Electric Co.): Control of electrically-operated switches. [Request under Section 19 of the Act not granted.] 1240 Fester: Packing particularly adapted for use in connection with flat slide valves, piston slide valves, pistons, and like moving parts. 1437 Purdy: Steam engine and like indicators. [Date applied for under International Convention, January 19th, 1909.] 1459 Hartman: Apparatus for purifying liquids by electricity. 1460 Hartman: Apparatus for purifying liquids by electricity. 1571 Wineberg: Foot clips for the pedals of cycles and the like. 1604 Houdard: Bed pans. [Date applied for under International Convention, March 9th, 1909.] 1936 Malden: Manure infuser. [Post-dated April 12th, 1910.] 2119 Debauche: Controlling or safety devices for apparatus driven by fluids under pressure. 2124 Tyson: Propellers. 2376 Shifley: Boats and barges.

2416 Wilson and Wilson: Gas producers.

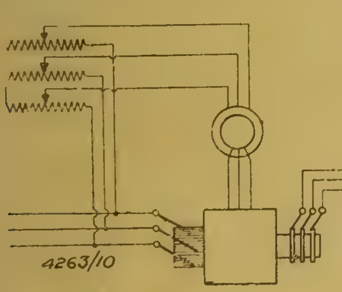
This invention relates to gas producers provided with means for the removal of soot and dust from the gas produced, which means are located within or in proximity to the producer chamber so as to be highly heated and thereby avoid the condensation of tar. The invention comprises a gas-producing chamber and a gas-scrubbing chamber arranged at approximately the same level in a common casing or constituting one structure and in such relation to each other that the scrubbing chamber is sufficiently heated to avoid condensation of the tar therein, a gas passage or passages also within the casing or structure and connecting the upper part of a gas producer chamber with the lower part of the scrubber chamber, and means such as a water-luted opening for the withdrawal of the fouled material from the scrubber chamber periodically or continuously.

2665 Le Bas, Garvie, and Garratt: Apparatus for withdrawing piles, sheet piles, well tubes, and the like. 2994 Gerdes: Escapement movements for clocks, clock-synchronising devices, and the like. 3194 Krautzberger: Apparatus for use with paint-spraying and like machines for separating paints and colours from air. 3206 Kalle and Co. Akt.-Ges.: Manf. of indigoid colouring matters of the anthracene series. [Date applied for under International Convention, February 17th, 1909. Samples furnished under Section 2 of the Act.] 3217 Hodge: Printing presses. [Date applied for under International Convention, March 9th, 1909.] 3233 Chadwick, and Hugh Stevenson and Sons Ltd.: Collapsible boxes. 3563 White: Compact case for the use of smokers who use tobacco made up into packets or cartridges. 3614 Dunford, Bartlett, Milburn, and Emens: Apparatus for lubricating the axles of colliery tubs or corves and like vehicles. 3642 Blyth: Show cases. 3734 Bilyeu: Collapsible pile formers. 3738 Macomber: Trousers stretchers. 3739 Harden: Metallurgical furnaces. 3743 Down: Operation tables for surgical use. 3985 Morrison: Machines for bottling aerated liquids.



4263 Siemens Bros. Dynamo Works (Siemens Schuckertwerke Ges.): Regulation of electric frequency transformers.

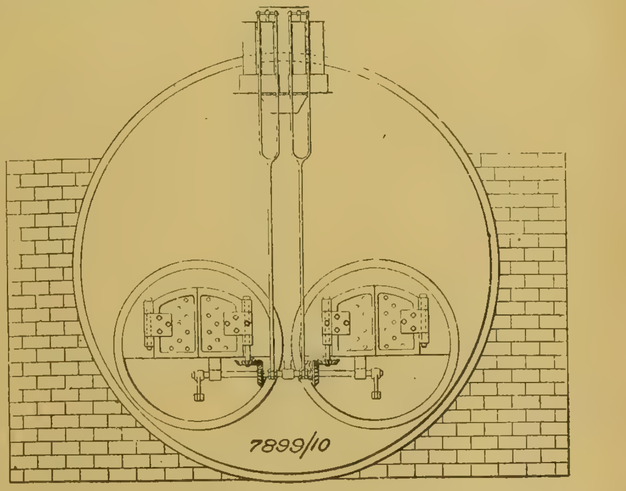
This invention relates to the regulation of electric frequency transformers, and consists essentially of a stator winding energised from brushes on the commutator of the transformer in combination with means for regulating the value of the voltage applied to the stator winding, and for regulating either the phase of the voltage applied to the winding with respect to the phase of the brush voltage or the angular position of the stator.



4280 Heinmuller: Belt fasteners. 4330 Steueur: Settling apparatus for purifying liquids. 4397 Williams: Devices for holding and sprinkling pulverulent material. 4417 Weintraud: Looseleaf note books and the like. 4440 Paul: Throttle valves. [Date applied for under International Convention, March 1st, 1909.] 4459 Priestley and Hinchcliffe: Cinder sifter. 4659 Fairbrother (Blair-Forth Manufacturing Co.): Feed-water heaters. 4692 Warren: Apparatus for granulating blast-furnace slag. 5026 Snyder: Rollers of spinning and like machines. [Date applied for under International Convention, July 30th, 1909.] 5150 James Purdey and Sons, and Clark: Single-trigger double-barrelled guns. 5209 Heaton: Locking of nuts. 5283 Steele: "Stuffing boxes" and packings of piston and similar rods of steam engines. 5483 Stemmler: Shoe fastenings. 5684 Rietkotter and Kuhn: Magnetic separator. 5693 Smith: Apparatus for testing mine gases. [Date applied for under International Convention, June 11th, 1909.] 5714 Stewart: Driving connections for motor cycle speed indicators for correcting inaccuracies from vertical movement of the steering head. 5784 Zuche: Elastic tyres and rims therefor. 6008 Knorr: Heating apparatus for gas holders. [Date applied for under International Convention, March 20th, 1909.] 6049 Firm Albert Martz: Adjustable drawing tables. [Date applied for under International Convention, May 17th, 1909.] 6282 Wagener: Separating tar from hot gas produced in the destructive distillation of coal or the like. [Date applied for under International Convention, March 29th, 1909.] 6288 Ridge: Speed recorder for motor cars, locomotives, and the like. [Request under Section 19 of the Act not granted.] 6649 Roche: Two-cycle internal-combustion engines. [Date applied for under International Convention, August 14th, 1909. Application for Patent of Addition to 9161, 1909.] 6761 Robertson: Instruments for castrating pigs. [Date applied for under International Convention, March 17th, 1909.] 6973 Andreas and Wolf: Exhaust silencers for internal-combustion engines. [Date applied for under International Convention, June 12th, 1909.] 7037 Dzink: Airships. [Date applied for under International Convention, October 13th, 1909.] 7088 Engelmohr: Adjustable picture frame. 7135 Riebe: Ball bearings. [Date applied for under International Convention, March 23rd, 1909.] 7258 Hemming: Pamphlet filing devices. 7487 Fiala: Pneumatic tyres for vehicle wheels. 7496 Mustill: Punching ball apparatus. 7548. *See* 22137, 1909. 7612 Vogler: Envelopes with attached means for opening same. 7620 Donecker: Process for manufacturing weather-proof coloured artificial gravel for garden paths and the like. [Date applied for under International Convention, April 19th, 1909.] 7642 Case: Railway cross ties. 7645 Bocci and Lutz: Artificial stone or building block. [Date applied for under International Convention, March 29th, 1909.] 7707 Gavan: Convertible bedsteads. [Date applied for under International Convention, September 3rd, 1909.] 7743 Trautweiler: Book rests.

7899 Stewart and Downie: Appliances for automatically regulating air supply to steam boiler or other furnaces.

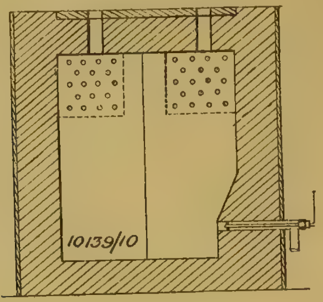
This invention relates to appliances for automatically regulating air supply to steam boiler or other furnaces, and comprises means for automatically opening the damper supplying air from the ashpit to the double fire bridge at the back end of a steam boiler or other furnace, consisting of a damper, a rod, a lever secured on the shaft, a loose bevel wheel with a pin engaging with a pin on the above shaft, and a bevel wheel on the spindle of the furnace door.



7935 Fairweather (Singer Manufacturing Co.): Button-sewing machine. 8068 Menarini and Emanuele: Device for practising shooting without projectile. [Date applied for under International Convention, April 5th, 1909.] 8079 Kirkham: Window fasteners. [Request under Section 19 of the Act not granted.] 8080 Lundberg, Lundberg, and Lundberg: Electric switches. 8132 Loader: Dog kennels. 8338 Gehrekens: Driving belts. 8340 Grimme: Joint for tramway rails. 8355 Atkinson: Piano-playing mechanism and the like. [Application for Patent of Addition to 9622, 1909.] 8952 Walker (Mergenthaler Linotype Co.): Typographical line-casting machines. 9054 Schoenfeld: Embroidering machines. [Application for Patent of Addition to 25531, 1909.] 9058 Cooper: Dishes for entrees and the like. 9141 Lachenmeyer: Blowpipes. 9188 Bradford and Olson: Power hack saws. [Date applied for under International Convention, September 24th, 1909.] 9282 Wyler, and Instanter Ltd.: Safety folding hat pegs and hooks with attachment device. 9623 Hardingham (Petersen): Means applicable for use in drawing perspective views. 9632 Archer: Method of and apparatus for constructing chests or boxes. 9954 Evans (Bichler): Method of refrigerating liquids. 10080 Harrington: Spinning machinery. 10092 Gunzel: Trap nest for fowls.

10139 Walker: Oil-fired and like furnaces for use in the manf. of rivets, bolts, and the like and for other purposes.

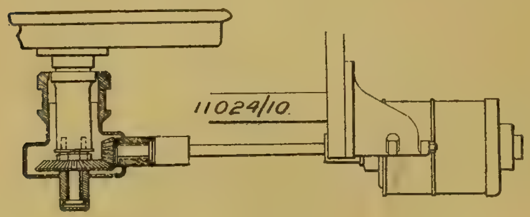
This invention relates to oil-fired and like furnaces of the kind consisting of a metal-cased fireclay chamber with working apertures at the sides, and an outlet or outlets in the roof. The invention consists of a rectangular, cube, or diamond shaped furnaces receptacle built up of firebrick and having an exterior sheathing of cast iron or other metal or material provided with four or less or more recesses formed in the lining thereof and which recesses are provided with a suitable number and sizes of holes or orifices into which the devices to be heated are inserted, and surmounted with a crown having one or more ports for the escape of the excess products of combustion.



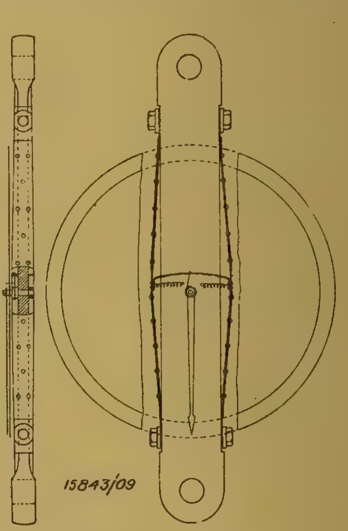
10188 Wiede: Safety lamps. 10227 British and Continental Camphor Co.: Process for converting pinene into camphene. [Date applied for under International Convention, May 7th, 1909.] 10496 Schwerin: Means for cutting open tins or metal boxes. 10551 Dancy and Westcott: Safety pins. 10556 Schiebknopffabrik Ges.: Corset fastenings. [Date applied for under International Convention, December 29th, 1909.] 10588 Hloch: Apparatus for making asbestos, cement slabs, and the like. 10614 Richardson: Treadle driving gear, more particularly for cycles. 10684 Honold: Regulation of the ignition and combustion of charges in internal-combustion engines. 10783 Pivoda: Record for sound-producing machines, and process and apparatus for the manf. thereof. 10796 Meyer and Ouchakoff: Horseshoes.

11024 Akt.-Ges. Brown, Boveri, and Cie.: Driving of train lighting dynamo electric machinery. [Date applied for under International Convention, May 5th, 1909.]

This invention relates to the driving of train lighting dynamo electric machinery. The invention consists in an arrangement in which the wheel axle is connected through a flexible coupling with bevel gears which transmit the drive to the dynamo. The invention also consists in an arrangement in which the wheel axle is connected at the front end to a journal mounted in the axle box by means of a coupling permitting axial and vertical movements, the rotary movement being transmitted to the dynamo rotor from the journal by bevel wheels and a flexible shaft or the like.



11061 Jager: Process for reducing the consumption of steam in steam engines. 11073 Amme, Giesecke, and Konegen Akt.-Ges.: Reciprocatory feeding gutters. [Date applied for under International Convention, November 1st, 1909.] 11110 Wilhelm Kober and Co.: Hair-cutting and shearing machines. [Date applied for under International Convention, October 4th, 1909.] 11256 Caspary: Means for constructing ship's cabins with removable partitions or walls. 11340 Frowein and Brinck: Device for attaching protecting envelopes to pneumatic tyres. 11543 Wilson: Auxiliary appliance for the concealment of a short leg. 11552 Hall: Bridle for paint brushes. 11558 Harris and Harris: Chimney cowls. 11565 Langlands: Pressed steel sectional pulleys. 11796 Neufeldt and Zurovec: Turbine rotors. 11924 Irwin: Hatpins and point protectors therefor. 12112 Childress: Devices for lessening the sound of discharge of guns. [Date applied for under International Convention, October 4th, 1909.] 12157 Zimmer: Disinfectants and emulsions having disinfecting properties. 12185 Schoenfeld: Device for holding and cutting threads on embroidering machines. 12293 Becker: Tubular and collapsible keys. [Rights under Section 19 of the Act not granted.] 12313 Scherer: Apparatus for placing belts on pulleys. 12350 Ball: Garden implements for destroying weeds and for other purposes. 12393 Thomas: Apparatus for teaching the composition of numbers to 20. 12484 Graw: Horseshoes. 12653 Naylor: Apparatus for making cores for valves and the like. 12693 Davies: Advertising apparatus. 12720 Daimler Motoren Ges.: Oil circulatory systems or apparatus for use in connection with the lubrication of machinery. [Date applied for under International Convention, November 30th, 1909.] 12752 Saer: Cans or receptacles for containing milk and other liquids. 12859 Warwick Machinery Co. (1908) (General Electric Co.): Turbine vanes or buckets. 12941 Heinel: Joints for steel driving bands. 12977 Bushell and Wood: Tobacco pipe fillers. 13262 Williams, and Williams and Williams Ltd.: Jointing of metal sashes used in the manf. of casements and the like. 13416 Kadar: Coin-handling and like apparatus. 13653 Marks (Wolf's Music Time Blocks Ltd.): Method of and means for demonstrating the value of notes and beats in a bar of music. 13727 Bushell: Cans to facilitate the opening thereof. [Date applied for under International Convention, March 30th, 1910.] 13818 Hedrich: Double-sided framework for the construction of concrete or like walls. 14125 Allgemeine Elektricitats-Ges.: Dynamo electric machines. [Date applied for under International Convention, June 10th, 1909.] 14295 Rieder: Breath deflectors. 14299 Stahle and Stahle: Resilient wheels. 14897 Dordelattre: Hydraulic apparatus for producing crucibles and retorts for zinc furnaces, retorts for the distillation of coal and other products, and for producing other hollow earthenware articles. [Application for Patent of Addition to 7766, 1904.] 14961 Meirowsky: Method of and apparatus for electrically insulating armature coils and other cores. 15111 Bartholomew and Bartholomew: Valvular means for discharging water from cisterns and the like. [Application for Patent of Addition to 8516, 1909.] 15391 Bloxam (Chemische Fabrik Grieshiem Elektron): Manf. of a new substantive dis-azo-dyestuff. 15417 Kohler: Alternating-current solenoids for operating electric controllers and for other purposes. [Date applied for under Rule 13, September 17th, 1909.] 15529 Vinsant: Machines for moulding building blocks. 15708 Copet-Hardenne: Devices for climbing up trees and the like. 15726 Reynolds: Apparatus for supplying or distributing desinfectant to closets and, the like. 15750 Bohn: Rammers for ordnance.

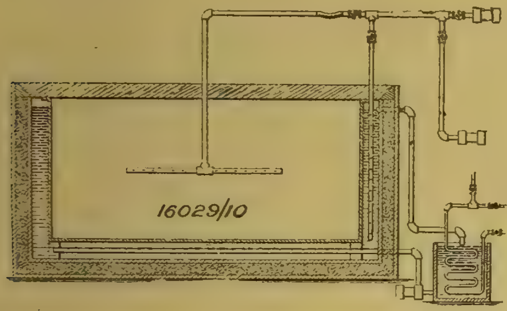


15843 Bevis and Clayton: Weighing machines. [Date applied for under Rule 13, November 6th, 1909.]

This invention has reference to means or apparatus for ascertaining and indicating the weight of articles or goods, and especially those of a heavy character. The invention consists of a weighing machine or apparatus wherein the weight of the article to be weighed is adapted to be applied to a metal body, and the change of dimension of such body, due to the weight applied to it, is adapted through means such as bowed or bent strips or the like connected to the body at different points in the direction of the strain, and indicating means connected therewith to enable the weight of the article to be ascertained or indicated.

16029 Berryman: Manf. of artificial ice. [Date applied for under Rule 13, August 16th, 1909.]

This invention relates to the class of apparatus for manufacturing artificial ice in which the water to be frozen is placed in cans or receptacles adapted to be surrounded by a freezing medium such as brine. According to the invention a conduit is provided extending beneath the centre of the bottom of each can and longitudinally thereof for discharging cold freezing medium and thawing medium into the tank in turn, so that they may flow evenly over the bottom of the can and then over all the sides thereof whereby the water is frozen and the ice thawed out uniformly and rapidly. The medium employed for freezing and thawing is preferably cooled and warmed respectively by passing it through a second tank in which it is subjected to the influence of a refrigerant or warm fluid with which it is in heat interchanging relation, but out of contact, as referred to above, with reference to a freezing medium. A further feature of the invention lies in the provision of means for introducing air into the water to be frozen or into the freezing medium, which means are adapted to be utilised for withdrawing the water or freezing medium when required.

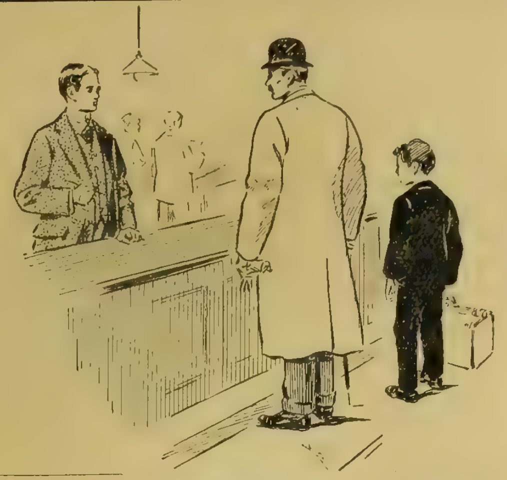


16183 Adamson: Covering for tennis shoes and the like. 16185 Cooper: Composition for the stiffening of silk and cotton crinoline hats and similar goods. 16284 Hochwald: Piston valve for use in steam engines. 16431 Monk: Clothes driers. [Date applied for under International Convention, July 12th, 1909.] 17082 Reich: Devices for connecting exchangeable treads to boot and like heels. 17178 Eriksen: Releasing mechanism for boats. [Date applied for under Rule 13, September 29th, 1909.] 17432 Hodd: Eyeglass mounts. 17712 Trimmlett: Gas pressure alarm apparatus. 17798 Pokorny and Wittekind Maschinenbau Akt.-Ges.: Pneumatically-actuated percussive implements. [Date applied for under International Convention, July 31st, 1909.] 18076 Eichengrun: Method of producing coatings from acetyl-cellulose. [Date applied for under International Convention, April 15th, 1909. Application for Patent of Addition to 1441, 1910. Originally included in 4959, 1910.] 18094 Firm J. Emrich: Key rings. [Date applied for under International Convention, April 28th, 1910.] 18273 Diehl: Process for doing Smyrna needlework. 20663 Rees: Rollers for hide-unhairing machines. [Date applied for under International Convention, September 16th, 1909.]

COMPLETE SPECIFICATIONS OPEN TO PUBLIC INSPECTION BEFORE ACCEPTANCE, UNDER THE PATENTS ACT, 1907.

1910.

7191 Loir: Portable field kitchen oven. 7714 Goulet: Hydrocarbon incandescent lamps. 9629 Loir: Portable field cooking vessel. 13422 Aaron: Pumping apparatus. 13691 Firm Robert Bosch: Method of and apparatus for starting multi-cylinder internal-combustion engines. 14023 Haber: Manf. of ammonia. 14204 Etrich: Monoplanes. 15628 Rheinisch Metallwaaren und Maschinenfabrik: Devices for facilitating the transference of a gun barrel from its carriage to a transport wagon and *vice versa*. 17734 Farbenfabriken vorm. Friedrich Bayer and Co.: Manf. and production of a new caoutchouc



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substance. 17962 Schuh: Driving of submarine boats. 19704 Story: Mechanical milkers. 20667 Blaine, Last, and Stevens: Means for indicating the position of sunken vessels. 20753 McLeod: Brush cleaners. 20796 Seck: Method of and apparatus for sorting and cleaning grain. 20957 Soc. Anon. Ateliers H. Cuenod: Automatic governors or electric regulating devices. 21104 Roellig: Sirens. 21228 General Composing Co., and Degener: Line-distributing device for matrix-setting and type-line casting machines of the Mergenthaler type. 21237 Collett and Eckardt: Utilisation of sulphurous acid. 21269 Ruthardt: Shuttle check for looms. 21273 Wehli: Grid bars for conical openers. 21293 Buffard: Self-locking, easy opening corset busk. 21320 Pinkert: Propeller applicable also as a pump. 21410 Ives: Coloured photographic print and process of making the same. 21414 Kalle and Co. Akt.-Ges.: Manf. of therapeutic preparations. 21599 Gockel: Apparatus for heating liquids. 21602 Bordt: Adding machines.

PATENT FOR SALE OR LICENSE.

THE Owners of British Patent No. 19839 of 1901, entitled "IMPROVEMENTS IN AUTOMATIC FIRE ARMS," granted to G. Roth and C. Krnka, are desirous of disposing of the Patent, or entering into a working arrangement under license with firms likely to be interested in the same. In the alternative, the owners would be open to consider proposals to manufacture the invention to fill any requirements of the market in Great Britain on terms to be arranged.

The Patent covers an invention interesting to manufacturers of Automatic Fire Arms.

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Patents and Designs Act, 1907.

Notice is hereby given that Schmidt'sche Heissdampf Gesellschaft, mit beschränkter Haftung, bassel, seek leave to Amend the Specification of Letters Patent No. 28733, of 1904, granted to Francis John Cole and Carl Johan Mellin, for "IMPROVEMENT IN STEAM BOILER SUPERHEATER."

Particulars of the proposed amendment were set forth in the illustrated Official Journal (Patents), issued on the 19th October, 1910.

Any person, or persons, may give notice of Opposition to the Amendment (on Patents Form No. 18), at the Patent Office, 25, Southampton Buildings, London, W.C., within one calendar month from the date of the said Journal.

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MUNICIPAL TRADING PROFITS.

THE great desire of the chairman of a trading committee of a municipality is to be able—in his annual statement to the Town Council—to recommend a large contribution in relief of rates. When he does so he is hailed, in the local press, as a great man worthy of the homage of the entire community. If a timorous councillor ventures to suggest that it is possible to pay too much for a good thing, and that there are other matters to consider beside contributions in relief of rates, he must be prepared to receive a bullying from the "big-wigs" on the aldermanic benches, and to be told that he is a reactionary and entirely out of touch with the spirit of the times. And so the community continues to be fooled, and to express its humble and grateful thanks to those who return to the citizens, in their capacity of ratepayers, that which has been first taken from them in their capacity of gas or electricity consumers.

In a certain large manufacturing city, having coal fields quite near at hand, the Corporation Gas Committee is constantly boasting of the fact that it is able to make an annual contribution of £72,000 in relief of rates—an amount which equals the product of a sixpenny borough rate. But the citizens are not told that before this can be done they are required to pay for their gas twopence per thousand more than is charged by a gas company supplying the south of London, notwithstanding the great distance of that company's works from the coal fields. Neither are the good, but simple, people told that every penny on the price of gas in that particular city represents the extraction of £30,000 from their pockets, so that to get 2½d. off the price of gas would pay them better than the boasted contribution of £72,000 in relief of rates.

In the self-same city as that previously referred to, the electricity department makes an annual contribution now amounting to £10,000 in relief of rates. But what do we find as to the charges made for "juice"? Notwithstanding a low cost of production, reflecting the highest credit on the technical staff, the Committee levy an average selling price over 50 per cent above that at which current is supplied in an obscure Metropolitan district. And that is not all. The tramways of that city obtain the power from the Electricity Department. Both undertakings—trams and electricity—are municipal concerns. The price paid by the Tramways Department to the Electricity Department for current is 1¼d. per unit, or at least 25 per cent more than it should be. The difference between 1d. and 1¼d. per unit on the amount of current supplied by the one department to the other, represents the sum of £12,000 sterling per annum. And so the one department is allowed to rob the other in order, presumably, that a loss of £2,000 may be hidden and the sum of £10,000 paid over in relief of rates, thus deluding the populace and giving the members of the Electricity Committee the opportunity to pose as public benefactors.

The prosperity of a manufacturing district depends, in a very large measure, on the price at which power can be readily obtained. Our municipalities spare no expense—of the ratepayers—in warning off private enterprise that would venture its own money in the endeavour to supply power at a rate low enough to attract all consumers of that commodity. The little business men who, in the Council Chamber, are converted into great city magnates, insist that all monopolies must be run "by the people for the people, etc., etc." They form themselves into gas committees, electricity committees, and the like, and kindly undertake these things for us. Hence it comes about that we acquire the delightful habit of being thankful to those who rob the power consumer of a shilling in order to relieve him of six-pennyworth of rates.

It may be said that these things afford eloquent testimony of the good nature of the people, otherwise they would send such municipal administrators to look after their own little businesses. Perhaps it is so. We fear, however, that the real explanation is not so flattering to the populace. For it can scarcely be said that the average elector is distinguished by great depth of thought. When a municipal candidate makes his appeal for support he does not generally do so on the ground of any qualification for undertaking the work of the municipality, but rather because he is good enough to express himself as being in entire agreement with the views of somebody else in matters political. If we can only get our town councillors and their constituents to recognise that their business is with the "parish pump" rather than with the Empire, it will be better for the Empire and better for the town to which they belong.

STANDARD HOLDERS FOR ELECTRIC LAMPS.—A standard specification (Report No. 52) for bayonet socket electric lamp holders and caps has been issued by the British Engineering Standards Committee. In drawing up the specification the desirability of interchangeability has been kept in view, but care has been taken not to interfere with invention and progress. Users of electric light who have suffered from the too common inconvenience that their lamps, owing to imperfect contact, fail to light when pushed into the holders, will certainly be benefited if makers will adopt these standard dimensions and adhere to them strictly. But it is to be feared that this defect is often due not so much to differences in the dimensions adopted by different makers as to carelessness in manufacture and the skimping of material, for cases are not uncommon in which lamps and holders purporting to be made by the same makers do not fit each other properly.

MARINE OIL ENGINES.—An exhibition of marine oil engines, suitable for fishing vessels, has been opened at Yarmouth. Just now the fishing season is at its height on the East Coast, the assembled fleet, which includes nearly 100 auxiliary motor boats, being more numerous than at any other time of the year. With so many fishermen on the spot it is hoped that the show will stimulate general interest in the question of auxiliary motor power. Most of the engines are shown running under load, and their utility and ease of control can, therefore, be thoroughly demonstrated. Amongst the engines on view are a Beardmore, a Blackstone, a Bolinders, a Gardner, a Griffin, a Kromhont, and a Thornycroft.

VESSEL FITTED WITH INTERNAL-COMBUSTION ENGINE.—Messrs. Thornycroft's agent in Russia, Messrs. E. A. Reine and Co., of Helsingfors, have just built for the Railway Department of the Russian Government an interesting vessel. She is 42 ft. long by 9 ft. beam, and draws only 16 in. of water. Her engine is a 36 H.P. Thornycroft paraffin type, and it drives her through the water at the very satisfactory speed of ten knots. She is intended for the use of the medical officer in the Vilna district, where she will be employed in transferring patients suffering from cholera from the outlying districts to the hospitals. Consequently the interior aft resembles a small floating hospital. The boat was delivered early this month, and is now actively engaged in the Vilna district, where cholera is distressingly prevalent.

EXPOSITION UNIVERSELLE, BRUSSELS.—We are informed that Messrs. David Bridge and Co. Ltd., Castleton, Manchester, have been awarded the Diplomé de Grand Prix at the Exposition Universelle, Brussels, for rubber preparation machinery in connection with the Coloniale Section of the above exhibition held at Parc de Tervueren. Messrs. Bridge had a complete installation in the Exhibition itself, and in the basement they had a second plant actually at work, *i.e.*, they took the latex, coagulated same by their Da Costa patent smoking system, and put it through the various machines and prepared the rubber ready for manufacture in crepe, sheet, and block form. They also had various wild rubbers and thoroughly cleansed them, as is now being done in the countries from whence the wild rubbers are exported. The company also demonstrated the extraction of rubbers from vines and bark, such as landolphia.

RAILWAY TO BE REPLACED BY MOTOR CAR SERVICE.—It is reported that the Invergarry and Fort Augustus Railway is to be closed. The railway is 24 miles long and was opened for traffic in July, 1903. The district traversed is a notable shooting area, with some crofting. The railway was worked by the North British Railway Company on the basis that any loss would be mutually shared by the Invergarry and Fort Augustus Company and the North British. The railway has always been unprofitable, and the North British Company announce that their agreement has been terminated and the Invergarry and Fort Augustus Company will close the line on the 31st January next. The needs of the district will probably be met by a motor car service. The non-success of the railway is attributed to the growing use of the motor car in the Highlands. The company has an issued share capital of £240,000 and £80,000 has been raised on debentures.

WE have received a copy of the souvenir of the Great Central Railway produced by the Locomotive Publishing Co. at one shilling. It comprises one dozen plates, reproductions of G.C.R. locomotives from direct photographs.

THE PRINCIPLES OF IRONFOUNDING.

By Prof. A. Humboldt Sexton, F.I.C., F.C.S.

(Continued from page 482.)

Loam.

In loam moulding no patterns are used, but the mould is fashioned by hand with the aid of templates or otherwise. The material used in this kind of moulding must therefore be much more plastic than ordinary sand. The characteristics to be aimed at are (1) considerable plasticity, (2) small shrinkage during drying and, of course, (3) sufficient refractoriness to resist the heat of the metal, and (4) cheapness.

Natural loam is usually a more or less calcareous clay; that is, it is a mixture of carbonate of lime, clay, and excess silica, but good loams are not very abundant, at least those containing the constituents in anything like the best proportions, so that they are often made up by mixing, and if the properties required are considered this is not difficult, but as the constituents vary so much no rules can be given, and the best results can only be obtained by a process of trial and error.

The plasticity is, of course, given by the clay; the more clay the more plastic will the material be when wet—the better will it adhere to the bricks or other material used in building up the mould, but the more it is likely to contract on drying and the less porous it will be. The non-plastic material must be of such a character as to resist shrinkage without unduly destroying the plasticity, and at the same time must tend to produce porosity in the finished mould. The natural material as usually used will be a clayey (*i.e.*, argillaceous) sand, but the sand particles should not be too fine. To incrase the porosity the loam is almost always mixed with organic matter of some kind—horse dung, fine wood shavings, cow hair, chopped straw, bran, coal dust, or similar material. These are all best mixed in dry; when the loam is moistened they all expand, and on drying the mould they contract and leave the mass porous, this contraction not tending to produce cracks as does the contraction of the clay. Whatever material is added it must not be too fine. Just as in the case of sand moulding, floor sand may be used for the back of the mould, so in loam moulding a common loam which is sufficiently cohesive may be used for the body of the mould, but a finer or "facing loam" (the loam proper) must be used for the portions which will come in contact with the metal.

Many moulding sands are in reality good loams, for, as described above, they are too binding for use as sands, and are therefore mixed off with floor sand and other less binding materials. Erith sand is one of these, the addition of silica sand being often necessary. It will be seen that a good loam can be prepared by mixing a good fire clay (a fire clay because it must be refractory) with a proportion of silica sand to give the required properties. Sea sand may be used, provided it is free from salt, but river sand or crushed sandstone are much better

The proportions required will, of course, vary with the character of the materials employed; roughly, one part of clay will be required to bind from four to six parts of sand. Various mixtures have been published, but they are of little special value.

Artificial loams (*i.e.*, those made by mixing clay and sand) dry readily, and are porous. They are therefore more easy to dry than the natural product, but are often more friable after drying. If the sand used is coarse, it is difficult to get a good finish.

Parting Sand.

When a mould is made in two or more portions, these must be capable of being placed together and removed again without risk of adhesion and consequent breakage. The surfaces which are to come into contact are therefore covered with a layer of silica sand or other similar material which is absorbent, and which will keep the two surfaces sufficiently apart. Such a sand is called a parting sand. Many materials are now used for this purpose, such as ground bricks, powdered blast furnace slag, and many others. The parting sand should be different in colour from the sand of the body of the mould, so that the moulder may see at once that the surfaces are properly covered. As the moulding sand is always black, the parting sand should be light in colour.

Blackings.

The surface of the mould is always protected from the action of the hot metal by a layer of a material called "blacking." This keeps the molten metal from actual contact with the sand, prevents the metal entering into the sand, and gives a better surface to the casting. The blacking must be very fine. In the case of green sand moulds it is usually applied dry by sifting it on to the surface of the mould from a muslin bag, and then smoothing over the surface with a metal "sleeker" and blowing away the excess. In dry sand and loam moulds the "blacking" is applied in the liquid condition (*i.e.*, stirred up with water) by means of a brush or a swab of hemp; the dry sand absorbs the water and leaves a layer of blacking. Loam moulds which have been skin-dried are moistened before putting on the blacking, so as to leave a surface suitable for a final "sleeking."

Blacking is not necessary for rough castings. Many blackings evolve gas when heated; this takes time to escape, and this still further protects the surface of the mould.

Many materials are used, nearly all having carbon in some form as a basis. The essentials are infusibility and capability of giving a smooth surface.

Charcoal, finely ground and preferably made from oak or some other heavy wood, is a very good material. A heavy charcoal is best, as a light charcoal burns away too rapidly. Charcoal is quite infusible and always contains a considerable quantity of gas, which is given off as soon as the metal comes in contact with it, and as it burns it also produces a considerable volume of gas. It is one of the best blackings, especially for green sand work. Peat charcoal has been largely used.

Gas Retort Carbon is a hard form of carbon deposited in gas retorts by the decomposition of the heavy hydrocarbons of the gas. It burns much less readily than charcoal.

Coke Dust is sometimes used, but it is not as good as gas retort carbon, as it burns more readily.

Anthracite.—This may be regarded almost as a natural coke; it is a hard, dense form of coal, and contains over 90 per cent of carbon and gives off very little gas.

Blacklead (*Plumbago or Graphite*).—This is a form of carbon which occurs abundantly in nature. It is infusible (if pure), is very difficult to burn, and has an unctuous, soapy feel. It is an excellent blacking; it gives a very smooth surface, and is very easily "sleeked" on. Many varieties of graphite contain a large quantity of mineral matter, and such are not suitable for blackings, whilst powdered graphite is often adulterated with cheaper materials, most of which are not strictly harmful, except that they reduce the valuable qualities of the graphite itself. The adulterants are generally charcoal in some other form, such as powdered gas retort carbon, or mineral matter, such as steatite.

Patent Blackings.—This is a very vague term, and covers all mixtures sold as blackings. That known as patent Scotch blacking is a nearly pure carbon obtained by grinding the residue left in the retorts from the distillation of paraffin. The deposit is a light friable mass, and when powdered yields a powder which is nearly as incombustible as graphite, and is an excellent blacking.

Smoking.—In rare cases small moulds may receive a coating of blacking by smoking them with the smoky flame of a lamp; the deposit is an impure carbon (soot) in a very fine state of division.

Talc (*Soapstone, French Chalk*).—This is a hydrated silicate of magnesia, and has a soapy feel not unlike graphite, but it is a white powder. It is used dry, and is an excellent "blacking" for most purposes.

Additions to Blacking.—When blacking is used wet, it is frequently mixed with clay water, dextrine, molasses, or some other material, to make it adhere. Molasses is probably the best, but all adhesives require to be used with care.

The Principles of Moulding.

There are two distinct methods of moulding in common use in iron foundries—(1) sand moulding, (2) loam moulding.

In the first, ordinary moulding sand is used, and a pattern of the article to be cast is made, and used to form the mould. In loam moulding no pattern is used, but the mould is built up in loam, which is a strong sand; templates being usually used to give the required form. Loam moulding is usually used for large articles of which but few are required, and is specially suitable for castings of simple form.

Sand moulds may be used in the condition in which they are prepared, in which case the process is called green-sand moulding; or they may be artificially dried, in which case it is called dry-sand moulding. There is some difference in the sand most suitable in the two cases, and also slight differences in manipulation, but the principles applied in the two cases are exactly the same.

The casting may be intended to fill the whole of the mould so as to give a solid mass, or the mould may have a central portion, or core, so that the resulting casting will be hollow.

In a few cases a casting may be required of which only one surface need bear the impress of the mould, the hank being left rough, and in such a case an open mould may be used. In almost all cases, however, the mould makes a closed cavity, which will be filled with the molten metal, and in such a case the mould must be made in two or more parts, so that it can be taken asunder to allow of the removal of the pattern. The mould is only used once and is broken up when the casting is removed.

It is not intended to give any instructions here as to the method of moulding any particular articles. The moulder who desires such information must refer to such works as Bale's "Modern Foundry Practice," Rhead's "Principles and Practice of Iron Founding," or MacWilliam and Longmuir's "General Foundry Practice," in any of which details are given of the method of moulding articles of many forms. All that will be attempted here is to give a general description, omitting many details of actual work, but sufficient to illustrate and form a basis for the explanation of the principles on which moulding is based.

Flasks or Boxes.

As one portion at least of the mould will need to be removed to allow of the removal of the pattern, and then to be replaced, it must be made in a vessel of some sort which will allow of handling. The boxes, or flasks as they are called, which are used for this purpose, are iron frames, usually rectangular, but varying in form and size according to the article to be cast, it being necessary always that there should be a thickness of some inches of sand between the pattern and the side of the flask. In small work the flasks are simply rectangular frames open bottom and top, but for larger work the one side is crossed by a grating of bars to support the sand, as it is quite obvious that a large mass of a material as slightly binding as moulding sand would not retain its place without some support. If more than two flasks are used the middle ones are, of course, open frames. The bottom box, which contains the lower portion of the mould, and which is at the bottom during casting, is called the bottom, or drag, and is provided with cross bars to hold in the sand (see fig. 91). The middle portion, where such is used, is called the middle, and the upper portion is called the cope, being provided with notched cross bars to assist in gripping the sand (see fig. 92). The flask must be strong enough to be perfectly stiff, so that it will not yield when it is lifted, as any sagging would lead to displacement of the sand. The thickness of the metal will vary, therefore, with the size and form of the flask, the objection to undue thickness being that the flasks are too heavy. It is, of course, absolutely essential that when a flask is removed to allow of the removal of the pattern, and replaced, it should be replaced exactly in the same position or the resulting casting would be irregular, even the smallest displacement forming an awkward ridge.* The flasks are therefore provided with pins and eyes which fit one into the other, and thus hold the two portions in relatively identical position, and when the flasks are used they are firmly fixed together by cotters, clamps, or in any other way, so that they may not become separated when the metal is poured into the mould.

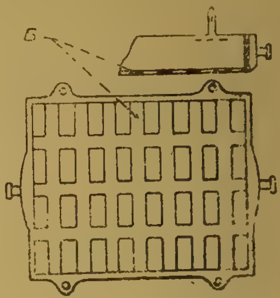

Fig. 91.—Bottom Box or Drag.

Bedding in.

In this method of casting, which is used for large articles, only one flask, the cope, is used, the lower portion of the mould being in the sand of the foundry floor. The floor sand, as already explained, is quite suitable for forming a background, but is not suitable for taking the actual impress of the pattern, for that purpose new sand of proper consistency being prepared. The example given is that of casting a small cylinder cover, and the illustration, fig. 93, is from Bale's "Iron Foundry Practice."

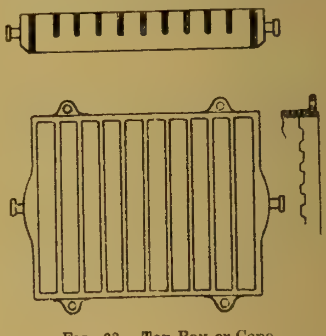

Fig. 92.—Top Box or Cope.

The first thing to be done is to dig a hole in the floor sand, somewhat deeper and wider than the pattern, and into this is put, preferably by sifting, some moulding sand so as to form a basis on which the pattern is built up. This is rammed by means of rammers till it is sufficiently hard, the hardness required being judged by the moulder, and then, by means of a fine wire, about $\frac{1}{4}$ in. in diameter, he makes a series of vent holes downwards into the mass of the floor sand, and over this another layer of sand is spread. The pattern is then put in position and firmly pressed down, the sand being "tucked in," that is, pressed in by hand all round the flange and wherever it can be reached. The pattern is then lifted out and a layer of facing sand, about ½ in. thick, is spread over the whole surface of the mould, the pattern is replaced and hammered down, using a block of wood between the hammer and the pattern. The amount of hammering that will be needed will vary and must depend entirely upon the judgment of the moulder; the object is to obtain a mould of as nearly as possible uniform hardness. It will be seen at once that owing to the irregularity of the pattern the distance to which the pattern will need to be pressed into the sand will vary, though the variation is made as little as possible by sifting the facing sand in an even layer over a previously made impress of the pattern, but it is not possible to obtain the same uniformity in the sand by pressing the pattern into it as by ramming the sand on to the pattern.

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* See Bale's "Modern Iron Foundry Practice," Vol. I., page 150, *et seq.*

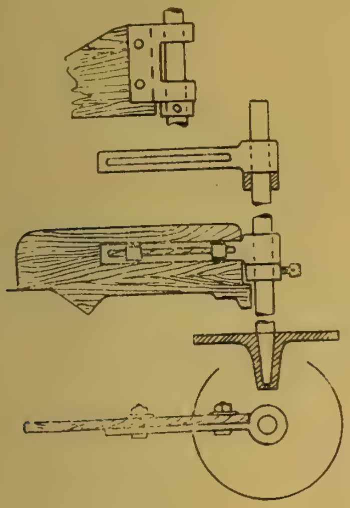


Fig. 93.

Before the pattern is removed for the first time, three guide stakes S (fig. 94) are driven in, the tops being driven to the level of the top of the pattern. The object of these stakes is, of course, to guide the pattern back into position, and to indicate how far the pattern need be hammered down. The moulder then places a weight on the pattern to prevent it from moving, and packs and rams the sand well round the edges; he then removes the guide stakes, heaps the sand well above the level of the pattern, rams it down as much as is needed, then, with a straightedge, he "strickles," or brushes, away the sand all round so as to leave a flat surface level with the top of the pattern, and this he "sleeks," or smooths, over with his trowel. Over this surface a layer of parting sand is now sprinkled, to prevent the adhesion of the upper part of the mould, and a suitable flask B is carefully let down into position. As this flask will have to be lifted and replaced, it is carefully staked—that is, vertical pegs, long enough to have a firm grip in the sand, are driven in at the corners, so that when it is lifted out it may be returned to exactly the same position. It will be necessary to provide a gate or passage by which the metal can flow in, and for that purpose a gate pin is placed in a suitable position—the best position being determined by the judgment of the moulder. A layer of facing sand, about ½ in. thick or so, is sifted over the whole pattern, and the box is filled up with floor sand, each layer being carefully rammed so as to give the required consistency. As the area of the sand is large, the mass is strengthened by the introduction of "giggers," iron hooks hung from the grating of the flask, a short piece of iron or wood introduced into the sand to give it increased strength, and by means of the vent wire holes are made through the sand, reaching nearly to the surface, over the whole area where the pattern lies. As soon as the ramming of the cope is complete, it is lifted off and turned over. The impression which has been left by the pattern is sure not to be quite perfect, and parts that have been broken away are made good by means of the tools with which the moulder is provided. The pattern now has to be lifted out. The loose grating sand is brushed away and the edge of the pattern is drawn it must be loosened a little, and hence the and to prevent it breaking away at the edges. Before the pattern is drawn it must be loosened a little, and hence the cavity left is always a shade larger than the pattern itself. The arrangement for loosening and lifting the pattern is often somewhat as follows: An iron drawplate (called a rapping-plate) is screwed into the pattern, and a vertical bar is fitted into a hole in this. Holding the bar in the left hand, the moulder taps it with a hand hammer, so as to give it a slight sideways motion. Often in the rapping plate another hole is tapped, as shown in fig. 95, so that as the threaded draw bolt is screwed down into it, and used as a handle by which the pattern is lifted, the imprisoned sand can escape by the second aperture. The pattern is now lifted out, great care being taken that the lift is vertical, so that the plate is kept horizontal during the whole of the lift, otherwise the vertical edges of the pattern will be broken away. The mould is carefully examined and mended where necessary. The position of the gate pin will, of course, be indicated, and a channel or runner is cut from it so as to form a passage for the molten metal. The two surfaces of the mould are now blackened by sprinkling over them a fine layer of graphite from a muslin bag, and smoothing or "sleeking" this with a "sleeker." The cope is then carefully returned to its place, a basin is cut round the top of the gate pin, the gate pin is withdrawn, suitably heavy weights are placed upon the top of the cope to keep it from being lifted, the metal is brought up in a suitable ladle and poured into the mould. As soon as the metal has set the cope is again lifted off, the sand is broken away and the casting is lifted out to be cleaned and finished as may be required.

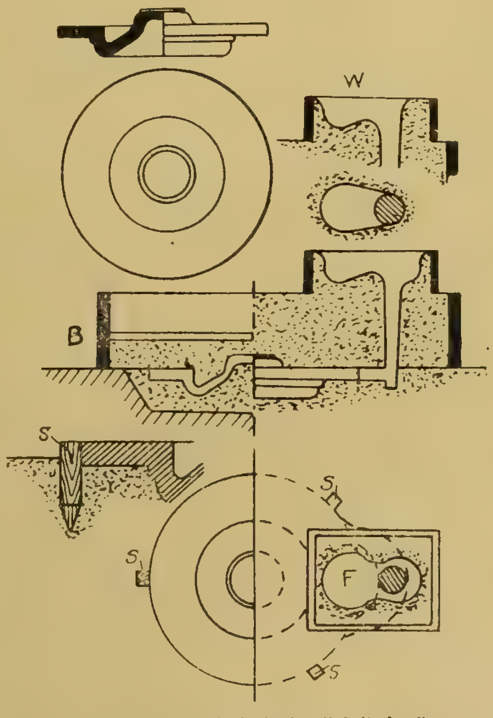


Fig. 94.—Bedding in Mould for Small Cylinder Cover.

Turn-over Moulding.

When two flasks are used the process is the same in principle, but differs in detail. The cope is placed on the ground, of course, in the opposite position to that which it will occupy in the casting, and it is filled up with floor sand. The pattern is embedded in it in the required position, the sand is stricked off, a layer of parting sand is sprinkled over it, and the drag is put on; this, of course, also being in the opposite position to that which it will finally have, so that the whole mould is upside down. A layer of facing sand is now put over the pattern, and it is pressed into contact with the pattern, and the drag is filled up with floor sand, carefully rammed to the hardness required, and the necessary vent holes are made by means of vent wires. The whole is now turned over so that the drag is in its proper position, the cope is lifted off, and the floor sand which it contained is shaken out. The exposed front of the pattern is brushed to remove any adherent sand; the surface of the sand in the drag is smoothed; a layer of parting sand is sprinkled over it, and the cope is replaced in position. A gate pin is put in, a layer of facing sand is introduced, then the backing of floor sand, and the whole is well rammed. Vent holes are made as required. The cope is lifted off, turned over, examined and mended as required; the pattern is removed, and the impression in the drag is examined and mended; the runner is cut, the two halves of the mould are blackened, the cope is returned to its position, fastened down, and the casting is made.

Principles.

In the brief outline given it will be noticed that there are many operations, about the principles of which something may be said. No rules can be laid down for the performing of any of them, only general principles, and the application must always be left to the skill and judgment of the moulder. The number, size, and form of the boxes to be used will, of course, depend on the form of the article being cast; the skilled moulder will have no difficulty in deciding this. The method of moulding may often present difficulties; it may be necessary to make the pattern with movable parts that can be removed separately, but for such points as this no details can be given.

The object of the mould is to make an exact reproduction in metal of the pattern. It must be strong enough to resist the flow of the molten metal; it must be sufficiently porous to allow all the air forced out by the metal and the gas generated in the casting to escape; the gates and runners must be suitably arranged.

(*To be continued.*)

BOILER EXPLOSIONS.

Abstracts from Recent Board of Trade Reports.

Explosion from a Water-tube Boiler.

Report of Preliminary Inquiry, No. 1,953.—The explosion occurred on the 15th May last, at the Mansfield Colliery, Mansfield, Nottinghamshire. No person was injured by the explosion. The boiler is of the water-tube type, and consists of four drums—three upper, each 42 in. in diameter and 12 ft. 10 in. in length, and one lower, 42 in. in diameter and 11 ft. 4 in. in length. The ends are dished outwards, and flanged for attachment to the cylindrical part. Each of the upper drums is connected to the lower one by four rows of tubes, each 3 in. in internal and $3\frac{1}{4}$ in. in external diameter, and about 17 ft. 6 in. in length. They are bent near their ends where they enter the drums into which they are expanded. The upper drums are connected by shorter curved tubes. The tubes originally forming part of the boiler were made of mild steel, and lap welded. The tube from which the explosion occurred is said to be one of those originally supplied as part of the boiler. Most of these tubes have, from time to time, been removed, and their places taken by steel tubes manufactured by the solid-drawn process, and of slightly thicker gauge. The boiler was, at the time of the explosion, five years and eight months old. The principal repairs to the boiler appear to have been the renewal of tubes, due to corrosion and leakage around their necks where expanded into the drums, it having been found necessary, of recent years, to renew several tubes every three months. In June, 1909, 41 tubes were renewed, and on 8th May, this year, just six days prior to the explosion, thirteen new tubes were fitted. Re-expanding of the tubes into the drums had frequently to be resorted to. One of the tubes connecting the upper centre and the lower drum burst at about 2 ft. above the top of the latter drum, the rupture being about $5\frac{1}{4}$ in. in length and $2\frac{1}{2}$ in. in width. Through this aperture the boiler emptied itself, displacing the greater part of the fire from the firegrate, forcing open the inspection doors in the brickwork surrounding the boiler, and damaging a considerable amount of brickwork. The explosion was caused by the tube having become so thin, through external corrosion, that it was unable, any longer, to withstand the pressure within it. The corrosion was caused by leakage of water and steam from between the tube neck and the lower drum into which it had been expanded.

Explosion from a Main Steam Pipe.

Report of Preliminary Inquiry, No. 1,954.—The explosion occurred on Wednesday, the 9th February last on board the s.s. Boulama, when the vessel was about 60 miles south-west of Ushant, on a passage from Las Palmas to Hamburg. No person was injured by the explosion. The pipe was made from a copper tube with a brazed longitudinal joint, and was bent at right angles to a mean radius of about 15 in., about 2 ft. 10 in. from the end which joined the boiler stop-valve chest. It was fitted with brass flanges, 10 in. in diameter and $\frac{7}{8}$ in. in thickness. One flange was connected to the boiler stop-valve chest by six bolts, $\frac{3}{4}$ in. in diameter, and the other to the length of pipe which joined the engine stop-valve chest by seven bolts, $\frac{3}{4}$ in. in diameter. The distance from the centre of flange at the boiler end to the opposite end of the pipe was about 5 ft. It was $4\frac{1}{2}$ in. in internal diameter and No. 5 S.W.G. (·212 in.) in thickness. The pipe fractured circumferentially for a length of about 6 in. at the neck of the flange, joined to the starboard boiler stop-valve chest. The fracture subsequently extended to a length of about 9 in., steam continuing to escape from it until the boiler stop valves were closed. The explosion was due to excessive stresses set up during heavy weather by the pitching of the vessel, the racing of the engines, and the consequent vibration. The vessel was in ballast at the time.

Explosion from a Cast-iron Steam Pipe.

Report of Preliminary Inquiry, No. 1,955.—The explosion occurred about 4-10 p.m. on 8th May last, at the Brickworks, Bolsover Colliery, near Chesterfield. No one was injured by the explosion. The pipe was of cast iron, 6 in. in internal diameter and 9 ft. long; the thickness varied from $^{7}/_{16}$ in. to $^{11}/_{16}$ in. The name of the maker is not definitely known, but the range, including the pipe which failed, is stated to have been erected new about 19 years ago, and has been in regular use since then. The pipe fractured longitudinally for a length of about 2 ft. 4 in., and a piece measuring 14 in. by $5\frac{1}{2}$ in. was blown out of the pipe to a distance of about 20 yards. The explosion appears to have been caused by water hammer. Water of condensation had accumulated in such a manner that the drainage was not effective, and on the admission of steam to the range a shock of water hammer occurred, causing the pipe to fracture.

Explosion from a Heating Tube in a Baker's Oven.

Report of Preliminary Inquiry, No. 1,956.—The explosion occurred on 14th May last, at the bakery occupied by Mr. G. T. Friday, 141, Hainton Avenue, Grimsby. No person was injured. The general structure of the oven is of brick, and it is described by the maker as a double-decker Peel steam oven. It contained two compartments each 7 ft. in length by 5 ft. in breadth, provided with suitable doors, and heated by 67 sealed tubes arranged in three rows. The bottom row contains 22 weldless steel tubes 9 ft. 3 in. in length, $1^5/_{16}$ inches external diameter, and $\frac{1}{4}$ in. in thickness; the middle row, 25 butt-welded wrought-iron tubes 9 ft. 8 in. in length, $1^5/_{16}$ in. external diameter, and $^5/_{16}$ in. in thickness; and the upper row, 20 butt-welded wrought-iron tubes 10 ft. 8 in. in length, $1^5/_{16}$ in. in external diameter, and $^5/_{16}$ in. in thickness. The ends of the tubes were plugged and welded, and each tube contained a small quantity of water, but was not provided with any fittings. The tubes were depressed from the horizontal at the furnace end, and in the bottom row projected into the furnace a distance of about 7 in. The ends of the middle and upper rows being bent downwards, a greater length of each tube projected into the furnace. Suitable furnace and ash-pit doors were provided, two flue doors, and a sliding damper to regulate the draught. Each compartment of the oven was provided with a mercurial thermometer graduated to 600 deg. Fah. The oven was fully eight years old. The name of the maker of the heating tubes could not be ascertained, the tubes having been taken from a stock supplied by different firms. Several tubes were renewed about August, 1904, but no information could be obtained as to their position or actual number. In July, 1908, three tubes were renewed in the middle row, and 14 in the bottom row. The eighth tube from the left side in the bottom row burst at the furnace end for a length of about $3\frac{1}{4}$ in., on the side immediately above the fire, and was bent upwards about 60 deg. The explosion appears to have been caused by the material of the tube having become weakened by over-heating until it was unable to withstand the pressure generated within the tube.

Explosion from a Tube in a Steam-Heated Baker's Oven.

Report of Preliminary Inquiry, No. 1,957.—The explosion occurred on the 11th October, 1909, at the bakery of Messrs. W. Partridge and Son, Reepham, near Lincoln. No person was injured. The general structure of the oven is of brick, and it is described by the maker as a double-decker Peel steam oven. It contained two compartments, each 6 ft in length by 6 ft. in breadth, which were provided with suitable doors. The oven was heated by 86 sealed tubes, arranged in three rows. The lower row contained 26 weldless steel tubes 8 ft. 3 in. in length, $1^5/_{16}$ in. in external diameter, and $\frac{1}{4}$ in. in thickness; the middle row, 30 butt-welded wrought-iron tubes 8 ft. 8 in. in length, $1^5/_{16}$ in. in external diameter, and $^5/_{16}$ in. in thickness; and the upper row, 30 butt-welded wrought-iron tubes 9 ft. 8 in. in length, $1^5/_{16}$ in. in external diameter, and $^5/_{16}$ in. in thickness. The ends of the tubes were plugged and welded, and each tube contained a small quantity of water, but was not provided with any fittings. The tubes were depressed from the horizontal at the furnace end, and in the lower row projected into the furnace for a length of about 7 in. The ends of the middle and upper rows being bent downwards, a greater length of these tubes projected into the furnace. Suitable furnace and ash-pit doors were provided, together with two flue doors, and a sliding damper to regulate the draught. Each oven compartment was provided with a mercurial thermometer graduated to 550 deg. Fah. The explosion occurred the second day the oven was in use. The end of the third tube from the left side in the lowest row ruptured longitudinally on the side immediately above the fire, and was bent upwards about 4 in. The rupture measured 5 in. longitudinally and 2 in. at the widest part of the opening. The furnace door was forced open and cracked by coming in contact with the adjoining brickwork. The explosion appears to have been caused by the material of the tube having become weakened by over-heating until it was unable to withstand the pressure within the tube.

NOTICES OF MEETINGS, &c.

November 4th.—Institute of Marine Engineers. Annual Dinner at the King's Hall, Holborn Restaurant.

November 5th.—The Birmingham Association of Mechanical Engineers. Monthly meeting. Paper on "The Flywheel," by Mr. J. Batey.

Leicester Association of Engineers. Paper on "Some Press Tool Problems" will be given by Mr. T. Smithies Taylor.

November 6th.—British Foundrymen's Association. Paper on "The Moulder and Chemical Analysis, with some Notes on Contraction," by Mr. F. Andrew.

November 7th.—Institution of Marine Engineers. Meeting at 58, Romford Road, Stratford, London, E. Discussion on "Electro-Magnetic Transmission" and "The Telemotor."

The Society of Engineers.—Ordinary Meeting held in Room 18, Caxton Hall, Westminster, at 7-30 p.m. A paper will be read on "Public Slaughter Houses," by Mr. S. M. Dodington.

November 8th.—Manchester Local Section of the Institute of Electrical Engineers. Second ordinary meeting, held at the University (Physical Laboratory), Manchester, at 7-30 p.m. A paper will be read by Mr. C. F. Smith on "Irregularities in the Rotating Field of the Polyphase Induction Motor."

The Glasgow Local Section of the Institution of Electrical Engineers.—Meeting at the Lecture Hall, 207, Bath Street, Glasgow, at 8 o'clock. Chairman's Inaugural Address.

November 9th.—The Incorporated Institution of Automobile Engineers. Second General Meeting to be held at 8 p.m. at the Institution of Mechanical Engineers, Storey's Gate, S.W., when a paper will be read on "Carburetter Action," by Professor W. Morgan, B.Sc., and E. B. Wood, Esq., M.A.

The Midland Institute of Mining, Civil, and Mechanical Engineers. Meeting to be held in the Institute Rooms, St. James's Chambers, Sheffield, at 3-30 p.m. The following papers will be open for discussion: "Some Experiments of Explosive Gases, and their Bearing on Colliery Explosions," by Mr. G. R. Thompson, B.Sc., A.R.S.L. "The Pollution of Rivers by Effluent from Coke-oven Bye-products," by Mr. H. Maclean Wilson, M.D., B.Sc. "Colliery Companies in Relation to the Law of Statutory Undertakings," by Mr. J. H. Cockburn. The Annual Dinner will be held on the same evening, at the Grand Hotel, Sheffield, at 6-45 p.m.

The Society of Engineers.—Mr. L. W. J. Costello, M.A., L.L.B. (Cantab.), will deliver his third lecture on "The Law and Its Relation to Engineering," at Caxton Hall, Westminster, at 7-30 p.m.

November 10th.—The Institute of Electrical Engineers. Opening meeting at 8 p.m. The President, Mr. S. Z. de Ferranti will deliver his inaugural address.

Institution of Civil Engineers' Association of the Birmingham Students. Meeting held in the Lecture Theatre, Birmingham University, Edmund Street, Birmingham, at 7-30 p.m. Presidential address by Mr. W. B. Worthington, M.Inst.C.E.

November 11th.—Coventry Engineering Society. A paper will be read by A. E. Bell, Esq., on "Some Recent Examples of Modern Electrical Time Service."

November 12th.—The Manchester Association of Engineers. Meeting held in the "Masonic Room," Grand Hotel, Aytoun Street, Manchester, at 7 p.m. Paper on "Humphrey Pumps and Compressors," by Mr. H. A. Humphrey, London.

The Junior Institution of Engineers. Dance and Whist Drive at the Gaiety Restaurant, Strand, at 7 p.m.

November 14th.—The Institution of Mechanical Engineers (Graduates' Association). Meeting at 8 p.m. A paper will be read entitled, "Foundry Plant, Machinery, and Working," by Mr. E. Timothy.

Cupro-nickel Steel.—In a paper presented before the American Society for Testing Materials, dealing with cupro-nickel steel, it is noted that alloys carrying from 5 to 20 per cent copper, which without nickel would be extremely hard and brittle become, by the addition of nickel in proportion of 20 to 50 per cent, highly ductile and easily machineable.

AN IMPROVED FUEL-SPRAYING VALVE FOR INTERNAL-COMBUSTION ENGINES.

The fuel spraying valve described below is of that class which serves for controlling a supply of liquid fuel to an internal-combustion engine under a high air pressure.

When valves of this kind are operated through packing glands, owing to the high air pressure and to the penetrating qualities of the fuel, the packing rapidly deteriorates and it is very difficult to keep the glands tight. In this arrangement the valves and their operating mechanism is such that the use of stuffing boxes or packed glands is avoided, and the leakage is obviated.

An air-tight box is provided in which the valve is adapted to slide in suitable guides, the valve being operated to move it from its seat by means of a lever mounted on a spindle which is carried in a plug bearing screwed into the walls of the box, a collar formed upon the spindle being ground to an air-tight fit against the end of the plug so as to prevent leakage around the spindle. The end of the spindle which projects through the plug bearing can carry a lever or other device through the medium of which the valve is to be operated.

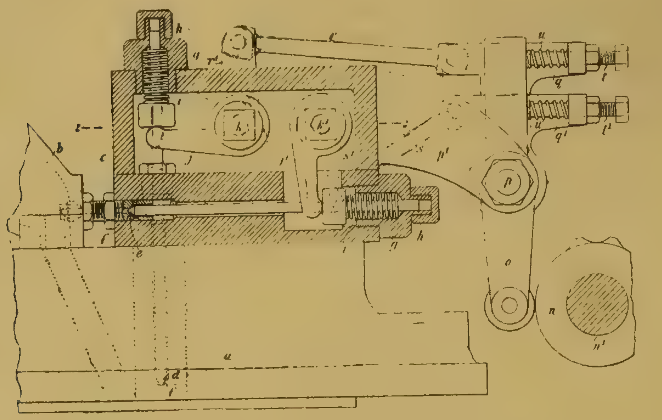


Fig. 1.

The device, which is the invention of Messrs. E. C. Blackstone and F. and E. Carter, of Rutland Iron Works, Stamford, is shown in our illustrations, figs. 1 and 2 being respectively a sectional elevation and a sectional plan showing the arrangement of two independently operated valves in connection with an air-tight box, the said valves controlling respectively the supply of oil into the main combustion chamber and into the supplementary combustion chamber of the engine; fig. 3 a plan view illustrating an arrangement wherein two valves are operated from a single spindle, and fig. 4 a sectional end view of the same section being taken on the line 4—4, fig. 3.

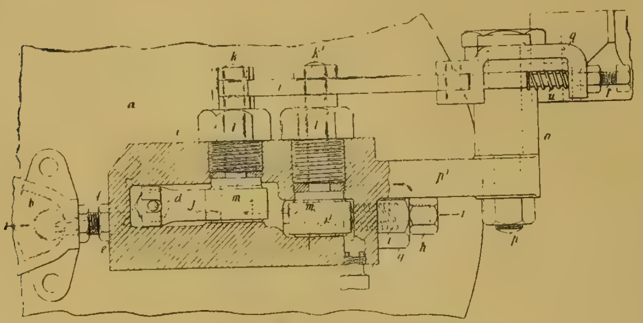


Fig. 2.

The end or cover of the cylinder or main combustion chamber of an engine is indicated by *a*, and the supplementary combustion chamber mounted upon the cover by *b*, and into this latter a supplementary charge of fuel is admitted. *c* is the air-tight box and *d*, *e* are the valves by means of which the charges are admitted into the main combustion chamber and the supplementary combustion chamber *b* respectively. These valves *d*, *e* are each of the needle type, and adapted at one end to work against a seat *f* in the usual manner, whilst the other end works in a guide *g* which is screwed into the wall of the box *c*, the hole in the guide being closed at the outer end by a cap *h*; a spring *i* in connection with each valve serving to hold it against its seat.

In the arrangement shown in figs. 1 and 2, the valves *d*, *e* are respectively operated by levers *j*, j^1, mounted upon spindles *k*, k^1, which extend through plug bearings *l* screwed into the wall of the box; the inner end of each of these bearings being accurately faced, and each spindle having upon it a collar *m* which is ground to an air-tight fit against the faced end of the plug *l* so as to prevent leakage around the spindle.

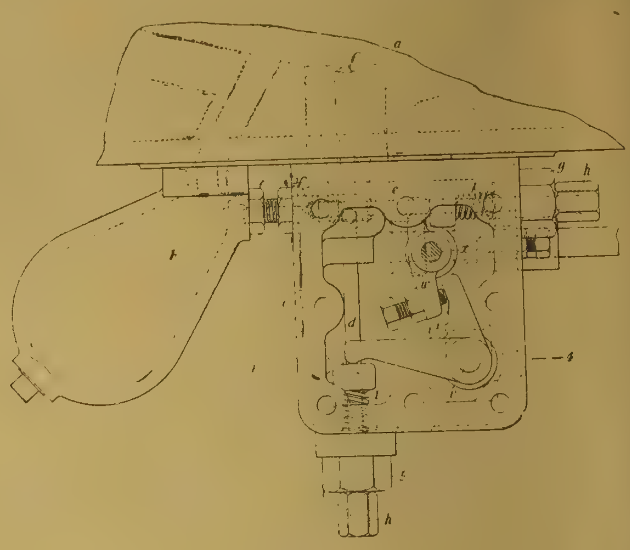


Fig. 3.

As shown, motion is imparted to the spindles *k*, k^1, and consequently to the valves through the medium of a cam *n* on a lay shaft n^1, the cam acting upon a lever *o* pivoted upon a pin *p* carried by a bracket p^1 projecting from the box. This pin *p* has also pivoted upon it two levers *q*, q^1 which may be termed intermediate levers, the lever *q* being connected by a rod *r* and lever r^1 to the spindle *k*, and the lever q^1 by a rod *s* and lever s^1 to the spindle k^1, the intermediate levers also carrying set-screws *t*, t^1, by means of which the amount of movement imparted to them by the main lever *o* can be adjusted; spiral springs *u*,

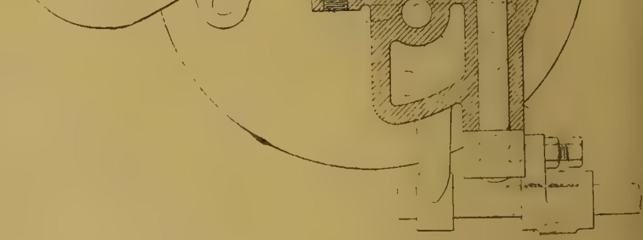


Fig. 4.

u^1 in connection with these adjusting screws serve to keep the roller on the lever *o* in contact with the surface of the cam *n*.

Figs. 3 and 4 show an arrangement in which only one spindle *v* projects through the air-tight box *c* for operating both valves, this spindle being carried in a plug bearing provided with a collar *m*, and carrying on its inner end a bell-crank lever v^1, one arm of which directly operates the valve *d*, whilst the other arm acts upon a rocking-lever *w* through which the valve *e* is operated; the end of the rocking lever *w*, in contact with the arm of the bell-crank lever, being preferably provided with a set-screw (to which access can be had when the cover of the air-tight box is removed) for the purposes of adjustment. For advancing or retarding the operation of one valve relatively to the other without removing the cover, the rocking-lever *w* is mounted upon the eccentric portion of a screw-pin *x*, which is inserted through the wall of the air-tight box, and the rotation of which serves to alter the position of the rocking lever *w* relatively to the bell-crank lever.

It will be seen that the main features of the improvement consists in adapting the valve to slide in suitable guides or bearings in an air-tight box, and having motion imparted to it through the medium of a spindle extending through the wall of the box, the spindle having upon it a collar, one of the faces of which is ground against and adapted to co-operate with a corresponding face inside the box so as to form an oil or air-tight joint.

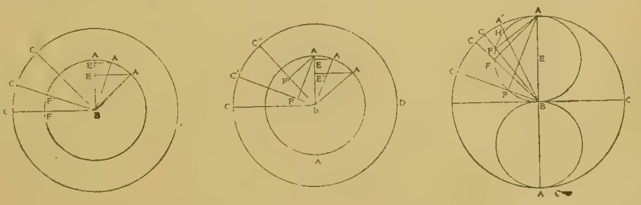
THE ZEUNER VALVE DIAGRAM.

The Zeuner valve diagram, by means of which the valve displacement can be found for any position of the main pin, is a simplification of longer processes to obtain the same result, and its construction can best be studied by showing how this is done. Assuming an engine whose valve has no lap, as in fig. 1, it is evident that A′ E and A″ E′ represent the distance the centre of the valve has moved from its mid position when the crank pin is at C′ and C″ respectively. With the pin at C the valve will be on the centre of its seat. While the valve displacement for any position of the pin could be found by drawing the main crank and the crank representing the eccentric at right angles to each other and then drawing a perpendicular to the vertical line A B, or A B produced, yet a simpler method of obtaining the same result is shown in fig. 2. The valve displacements for the positions C′ and C″ of the pin will be A′ E and A″ E′. From A draw A F and A F′ perpendicular to C′ B and C″ B. Considering the two triangles A F B and B E A′, the angle F A B is equal to the angle A B A′, as A F is parallel to A′B. Also the angle A F B is equal to the angle B E A′, as both are right angles. The side A B is equal to the side A′ B, both being radii of the same circle. The two triangles are therefore equal and the side F B is equal to the side A′ E. But A′ E represents the valve displacement when the crank pin is at C′; therefore F B also represents the valve displacement when the crank pin is at C′. It is then evident that the valve displacement for any position of the pin between C and D can be found by dropping a perpendicular from A to the line representing the main crank, while for the return stroke of the piston the corresponding valve displacements can be found by drawing the perpendiculars from the point A′.

The diagram has then been simplified to the extent of eliminating the line representing the valve crank, and the perpendicular from the extremity of this line to the vertical line A B; in other words, the valve displacement can now be found by dropping a perpendicular to the main crank position and noting the intercept between the centre and the point at which the perpendicular falls. However, the diagram can be still further simplified, and it will be shown next how the perpendicular to the main crank position can also be eliminated.

Fig. 3 represents the main pin in three positions, C, C′, and C″, and the corresponding valve displacements F B, F′ B, and F″ B have been measured off on the main crank by the perpendiculars A F, A F′, and A F″. The three right-angled triangles A F B, A F′ B, and A F″ B are all described upon the same base A B. It can be proved by geometry that when a series of right-angled triangles are constructed upon a common base, their verticles all lie upon the circumference of a circle, the diameter of which is formed by the base line of the triangle. If a circle be described with such a diameter, the part of the line representing the main crank, which is intercepted between the centre of the axle and the circumference of the circle, will then be the valve displacement for that position of the main pin. This circle, known as the valve circle, then renders unnecessary the drawing of a perpendicular to ascertain the valve displacement. The lower valve circle described upon the position of the eccentric radius A′ B with the pin at G gives the valve displacement for the return stroke of the piston. This completes the construction of the Zeuner valve diagram, considering an engine having a valve without lap.

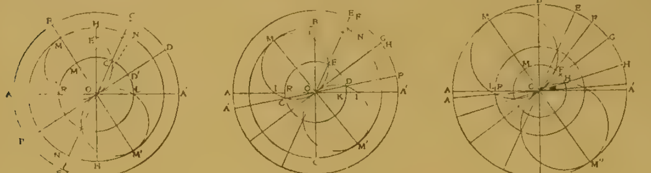
Fig. 4 shows the diagram applied to a valve with lap, but with no lead, H O N being the angle of advance of the eccentric. When this diagram is applied to a valve having lap, the angle of advance must be laid off negatively if a clockwise rotation of the main crank is to be considered, and the valve circles described, using as diameters the valve crank M O or M O produced to M′. If a negative angular advance is not assumed, that is, if N O or N O produced to N′ is taken as the diameter of the valve circle, a negative rotation of the crank will have to be assumed. In this case, in order to find out how far the valve has moved from mid-position when the main crank has moved through a certain angle from one centre, an imaginary crank must be assumed rotating through the same angle in the opposite direction from the other centre. In order to avoid this a negative angular advance is assumed, although the diagram is sometimes found with the circles described on the positions the valve crank would assume in actual practice with the engine on either centre, a negative rotation of the crank then being necessary. A negative rotation of the main crank assumes that the eccentric is fixed independent of the crankshaft, the whole engine revolving around the centre of the axle, the direction of motion being such as already stated. Having described the valve circles, using M O and O M′ as diameters, next, from the centre describe a circle with a radius equal to the lap. With the pin at A, the valve displacement is equal to O R, but as O R is equal to the lap, the valve displacement will be equal to the lap, or the valve will be at admission. With the main pin at B, the valve displacement is equal to M O, and the port opening equal to M M″, this position of the pin giving the greatest port opening. At C the displacement of the valve is again equal to the steam lap O C′, and the valve is at cut-off. At D the displacement is zero, no part of the main crank being found in either valve circle, the pin now being in mid-position and release about to occur at the left port and compression at the right port. With the pin at A the valve displacement is equal to the lap and



Figs. 1, 2, and 3.

the right-hand steam port will be on the point of taking steam. The left port will be open to the exhaust, an amount equal to the steam lap at this time. The lower valve circle shows the events for the return stroke of the piston. At M′ the right-hand steam port is wide open, cut-off occurring with the pin at E, and release and compression with the pin at F.

Fig. 5 shows the diagram applied to a valve having lead. With the pin at A″ the valve displacement is equal to the lap O C, and the valve is on the point of opening the port. With the main pin at A, the valve displacement is equal to L O, and subtracting the lap R O leaves a port opening L R which is the extent of the lead. Cut-off occurs at E; if no lead existed this event would occur at F. Release and compression take place at G, and if no lead existed these would occur with the pin at H. With the pin at A′ the port opening would be equal to the amount of lead K I. Considering the return stroke of the piston, the greatest port opening would occur with the pin at M′.



Figs. 4, 5, and 6.

Fig. 6 shows the diagram applied to a valve which has lead and exhaust lap, the inner circle being described with a radius equal to the exhaust lap. With the pin at F, compression is about to occur at the right-hand steam port. The valve will be in mid-position when the main pin is at G, and release will occur at the left-hand steam port when the main pin is at H. With the pin at F and H the valve displacement is equal to O F′ and O H′; that is, it is equal to the exhaust lap. Considering the inner circle as being described with a radius equal to the negative exhaust lap with the main pin at F, the valve displacement is equal to the negative exhaust lap, and release will be about to occur at the left steam port, and compression at the right port with the main pin at H. Cut-off occurs at the left port with the pin at E. The valve events for the return stroke are shown in the lower part of the diagram.—By W. J. Harden, in *Power and the Engineer.*

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 27th October, 1910.

Aberdeen.—*First Class :* James D. Ferries.

Bristol.—*First Class :* Percy Ridler, William H. E. Cann. *Second Class :* Frederick J. Grose.

Greenock.—*First Class :* Daniel F. Pollock, Tom Mitchell, William Walker, Alexander S. Tweedlie, John L. Thomson, William T. Oliver, Thomas F. Miller. *Second Class :* Thomas Steel.

Hull.—*First Class :* John T. Harrison, Arthur E. Vickers, Edwin Pitt. *Second Class :* William Laycock, James S. Marshall.

Liverpool.—*First Class :* Robert N. Ashton, Maurice J. Thomas, John Griffith, John J. Morris, Thomas Murphy. *Second Class :* Charles J. Slack, Nicholas Bowden, William W. Evans, Owen D. Thomas.

London.—*First Class :* Frederick C. Cable, Donald McT. Anderson.

North Shields.—*First Class :* Brynjolf Skagen, John T. Miller, James W. King, John Teasdale, Edwin M. Lennon. *Second Class :* Charles Patterson, Ernest F. Price, Isaac Wilkinson, David D. Williamson, Thomas R. Day.

Sunderland.—*First Class :* Reynold Hauff, Robert Dawson, Ernest Winton. *Second Class :* William Cowens, George A. Swinson.

THE "UNICA" ACCUMULATOR SEDIMENT PUMP.

The "Unica" accumulator sediment pump is a new design of pump for removing the sediment or deposit and other foreign matter from the bottom of accumulator cells. The use of this pump enables the operation of removing the deposit to be performed with great expedition and facility, and saves a considerable amount of labour and expense. The "Unica" is no syphon, working with a small pressure difference, but a continually-acting suction and pressure pump with full atmospheric pressure. It lifts the heaviest lead sediment and foreign matter direct from the bottom of the accumulator cell without carrying away too much acid, and deposits same into any available vessel of suitable size. The pump works without interruption, there being no small sediment collecting vessels to be emptied. Interchangeable suction pipe nozzles suitable for the dimensions of the cells are provided. Two of these are square-shaped for reaching below the plates, while the third flat pipe can easily be inserted into the narrowest space between the plates down to the bottom of the cell.

By means of this apparatus the largest storage batteries can be cleansed in a very short space of time without requiring the plant to be shut down, and cutting out of accumulator plates is not necessary.

The "Unica" can also be employed for filling up of acid or distilled water, and acid can be raised to a considerable height, the pump being designed for both suction and delivery up to about 32 ft. In construction the apparatus is simple, there are no stuffing boxes or other packings subject to wear and tear; it does not require taking into parts and cleaning whilst in use, but when necessary it can be taken into parts and assembled within a few minutes after being done with by loosening five winged screws. The pump consists of warranted acid-proof materials and has sufficiently dimensioned holes, and the valves are of such design as will prevent sticking and stoppage.

The "Unica" Accumulator Sediment Pump.

The "Unica" is made in two sizes, viz., No. 1, which lifts, with piston moving slowly, 5·28 gallons per minute, output per stroke being 0·33 gallon; No. 2, which lifts 2·64 gallons per minute, output per stroke 0·154 gallon.

The advantages possessed by this pump constitute it a necessary adjunct to every storage battery plant. It is supplied by S. Heilpern, 5, Arcade Chambers, St. Mary's Gate, Manchester, and is coming into very general use in large power stations and for private battery plants.

AN IMPROVED METHOD OF LUBRICATING THE BEARINGS OF GYROSTATS.

In gyrostats of the type in which the heavy wheels rotate within vacuous casings, it is desirable to avoid any necessity to frequently open the casing because such openings would, of course, spoil the vacuum within. Moreover, in gyrostats of this character which are driven by electric motors it is desirable to prevent lubricant finding its way to the brushes and other gear of the motors. The improvement consists in maintaining a continuous flow of lubricant over bearing surfaces by centrifugal action by adapting relatively rotatable means on a portion of the shaft adjacent to the journal to effect a circulation of the lubricant. Also of means whereby any lubricant escaping from the bearing is collected in a reservoir so arranged that a transference of the collected lubricant to the main reservoir can be periodically effected by the agency of atmospheric pressure, and, periodically or continuously, by pumps hand or power driven.

The improvements, which are the invention of Mr. Louis Brennan, of Gillingham, Kent, are shown in our illustrations. Fig. 1 being a part sectional elevation showing the location of the lubricant reservoirs and part of the return pipes; fig. 2, a plan showing the cooling coils and general arrangement of parts; fig. 3, a sectional plan showing details of the bearings; fig. 4, a sectional elevation showing further details of the bearings and circulating rings, leakage revervoir, lubricant returning valve and non-return valves; fig. 5, a side view of the non-return valves; and fig. 6, a plan view of the lubricant-returning valves.

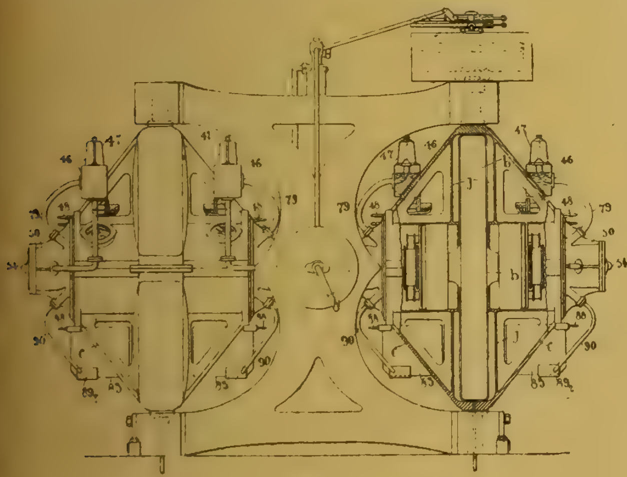


FIG. 1.

One construction has upon the swivelling frames *c c*, carrying the heavy wheels *b*, receptacles 46 for containing the lubricant, there being one receptacle for each bearing of the gyrostat wheel axle. The parts necessary for the lubrication of one of the bearings will be described, the parts being duplicated for the other bearings; there being four bearings to be lubricated in the machine illustrated. These receptacles 46 are preferably provided with glass domes or equivalent devices 47, in order that the condition of the lubricant may be ascertained. Leading from the receptacle is a coiled pipe or other form of radiator, so arranged as to expose a considerable area to the cooling influences of the surrounding atmosphere. This pipe or radiator 48 connects to an orifice 49 in the side of the boss 50, carrying the heavy wheel axle bearing 51. From this orifice the lubricant is conducted by a suitable passage 52 to a cavity 53 in a block 54 situated over the end of the heavy wheel axle. In this block 54 there is formed a spherical seating 55, upon which rests a washer 56 having one side flat and the other spherical to fit cavity 55. Upon this washer 56 there bear one or more other washers, preferably alternately of different metals, the contacting faces of the latter washers being suitably grooved. A tube 59 projects from the lubricant-receiving cavity 53, formed in the block 54, through holes in the centre of the washers. This tube has slots or the like, 60, in it, which permit the lubricant passing from the cavity in the block to reach the grooves 61 in the faces of the washers. After escaping from the face grooves 61 the lubricant enters a small recess 62 communicating with a spiral groove 63 formed in the surface of the lining material of bearing 51 of the axle journal or in the axle journal 64 itself or in both. The lubricant traverses the length of the axle journal by means of this spiral groove 63 and reaches a cavity 65 formed partly by the journal fillet 69 of the axle and the end of the journal bearing, and partly by the floating annular ring 66 having projecting extensions 67 engaging with pins 68 upon the axle bearing and adapted to keep the floating ring 66 from rotating with the axle. Freely mounted upon the axle at the part immediately beyond the fillet 69, forming the junction of the journal and the axle proper, is a ring 70 approximately triangular in cross section. One side of this ring bears against a lubricant catching ring 71 secured to the gyrostat frame *c*. Upon this triangular section ring 70 there bears another ring 72 of approximately triangular cross section, the faces 74 of these triangular rings being opposite their right angles and bearing upon one another. The second triangular ring 72 is pressed against the first ring 70 by the floating ring 66 before described by means of spiral springs 73 contained in cavities in the end of the bearing.

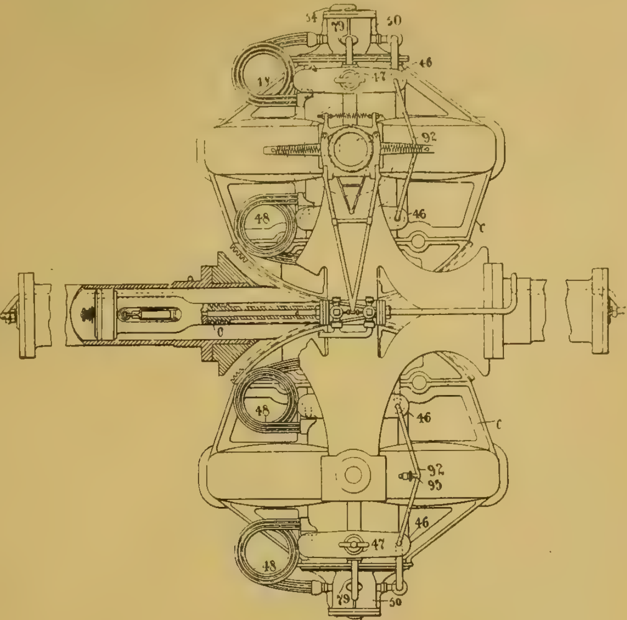
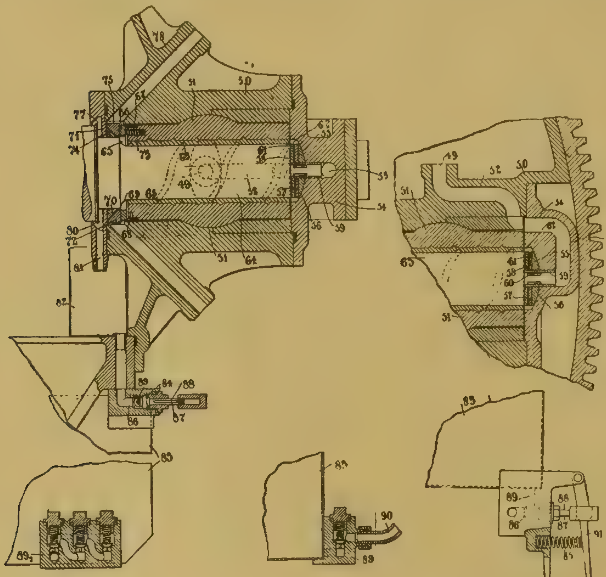


FIG. 2.

The lubricant delivered through the spiral groove fills the cavity 65 formed at the inner end of the journal and flows partly through the interspace between the floating ring 66 and the end of the journal bearing 51 into the surrounding channel 75 and partly along the shaft and through the contacting faces 74 of the two triangular rings into the same channel 75. The triangular ring 70 fits closely upon the shaft 76 and the film of lubricant between it and the shaft being very thin viscous friction is operative in rotating it at a high velocity though its speed of rotation is generally lower than that of the shaft. The ring 70 is preferably-cut away leaving a triangular space adjacent to the shaft and the lubricant catching ring 71, thus leaving room for the oil to be thrown outwards radially by centrifugal action.

The viscous friction of the oil or other lubricant film between the two triangular rings 70 and 72 is also operative in rotating the triangular ring 72, though the speed of the latter is lower than that of the ring 70. Any lubricant passing along the shaft 76 past the triangular ring 70 tends to be thrown off centrifugally as a film between it and the lubricant catching ring 71, and from thence into the surrounding channel 75. From this channel 75 there leads a duct 78 connected to a pipe 79 directly to the lubricant reservoir 46. The end of the pipe 79 projects within the reservoir and is directed upwards towards the glass dome 47 so that the lubricant is thrown upwards in the form of a jet and its condition and volume can be at once observed.

Returning now to the lubricant catching ring 71 against which the triangular ring 70 bears, this lubricant-catching ring has formed in it a circular groove 77 surrounding a lip 80 turned on or attached to the axle, this lip being intended to fling off any lubricant escaping past the triangular ring 70, which lubricant is caught by the lubricant-catching ring and conducted downwards by a suitable conduit 81. The lubricant passing downwards drops into a receptacle 82, from which it passes into a reservoir 83 adapted to collect a considerable quantity of lubricant.



FIGS. 3, 4, 5, and 6.

The lubricant from this receptacle 83 may be periodically discharged into the main lubricant reservoir 46 by the following means: Situated at the top of the leakage lubricant reservoir 83, and between it and the receptacle 82 for receiving the lubricant from the ring catcher 71, is a valve 84 so arranged as to be normally held open by a spring 85. Upon pressing this valve 84 in opposition to the spring, by means of handle 91, the head 84 of the valve is forced against an orifice 86 situated between the lubricant-catching ring 71 above mentioned and the leakage lubricant tank 83. This pressing of the head 84 against the orifice 86 closes it and shuts off the leakage lubricant collecting tank 83 from communication with the interior of the vacuous wheel casing, it being understood the ring 71 and receptacle 82 are situated within the vacuous casing *j*. Simultaneously with the closing of the orifice 86, grooves 87 formed upon the stem 88 of the valve establish communication between the top of the leakage lubricant tank 83 and the outside atmosphere by way of passage 89. The pressure of the atmosphere is thus allowed to act upon the upper surface of the lubricant contained in this reservoir 83 and the lubricant is forced by atmospheric pressure first through non-return valves 89, situated at the bottom of the leakage lubricant tank, and then up through a pipe 90 to the cavity 75 surrounding the triangular section rings, from which cavity it follows the same course as that taken by the normal lubricant circulation, and reaches the interior of the main lubricant reservoir 46, being on its way thrown in a jet showing as a fountain of oil under the glass dome 47. The two lubricant reservoirs 46 situated upon one of the moving frames *c* are connected by means of a pipe 92 in order that the pressure in each of the receptacles shall be the same.

It may, under some circumstances occur that air held in solution in the lubricant or vapours given off by the lubricant may collect in the upper part of the reservoirs 46, and thus spoil the vacuum in that upper part of the reservoir, which vacuum assists to raise the lubricant from the leakage collection tank. In order to overcome this difficulty, a branch pipe 93 is taken from the pipe 92 to the vacuous casing *j*.

In this branch 93 there is provided a spring-loaded valve, preferably a ball backed by a spiral spring, means being provided whereby the tension of the spring may be adjusted. This safety valve device enables the accumulation of pressure in the reservoir 46 to be limited as desired. In some cases a tap may be provided in the branch 93 to close communication between the pipe 92 and the casing *j*.

Instead of using atmospheric pressure to return the lubricant from the leakage to the storage tank it may be desirable to use some form of pump, operated either by hand or mechanically. In such cases the vacuum is not affected by the addition of the volume of air which enters the leakage tank each time that a transfer of lubricant is desired from the leakage to the storage tank.

From the above description it will be seen that the lubrication system is made up of two main parts, viz., firstly, the main lubricating system, secondly, the system for dealing with the leakage or overflow lubricant. The non-return valves 89 situated at the bottom of the leakage lubricant collecting tank 83 are preferably of the poppet type, and three such valves in series, all situated in one valve casing, are employed, so that in case of failure of one valve, will prevent lubricant running from the main lubricant reservoir 46 down into the leakage lubricant collecting tank 83. Cocks may be provided at different points in the lubrication system in order to cut out any portions of the lubricant circuits for the purpose of replenishing the lubricant supply. All the parts described are carried by the swivelling frames containing the heavy wheels.

The main feature of the improvement will be seen to consist in maintaining by centrifugal action a continuous circulating of lubricant over the bearing surfaces of the wheel axle by means of a plurality of relatively rotatable members positioned near the bearing and upon the axle, and rotated thereby at different relative speeds.

IT is well known to engineers that to design a structure so that there is no tensile stress over a joint the resultant thrust on the joint must pass within the middle third of the section. To fulfil this condition, masonry arches must be made with a great depth of section, which is obviously expensive. The perfection of wrought iron and steel brought about a new era in bridge construction by providing materials of great strength compared with their weight, and as strong in tension as in compression. The reduction of dead load due to weight, and the possibility of employing narrower and lighter cross sections, made much wider spans attainable. Iron bridges date earlier than those of steel. Southwark Bridge built in 1819 was made of iron, with a central arch of 240 ft. span and 24 ft. rise.

TESTING OF ALTERNATORS, WITH RESULTS OF TESTS ON A THREE-PHASE MACHINE.

By J. W. Rogers.

(Continued from page 427.)

The total short-circuit current for a three-phase generator

$$= \frac{C_1 + C_2 + C_3}{\sqrt{3}} = \frac{3\,C}{\sqrt{3}} = \sqrt{3\,C} \text{ with a star winding}$$

$$= C_1 + C_2 + C_3 = 3\,C \text{ for a mesh winding.}$$

These tests are made to determine the self-induction of the armature, and also the effect of armature impedance in decreasing the terminal voltage of a machine when run at a constant speed with different values of exciting current. The short-circuit test is made chiefly as a check on the voltage drop or regulation, and in the case of large machines on which it would be impossible to make a regulation test in the usual manner, it is the custom to calculate the regulation from the data given by the open and short circuit curves. The armature impedance is represented by the ratio

$$\frac{\text{Volts on open circuit}}{\text{Amperes on short circuit}},$$

the values of volts and amperes being read off the open and short circuit curves for the same value of exciting current. A knowledge of the armature impedance enables its self-induction to be calculated by transposing the equation

$$C = \frac{E}{\sqrt{Ra^2 + P^2 L^2}},$$

from which is obtained

$$L = \frac{\sqrt{E^2 - C^2 Ra^2}}{C\,P},$$

where C = current, E = terminal voltage, Ra = ohmic resistance of the armature, and P = 2 π n where n = frequency.

The value of the armature inductance may be directly obtained by passing current through the armature when stationary, with the full load exciting current on the field, and taking a reading of the volts necessary to produce full load current in the armature. This voltage is really the resultant of the resistance and reactance drops in the armature; then the value of the inductive drop and L may be found from the right angle relation which exists between these quantities. It will be found that there is a considerable fluctuation in the value of the armature inductance, this being due to the varying effect which an alternator field has upon its armature when their relative positions are changed. For this reason it is necessary to take readings with the armature in different positions as regards its relation to the field poles, and the mean value of the armature inductance at different positions will represent its effective value under full load conditions.

As is well known, impedance represents the total opposition to the flow of current, and is made up of the resistance and reactive components, the relation between the current, voltage, resistance, reactance, and inductance of an armature being easily calculated from the formula.

$$C = \frac{E}{\sqrt{Ra^2 + P^2 L^2}},$$

as follows. Transposing we get,

$$\sqrt{R^2 + P^2 L^2} = \frac{E}{C};$$

$$P\,L = \frac{\sqrt{E^2 - C^2 R^2}}{C} \quad \therefore \; L = \frac{\sqrt{E^2 - C^2 R^2}}{C\,P}.$$

Iron and Friction Losses and Saturation Tests.—These tests are generally made by belting the alternator to a shunt motor and measuring its input when driving the alternator at its normal speed with different exciting currents. During this test the speed should be held constant, the readings taken being those of terminal volts and armature current on the motor; also terminal volts and field amperes on the alternator, under the following conditions: (1) No excitation on alternator, (2) different exciting currents, (3) motor running light with the belt off. The total input to the motor is the sum of the losses in its field and armature, and includes the losses due to hysteresis and eddy currents in the iron; also the friction and windage loss of the alternator. This represents the distribution of the energy taken by the motor when driving the alternator on open circuit with any particular value of exciting current, and if the alternator excitation is varied, there will be a corresponding variation in the motor input, the difference representing the iron loss for that particular value of exciting current.

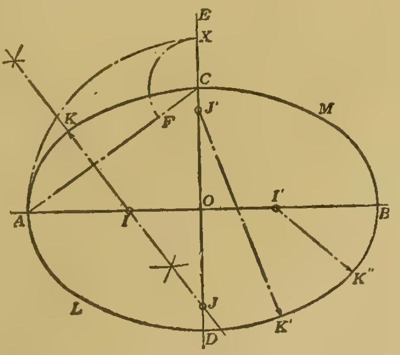
The C^2R loss in the motor armature will, of course, vary with the excitation of the alternator, the C^2R loss in the motor field being held at a fairly constant value by thoroughly heating the field before commencing the test and keeping the terminal voltage constant.

If P_1 represents the motor input when driving the alternator unexcited, and P_2 its input with the alternator excited, then the iron loss in the alternator for any value of terminal voltage or exciting current is given by $P^2 - P^1$. Supposing P represents the motor input when running light with the belt off, then the loss due to friction and windage on the alternator will be given by $P^1 - P$. During this test it is the custom to take several readings of the motor input when driving the alternator unexcited for the purpose of checking the friction losses of the alternator, which should remain fairly constant throughout the test.

(To be continued.)

METHOD OF DESCRIBING AN ELLIPSE WITH CIRCULAR ARCS.

The following simple method of drawing an ellipse with circular arcs is given in our contemporary, the *American Machinist*, as being good for various sizes and a wide range of proportions:—



Method of Describing an Ellipse with Circular Arcs.

Lay off major and minor axes A B and C D. With centre O, describe arc A X, meeting C D extended. With centre C, and radius C X, describe arc X F, meeting line A C at F. Bisect A F with the line K J, which is perpendicular to A F. With centre I and radius I A, draw the arc L A K, forming the end of the ellipse. With J as a centre, and radius J C, draw arc K C M, the upper half of the ellipse. The other parts of the ellipse are drawn in with arcs from points I' and J', the radii I' K'' and J' K' being the same, respectively, as I K and J K.

WHERE DERMATINE IS MADE.

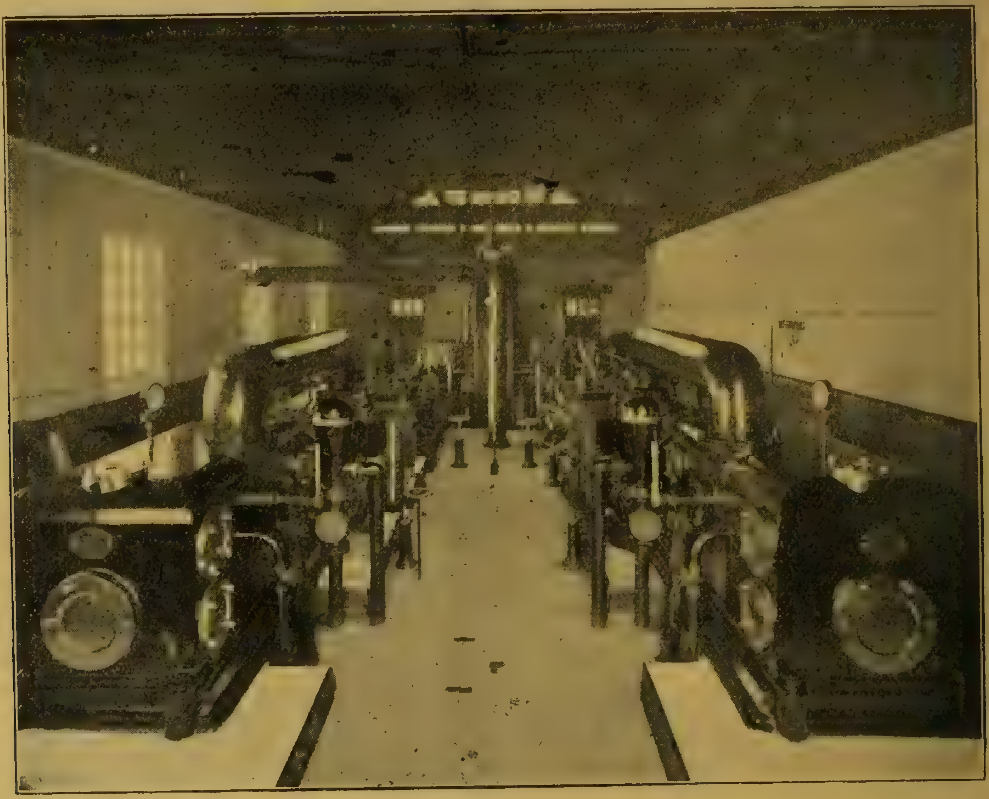
In a previous article we described the pump and other valves fitted with Hart and Fiegehen's patent anchor bushes made by the Dermatine Company Limited. A visit to the "Dermatine" works, in Neate Street, Camberwell, London, S.E., forms a very instructive experience. At these works the company have a very complete plant for the manufacture of the well-known "Dermatine" belting and "Dermatine" hose and tubing, as well as for the above mentioned valves.

The "Dermatine" belting is made of the best long staple flax three-ply warp, and the very strongest cotton duck weft. The flax yarn is specially selected, and the whole woven to stand hard wear. The fabric, after special preparation, is "incorporated" with the material known as "Dermatine," and all sizes up to 6 in. wide, and those of any width, if desired, are sewn with several rows of strong thread. Amongst the advantages possessed by this belting are uniformity of width and thickness, capability of withstanding heat, cold, damp, or steam, and great tensile strength and long wear. The "Dermatine" belting, moreover, does not stretch to any appreciable extent and does not laminate. The edges of the belts are protected by strips of solid "Dermatine," thereby considerably increasing their life. This is also where the well-known Stanley Dermatine motor cycle belt is manufactured. "Dermatine" hose and tubing, for various uses, is made in another department. Amongst the various kinds are garden, delivery, steam, oil, acid, alkali, gas, heating, brake, hydraulic, air drill, brewer's, wine, tanner's, fire, and suction of all kinds. The process of manufacture of this speciality of the company is a most interesting one. All kinds and dimensions of hose and tubing are to be seen in the different stages through which they pass before the finished stage. The hose and pipe are formed on suitably sized hollow mandrels, and the apparently difficult task of effecting their removal is performed by forcing a film of air between them and these mandrels.

A pattern of hose largely used is the "Dermatine" fire-engine hose, which is specially made to meet the requirements of fire brigades, and has stood highly satisfactory tests in actual use. This hose is most carefully made of the best materials, and is so constructed as to interfere as little as possible with the flow.

The "Dermatine" fire engine suction hose has an embedded spiral wire which, instead of being of round section as used in the ordinary suction hose, is of segmental shape in cross section—an arrangement which has been found to give excellent results.

Other special patterns made by the company are the "Dermatine" delivery hose, which is particularly suitable for rough work, not being affected by climate, and being capable of withstanding very high pressures. This type of hose is being largely used by the British Government, the London County Council, and many other corporations both in this country and abroad, as also by railway and dock companies.



DERMATINE CO. LTD. INTERIOR OF ENGINE ROOM.

Space does not permit of describing all the various patterns of hose and tubing made at the "Dermatine" works; mention may be made, however, of the special "Dermatine" hose for steam, oils, melted grease, tallow, or wax; the "Dermatine" seamless, woven, canvas fire brigade hose, and lined canvas hose; the "Dermatine" armoured hose; and the "Dermatine" tar-marlined hose.

The principal part of the machinery used consists of heavy rolls for coating the fabric and for incorporating with it the "Dermatine" composition. There are, of course, also a number of vulcanisers of special construction for treating the different articles.

It will be realised that the heavy rolls and other machines used in the works require a considerable amount of power, and this is provided by the couple of fine compound tandem condensing engines shown in our illustration, which depicts the interior of the engine house.

In conclusion we may observe that at the time of our visit to the "Dermatine" works the company had in hand a number of large orders for this country and abroad.

The Dermatine Company cordially invite engineers to visit their works, a few hours' notice only being required. They also invite engineers to communicate with them with a view to carrying out any experiments they may wish to make connected with their profession, in the manufacture of any articles not included in the catalogue.

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"The Steam Engine Indicator." By F. R. Law. Third Edition. Revised and Enlarged. London: McGraw Hill Book Company. Price 6s. 6d. net.

The importance of the steam-engine indicator is known to every engineer who is any way connected with the working and operation of this, still the principal prime mover of the day. On the score of competition alone, it is necessary to ensure that the best is being obtained from an engine, and the indicator, beyond all others, is the means by which this is best determined.

The method of treatment of the subject is simple and progressive, and includes both the theoretical considerations and the practical applications. There are many points that need careful attention in the manipulation of the indicator, such as the correct means of securing the reduced motion, selection of springs, position of steam connections, and in this work these factors are fully dealt with. All the points of a good and bad diagram are commented upon, as also the means adopted for computing the horse power of the engine under test.

The book is an excellent one, and should be in the hands of all interested in the working and testing of the steam engine.

"Aerial Navigation." A Practical Handbook. By F. Walker, C.E. Second Edition, Revised and Enlarged. London: Crosby Lockwood and Son. Price 5s. net.

This is a work of a popular character, giving as concisely as possible the general principles upon which flight is accomplished naturally, as in the case of birds and insects, and mechanically, based upon fundamental laws and dynamics of the air.

The lines upon which the Wright brothers and other pioneers proceeded in their experiments, and the results obtained by the more modern aeroplanes and dirigible airships are dealt with, while the author points out how the petrol engine has been the means of providing the necessary power for motion through the air. In a supplement will be found a description of the distinctive features of recent types of aeroplanes.

The book throughout is interesting, instructive, and leaves no room for anyone to be ignorant of the elements of aerial flight.

"Iron and Steel Analysis." Vol. I. Ordinary Constituents. By A. Campion, F.I.C., F.C.S. Glasgow: Fraser, Asher and Co. Ltd. Price 2s. 6d. net.

Originally prepared as a small text book for the author's own students, it is destined for much wider use. The merit of the work lies in the fact that it gives, with but few exceptions, one method for the analysis of each constituent, and which have proved themselves reliable and rapid. The substances dealt with in this volume include silicon, graphite, sulphur, phosphorus, manganese, carbon and arsenic. The tests are very clearly described and essentially concise. The concluding articles are devoted to the estimation of iron in pig, steel, etc., the analysis of coal and coke, and estimation of sulphur in the latter.

The author is a past master at the subject, and the book should reach a wide circle of readers, being a worthy companion, not only for students, but professional chemists.

"Water Turbine Plant." A Short Practical Treatise. By Jens Orten-Böving. London: Raithby, Lawrence and Co. Ltd. Price 10s. 6d. net.

The purpose of this book is primarily for the use of those responsible for the design of complete water-power installations, being confined to the more purely-mechanical portions of such plants. In the introduction, it is truly pointed out that nowadays engineers "have but little time to devote to the complete theory and mathematical treatment of the water turbine, but at the same time they wish to have quantitative data which will enable them to choose the best type of plant, and to lay out such plant in the most efficient and economical manner." This undoubtedly sums up the true position of the majority of commercial engineers.

The information throughout is that obtained from actual practice with large power plants, and embodies illustrated descriptions of installations with which the author has been connected. These include the plants at Näs, Gullspäng, City of Winnipeg, Calgary, Trollhättan, besides many others. The earlier portion of the book deals with the classification of turbines, outputs, water velocities, efficiencies and regulation, tests, etc.; while Part II. is concerned with tables of outputs, dimensions and weights, governors, valves, sluice gates, and pipe line works.

The book is one that will appeal to all engineers interested in the design and installation of water-power plants. It is a high-class production, printed on art paper, and includes numerous working drawings and half-tone illustrations most carefully reproduced.

Books Received.

"Syllabus Applicable to Technical Schools, Schools of Art, and Other Forms of Provision of Further Education in England and Wales." From the Secretary, Board of Education. Price 4d.

"Pitman's Public Man's Guide." A handbook for all who take an interest in questions of the day. Edited by J. A. Slater, B.A., LL.B. London: Sir Isaac Pitman and Sons Ltd. Price 3s. 6d. net.

"Pitman's Business Man's Guide." A handbook for all engaged in business. By J. A. Slater, B.A., LL.B. (Lond.). Fifth Edition. London: Sir Isaac Pitman and Sons Ltd. Price 3s. 6d. net.

"The Young Electrician." By Hammond Hall. London: Methuen and Co. Ltd. Price 5s. net.

"Water Turbine Plant: A Short, Practical Treatise." By J. Orten-Böving. London: Raithby, Lawrence and Co. Ltd. Price 10s. 6d. net.

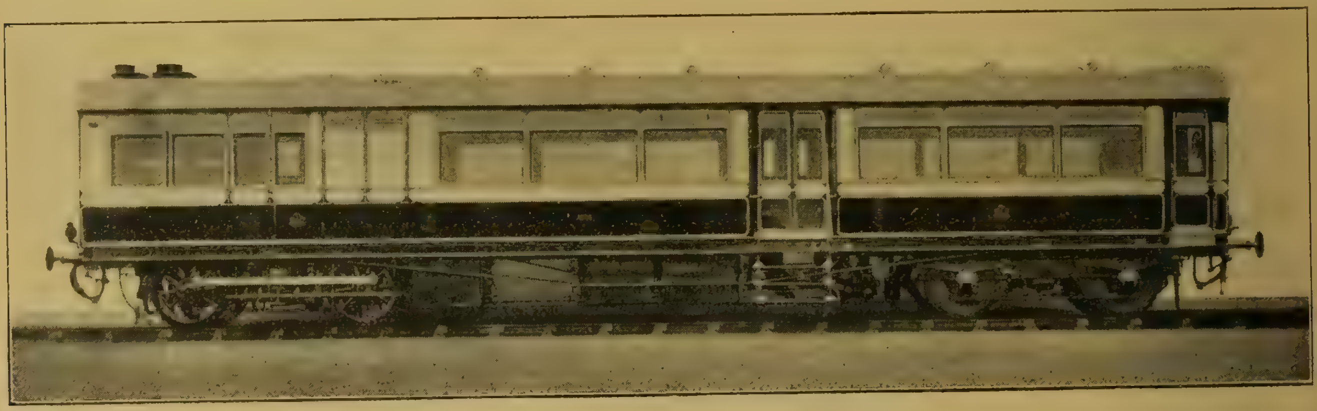
"Official Gazette of the United States Patent Office." Vol. CLIX., Nos. 2 and 3. Published by Authority of Congress, Washington.

"The Construction of Graphical Charts." By J. B. Peddle. London: McGraw-Hill Book Company. Price 6s. 6d. net.

AN INTERESTING VIEW OF TYNE RIVER FRONTAGE.

We illustrate below three-quarters of a mile of frontage of the River Tyne, showing the shipyards, engine works, and dry docks of Messrs. Swan, Hunter and Wigham Richardson Ltd., at Walker and Wallsend-on-Tyne. Viewed from left to right are seen successively the steamship Sidi Branim, passenger steamer for the Transports Maritimes, Marseilles; twin-screw steamer Carthage, 19½ knot mail steamer for the Cie Generale Transatlantique; the Neptune Engine Works; the 150-ton floating crâne; ships building under the overhead electric cranes; the Dry Docks Department, with two floating docks and the Cairn Line twin-screw steamer Tortona in the graving dock; the great glass-roofed building sheds where the Mauretania was built, and from which the Cunard Company's twin-screw steamer Franconia is being launched; the bottom plating of the British Admiralty floating dock, to lift 32,000 tons; the east yard glass-roofed building sheds; and the Indra Line twin-screw steamer Indrabarah alongside.

INTERESTING VIEW OF TYNE



L. AND N.W. RAILWAY RAIL MOTOR CARRIAGE.

LONDON AND NORTH-WESTERN RAIL MOTOR CARRIAGE.

This type of carriage, shown in our illustration, the first of which was completed in September, 1905, is intended for working the passenger traffic on the short branch lines connected with the London and North-Western Railway.

The body of the carriage is 57 ft. long, and contains two compartments, with seating accommodation for 48 passengers. The carriage, which was built at the company's works at Wolverton, is carried on two four-wheeled bogie trucks, with wheels 3 ft. 9 in. diameter. The truck at the engine end is of special construction, and together with the engine and boiler was built at the Locomotive Works, Crewe, from the designs of Mr. G. Whale, chief mechanical engineer. One of the objects aimed at in the design of this truck was not merely to make it a carrier for one end of the carriage, but to construct it to carry the engine, boiler, valve gear, water tanks, and all the engine mechanism entirely independent of the carriage, and at the same time connect it to the latter in such a way that it could be readily removed and replaced by a similar truck. This idea has been carried out, and if at any time the engine or boiler requires such extensive repairs as would under ordinary circumstances necessitate the carriage being laid up, all that is necessary is to raise one end of the carriage until the bolster casting is clear of the engine, when the latter can be removed, and a fresh truck with engine and boiler complete put in its place.

The frames of the truck are ¾ in. steel plates, the distance between them being 3 ft. 1 in., and to these frames is attached a floating steel casting carried on spiral springs connected to the truck frame. Immediately above this casting and resting on it is a steel bolster firmly secured to the carriage frames, and which has a projection in the form of a centre pin 8½ in. diameter, which engages freely in a hole in the centre of the floating casting, and thereby attaches the carriage to the engine truck. This arrangement permits of sufficient side play to allow the coach to pass with ease round curves two and a half chains radius.

The engine cylinders are 9½ in. diameter by 15 in. stroke, the valve gear being of the ordinary straight-link

The Engineering and Machinery Exhibition, Manchester.

[CONTINUED.]

Messrs. Peter Pilkington Limited, Bamber Bridge, who are well known as the pioneers of the pneumatic power hammer, exhibit a selection of their latest designs. The type known as the N.S.K. Patent Compound Pneumatic Hammer, illustrated in fig. 1, is one in which by means of a hollow piston valve the full air pressure is used to raise the tup, and the same air supply then diverted above the ram on increased area to produce the blow; in the latter case the air works expansively, and consequently a considerable degree of power economy is secured, and the hammer exhausts at low pressure. The N.S.K. hammer has thus only one cylinder and one piston, and there are no stuffing boxes. A balanced lever serves to control the piston valve, and is extremely sensitive in regulating the hammer blows from the lightest to full normal, and further to double the normal or deadweight blows, with full air pressure acting throughout the downward stroke. The lever also allows of holding the tup tight down on the work or anvil, thus serving as a vice, an important feature for foundry work where bending is to be done. On releasing the lever, the piston rises to the top, leaving the hammer gap full open. The makers recommend an air pressure of 80 lbs. or more per square inch as being most economical; this, as compared with the often-used lower pressures of 40 lbs. or so, permits of full advantage being taken of the quick lift of the hammer under full air pressure and larger range of strength of hammer strokes, which, as said, are worked with the air under expansion. As to the operating costs of such hammers, as compared with steam hammers, there can be no two opinions, and it is not surprising to learn that most of our leading shipyards and foundries are constantly adding pneumatic hammers of the Pilkington types to their equipments. From figures published recording the details of comparative tests of compressed-air N.S.K. hammers and steam hammers, it is shown that whereas the air hammer fed by an electrically-driven air compressor at 85 lbs. maximum pressure, *i.e.*, 58 lbs. per square inch, average striking pressure cost 2·58 pence per 1,000 full-weight blows, the steam hammer with coal at 10s. per ton cost 6·23 pence per 1,000 blows. In face of these results, which have been substantiated by very extensive practice under ordinary working conditions, it is only to be expected that quite a feature of this firm's present business is the conversion of existing steam hammers for pneumatic operation.

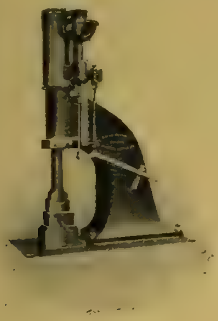


FIG. 1.

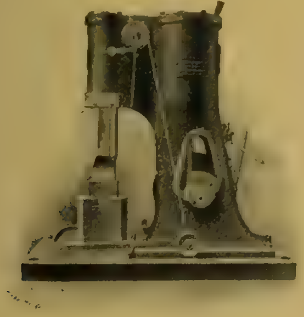


FIG. 2.

The second illustration shows the self-contained pneumatic hammer, in which the compressor cylinder and the hammer cylinder are placed side by side. In this case the hammer is simply belt-driven, or it may be arranged with an electric motor mounted on the top of the compressor cylinder for direct electric driving as an entirely independent unit. The principles of operation and control of these hammers are identical with those of the N.S.K. hammer described above. The hammers are built in a variety of sizes and types. The sizes range up to 50 cwt., and there are special high-speed and planishing and flue-welding types listed.

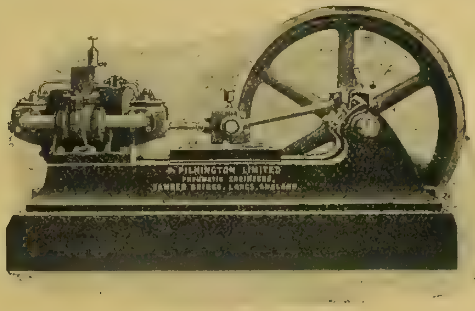


FIG. 3.

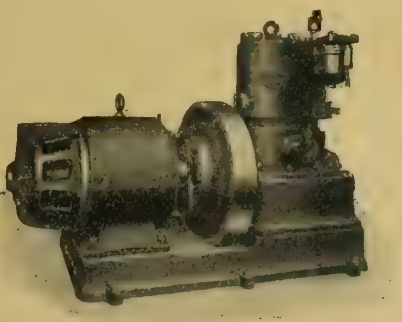


FIG. 4.

Other machines exhibited by Messrs. Pilkington include air compressors. Fig. 3 shows the single-stage, double-acting compressor, suitable for working up to pressures of 120 lbs. per square inch. The valves are of the "poppet" type, and both valve-chests and cylinder are water-jacketed; they are standardised in sizes of from 50 cubic

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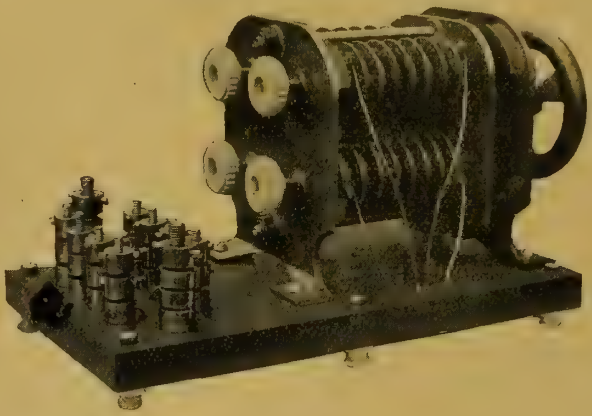

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304

feet to 250 cubic feet per minute. A direct-coupled electric motor air compressor is shown in fig. 4. These machines are listed in sizes of from 75 cubic feet to 700 cubic feet of free air per minute; the powers required for these sizes on maximum load, delivery pressure 120 lbs. per square inch, being 18 H.P. and 160 H.P., respectively.

The Dexine Patent Packing and Rubber Co. Ltd., Stratford, London, E., show a representative exhibit of the very many forms in which the ubiquitous "Dexine" is prepared for engineers' service. There are few engineers who are not now familiar with the claims of this rubber preparation, but it needs an exhibit of this character to reveal the hundred-and-one devices which are now standard manufactures of the company, and which have been called into being at the demand of clients. Dexine is a material which lends itself to preparation in a perfectly homogeneous form, in degrees of hardness or consistency varying from thin elastic sheeting and rings to pump buckets of more solid texture, and to valve bodies of almost metallic structure. An important feature of the company's business is that of promptitude in filling orders; any sheet packings or rings cut exactly to size or template are dispatched when required on the same day as order received. The well-known conical gauge-glass rings, of which it is said the Dexine Company are the largest makers, are stocked in a full range of sizes to meet all requirements. Turning to pump buckets, the company show interesting examples of these which have been in actual service for years in the Manchester district under very adverse conditions; the present preserved state of these buckets is evidence as to their great durability.

The Warin patent pump plunger, known as the N.P. type, is shown, and receives marked attention. This is probably the only pump plunger in which the side pressure or tightness of the bucket is really proportional to the load on the pump, and from figures of tests published it shows remarkable economies over the earlier forms of simple ram and bucket. Perforations in the discs of the ram transmit the fluid pressure directly to the interior of the Dexine channel section rings; thus the rings are not only forced outwards to make the tightest joint between ram and cylinder wall, but the rings are pressed out longitudinally to fill the piston grooves. Speaking generally of the Dexine products, it would seem that the increasing vogue of this material depends upon the ability of the manufacturers to produce the required grades of the material with certainty of uniformity, and the specimens shown demonstrate the high-water mark which has been reached in this respect.

Messrs. Royles, Limited, Irlam, Manchester.—According to a booklet issued this firm lays itself out to "catch units of heat." The exhibits include a number of heat-absorbing and yielding devices. Notable amongst these are the evaporators, condensers, feed-water heaters, calorifiers, etc., employing the "Row" tube, the well-known indented tube which, by reason of the systematic folding of its walls, yields about double the efficiency of a plain tube as a heat absorber. The form of the tube incidentally makes it of the expansive type, and thus it can be safely used between fixed end plates for variable temperature working. The company lists a remarkable number of appliances, which depend essentially upon this form of tube for their efficiency, these include steam kettles, air heaters, radiators, boiling batteries, hot-blast apparatus, etc.

Another class of exhibit includes Messrs. Royles' water-softening and purifying plants and a miscellaneous assortment of steam valves, cocks, water traps, separators, and water strainers.

Mr. G. T. Rook, 19, Bridge Street, Manchester.—As a specialist in all that appertains to grind stones and grinding, Mr. Rook shows a range of grindstones of various textures, some mounted in troughs and others loose. This is one of those exhibits about which very little can be written of the specimens actually shown, but which at the same time introduces a subject of ever-increasing importance to engineers, and yet withal not extensively understood. The exhibitor has supplied grindstones for almost every industry in which grinding is resorted to, and is avowedly at the exhibition to give enquirers the benefit of his experience. This is a matter which cannot be taken up at this writing owing to limitations of space. The illustration shows a general view of the stand, which is well set out, and in the specimens shown exhibits as far as is practicable the extremely wide range of stone qualities necessitated by present-day grinding requirements.

Grindstone Exhibit. G. T. Rook, Manchester.

The Patent File and Tool Company, Limited, 8, White Street, Moorfields, London exhibit samples of labour saving appliances as substitutes for files for all purposes.

"Dreadnought" files are to all intents and purposes hand-milling and planing tools, made from a high-quality Sheffield tool steel. The teeth are semi-circular in shape and cut especially deep, and have a drawing or shearing cut after the manner of a milling cutter. The action is scientifically correct, and entirely different from that of an ordinary file. The "Dreadnought" milling file cuts everything, including iron, steel, brass, copper, tin, lead, babbitt metals, aluminium, horn, wood, marble, etc., leaving an absoultely smooth and finished surface. The "Dreadnought" has an enormous cutting power and an extremely long life, and, owing to the shape of its teeth, it will not clog or choke up. The "Dreadnought" can be re-sharpened several times at a nominal cost, and the company has working at their stand one of their patent re-sharpening machines, showing that a blunt file can be made equal to new at a very small cost.

For the general trade they are showing the "Dreadnought" milling files in a large variety of shapes and sizes, and the makers not only claim their very great superiority over the ordinary files, but interested parties have an opportunity of testing this claim by seeing the "Dreadnought" at work on a Herbert's file-testing machine on all classes of metal.

Railway and tramway engineers will be interested in the "Dreadnought" rail planers, which can be seen at work under actual conditions, demonstrating their advantages over the methods generally employed.

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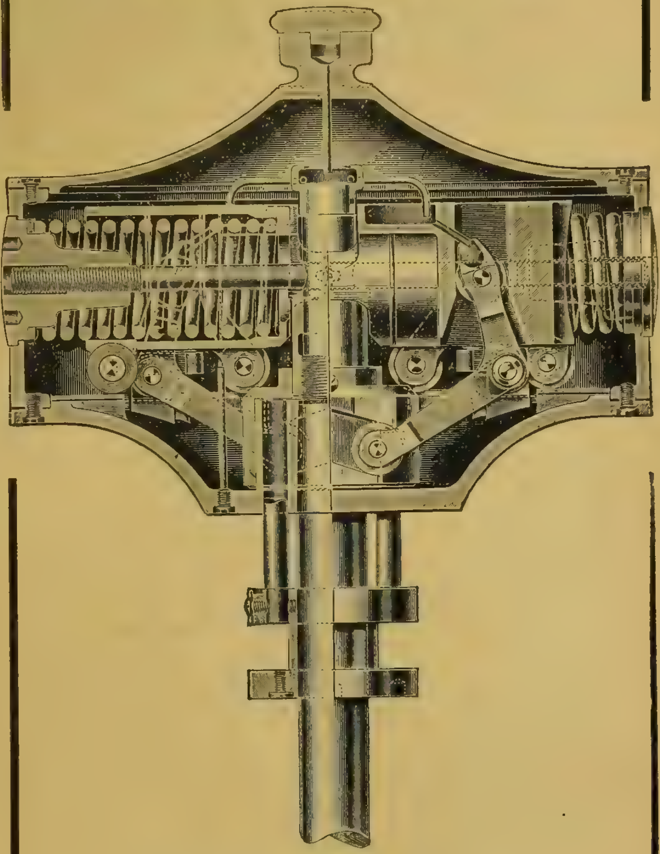

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65, WEST REGENT STREET, GLASGOW. TELEGRAMS: 1450, Argyle.

SEE STAND Nos. 57 & 58, ENGINEERING EXHIBITION, MANCHESTER.

Messrs. Clarke, Chapman, and Co. Ltd,, Gateshead-on-Tyne.—The prominent feature of this company's exhibit is a scale model of the "Woodeson" patent water-tube boiler, which, judging by the lengthy list of plants installed, has definitely established itself in this select and special branch of engineering. The general features of the boiler are shown clearly in the illustrations herewith. Without, at this writing, giving full details of its construction, it is of service to indicate the broad principles of design embodied, and to outline the major claims of its makers. These are—all tubes are straight, no screw joints, easy inspection and cleaning, maximum steam generation, and minimum tube deposit. It will be seen that the boiler consists of distinct sections, each made up of a top steam drum, connected by straight tubes to a bottom water drum; the steam drums and the water drums are respectively joined up by a series of cross tubes, as shown. A further large steam dome or drum is arranged above the steam drums to ensure an ample yield of dry steam. The arrangement of doors into the combustion chamber and of sight holes and man holes is such as to afford the maximum ease of inspection and mainten-

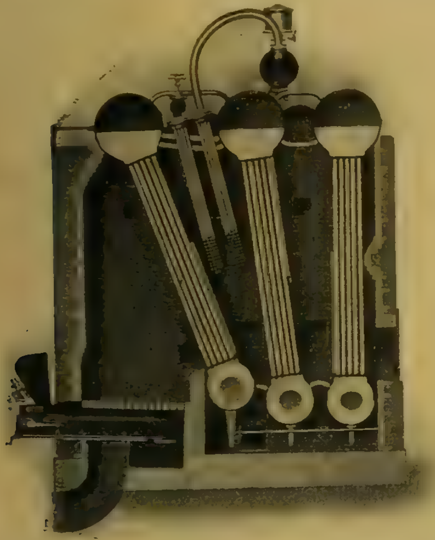
Fig. 1.—Clarke-Chapman Boiler, Superheater, and Underfeed Stoker.

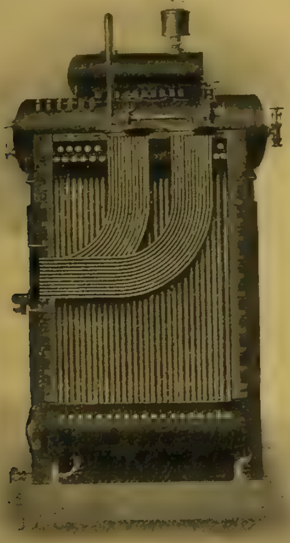
Fig. 2.—Front Section of Clarke-Chapman Boiler, showing Superheater.

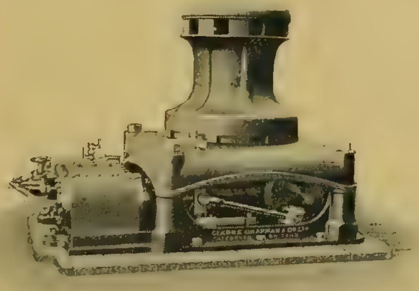
Fig. 3.—Clarke-Chapman Steam Warping Capstan.

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THE ART OF GRINDING DEPENDS UPON THE PROPER SELECTION OF STONE FOR EACH PURPOSE. . . .
A Specialist who understands this thoroughly is G. T. ROOK, 19, BRIDGE STREET, MANCHESTER,
who makes Grindstones of every class and size, and ships them to all parts of the World.
Contractor to H.M. Government, War Office, India Office, etc., etc.
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SNOWDRIFT LUBRICATORS
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Manchester Office: WALSH & DICK, 7, Pall Mall.
Telegrams: "Snowdrift, Manchester." Telephone: City, 4952.

ance. The boilers are arranged with furnaces to suit any class of fuel, and for fitting with any type of automatic stoker or forced draught. The illustrations show the boiler as fitted with the "Woodeson" superheater. A notable installation of particular interest to visitors to the Exhibition as being in the neighbourhood is the set of three boilers now under erection at the Bury Electricity Works. These boilers are of the "marine" type, having iron casings; each is capable of producing 25,000 lbs. of steam an hour at 200 lbs. per square inch pressure. Manchester is the home of boiler insurance and inspection, and many engineers practically engaged in this branch of work are taking the greatest interest in this exhibit.

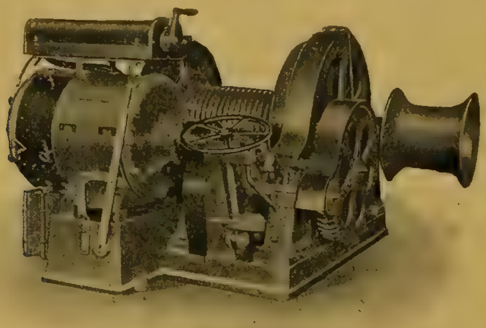

Fig. 4.—Clarke-Chapman 10-ton Two-speed Electric Winch.

For a long time Messrs. Clarke, Chapman and Co. Ltd. have been the makers of an all-steel seamless boat, mainly used for ships' boats, and with the recent boom in motor boats this form of vessel has gone ahead very rapidly. There is a wide sphere of usefulness for craft of this kind, particularly for tropical rivers and shallow water service; the boats are not only perfectly insect and rot proof, but they are able to resist damage from snags, groundings, etc., better than any wooden structure could.

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As contractors to the Admiralty and leading shipyards, Clarke, Chapman and Co. probably turn out more power-driven capstans and winches than any other firm in this country. The many large photographs shown of installations of this type indicate the extensive range covered by the many designs. Notable amongst these is an electric capstan, in which no part of the gear is below ground, the whole operating mechanism, including the motor and gearing, being assembled within the capstan head. A new form of winch gear is shown, in which, by an ingenious arrangement of the ropes, one winch serves to raise cargo from the ship's hold and deposit it 50 ft. over the ship's side; one simple winch does the raising and transfer, with a corresponding great economy of labour. There are many other most interesting applications shown, but space prevents the publication of details in this issue.

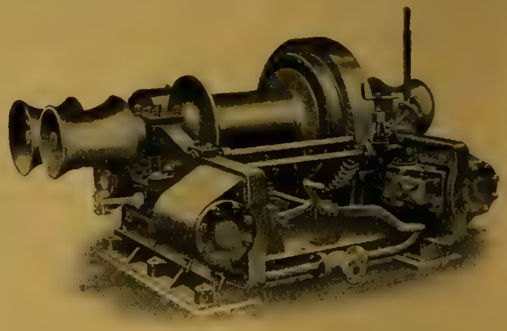


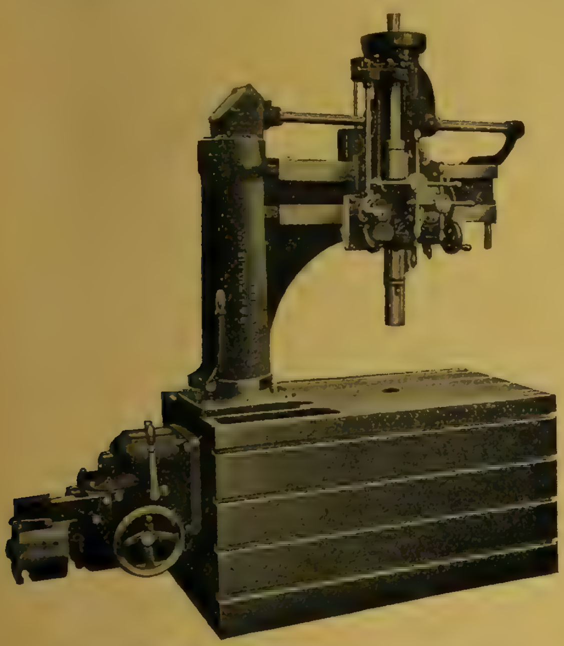
Fig. 5.—Clarke-Chapman Standard Steam Winch.

Messrs. F. G. Wrigley and Co. Ltd., Soho, Birmingham.—Claiming to be probably the first firm to take up as a speciality the manufacture of high-speed twist drills, this company to-day holds an exceptionally strong position amongst makers of drills, milling cutters, and high-class spur-reduction gearing. The exhibit includes a number of drilling machines, showing examples of twist drills engaged in the fastest and hardest work, demonstrating the remarkable perfection of hardening which has been attained in manufacture. The particular drill brought into prominence is the "S.B." type, the special boiler drill, which is advanced for boiler work, bridge making, and general structural steel work.

Gear cutters and worm hobs are another special branch of the company's work. As manufacturers of gearing they themselves use an immense number of these cutters, and their practice in this respect ensures the efficacy of the cutters put forward. E. G. Wrigley and Co. hold a large and varied stock of cutters in both high-speed and ordinary carbon steels.

Messrs. D. and J. Tullis Limited, Clydebank, N.B.—This company exhibits noteworthy examples of high-speed drilling and tapping machines. The illustration herewith shows the No. 1 type, which is a 3 ft. 6 in. radial machine embodying all the latest improvements. A distinctive feature is the admirable arrangement of the controlling handles, giving the maximum of convenience and consequent time-saving to the operator. The general points of this tool are as follows:—

The foundation is in the form of a cast-iron box bed, 2 ft. 6 in. by 2 ft. 6 in., with top and front sides surfaced and having T slots cut out of the solid. Special provisions are made to catch the lubricant. The standard, as will be seen, is a cylindrical casting of goodly proportions, carrying the box-section arm, which rides on a ball bearing. Ample provisions are made for secure locking and quick release, and the parts are proportioned to withstand any tendency to twisting strains. The saddle travels on a narrow guide, and is adjustable for wear by means of a taper strip. The spindle runs in a long sleeve, carrying the rack, which gives it a range of 15 in., the thrust of drilling being taken up in a ball bearing. A reversing motion is provided by which the spindle may be instantaneously stopped, started, or reversed. The drive is at constant speed on single pulley, speed changes being made entirely by gears, which are provided for giving eight changes of speed. These gears are machine cut and run in oil. An important adjunct is the automatic release fitted to the feed motion, which ensures the correct drilling of holes to any required depth. Altogether this tool represents the high-water mark of design, and from the exhibit there is nothing lacking in respect of its workmanlike construction. Other examples of vertical drilling machines are shown, including radial and non-radial types; their design and construction agree generally with the machine illustrated and designed here.


Tullis High-speed Radial Drilling and Tapping Machine.

Messrs. T. Davies and Son, West Gorton, Manchester, have at their stand examples of their foundry ladles, one of 12 tons capacity and one of 20 cwt., both worm geared. Also a small foundry cupola, arranged to tilt, suitable for emergency and breakdown work. There are also to be seen on their stand interesting models of the "Osborn" patent cupola spark arrester, as applied to one and two foundry cupolas; and a showcase of twist drills, files, and steel castings.

The Osborn patent spark arresters may be fitted to one or more cupolas grouped together. They are efficient, simple in design, there is nothing to get out of order, and they are easily fitted to new or existing cupolas. All sparks and grit pass over the arch and down the unworked cupola when grouped together, and into a suitable downtake tube to the charging platform when fitted to one cupola only, the gases escaping through outlet at the top of the arch. No water cooling is required, nor frequent cleaning, as in other spark arresters.

Where a double spark arrester is applied to two cupolas, the cupola which is not working may be repaired by the fixing of a damper across the cupola at the charge hole.

The spark arresters are built up of steel plates in sections, and bolted together on site. After erection the arrester is lined with firebrick.

Messrs. Webb, Peet and Co., Westgate Ironworks, Gloucester, exhibit examples of their friction clutch, aeroplane propellers, and of their portable hand-shapers, slotters, keyway cutters, vices, forges, drills, grinders, and shears.

The portable shaper is a very handy little tool, the baseplate is provided with a transverse rib on its underside for gripping in vice, and also with lugs for bolting to bench. A V is formed on the top for holding shafts up to 1½ in. diameter. Traverse in order that cuts can be taken at various angles, can be swivelled by slackening the two nuts which secure it to baseplate, this being graduated. It can also be moved forward, so that the ram overhangs the table. Deep work can then be clamped to the front of the table, and operated upon. Very deep work, such as facing the end of a column, can be effected by bolting the machine on to it. The traverse can be detached, and bolted direct to the work, such as for facing strips on castings, etc., or it can be clamped by means of the V on its underside, and the plates and bolts supplied, to shafts up to 3 in. diameter for keyway cutting.

The slide can be traversed either by handwheel, or automatically by means of a starwheel and pawl. The direction is regulated by a quarter turn of the latch plate on the ram, the mid-position being neutral, and a half turn of the drop handle on side of ram alters the speed. The ram head is graduated and fitted with swivelling tool box which has hand down feed. The tool holder, which also swivels, is brought back by a steel spring at the end of each stroke. Two tapped holes are provided on the top of ram to determine position of stroke. A hand lever is pivoted to the slide by the agency of a link, and has three holes for setscrew, which attaches it to ram. By this means the desired leverage and length of stroke are attained. The vice is fitted with hardened steel jaws, one of which swivels. Together with the nut, these are detachable from the base, which, when full depth is required, can be removed, and the remaining parts of the vice secured to the table by means of corresponding T slots provided for the purpose. The operating screws are of steel and square threaded. The slides are accurately machined and handscraped to a fit.

Messrs. Tangyes Limited, Birmingham, show on their stand one Tangye "T" type gas engine, "J T E" size, 35 B.H.P., for electric lighting, which represents their latest design in gas-engine construction, embodying all that is best in British and Continental practice. It is the outcome of long experience and careful selection as to what is necessary to form an engine of the highest standard, whether in regard to simplicity, economy of fuel, efficiency of working, or great strength in the build of the engine. These engines, which work on the well-known 2 to 1 cycle, are governed on the variable-admission system, through a "Tangye Patent" variable-admission operating gear, which varies the quantity but not the quality of the gaseous mixture admitted to the cylinder.

There is thus an impulse at every cycle of the engine, even when running absolutely without load.

Forced sight-feed lubrication is fitted for oiling cylinder, liner, and piston, and continuous ring lubrication to the three main crankshaft bearings, lubrication of the crank pin taking place through an accelerating ring which delivers the oil to the bearing by centrifugal action. The crosshead pin is separately oiled by means of a wiper. A lip is cast round the bed to catch any waste oil. The crankshaft is balanced, and this, combined with the fly-

OSRAM·LAMPS

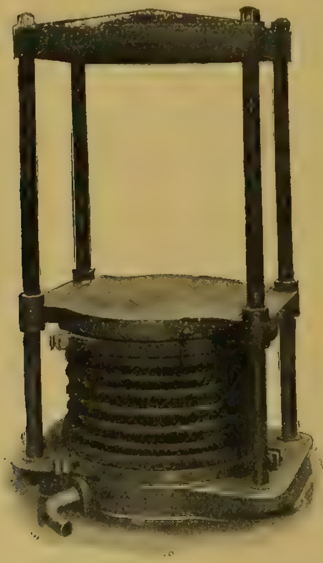
wheel effect, the system of governing, and great length of the engine bed, gives great steadiness in running, and reduce any tendency to vibration not attained in an engine of the ordinary construction, and governing on the "hit-and-miss" system.

These engines are built either right or left hand, as may be most suitable for the particular position where the engine has to be fixed. They are also built as coupled engines, a right and left-hand engine being placed side by side, with a suitable crankshaft carrying the flywheel between the two engines.

Single-cylinder engines are listed up to 216 B.H.P., and coupled engines up to 432 B.H.P.

The engine is served by one of Tangye's well-known "Suction" gas producers, "D" size, and is driving a dynamo and woodworking machinery exhibited by Messrs. W. B. Haigh and Co. on the adjoining stand.

Messrs. The Pistonless Hydraulic Press Co. Ltd. 3, Cross Lane, London, E.C., exhibit one of their patent pistonless hydraulic presses. This pistonless press, which is shown in the illustration, is an ideal press for light work of from 3 to 80 tons, because it overcomes the limitations of the screw press with its manual labour and constant adjustment of the screw while work is being done, and it eliminates the disadvantages of the ram press, as there is no ram, and consequently no cylinder nor cup leathers.



Pistonless Press.

This press also gives absolutely constant uniform pressure, which follows the work up as it is being pressed, and the pressure can also be maintained for any length of time, as there is no leakage. Another advantage is that owing to the elasticity of the collapsible cylinder the pressure can be brought gently upon the work, which is a great advantage in certain classes of work.

The unique feature is the construction of the armoured collapsible cylinder, which is said to be altogether reliable, and tested to double the working pressure. Water (or air) at low pressure is admitted into the cylinder, the top of which moves in guides and forms the platen of the press; the platen moves upwards, carrying the work with it in the usual way and pressing it against the head. This press is an efficient method of obtaining pressure for light work of from 3 to 80 tons.

Mr. J. F. Coates, 64, Mosley Street, Manchester, shows examples of his two-stroke "Ajax" marine and "Ruth" land motors. The motor is of extremely simple construction, having only three working parts to each cylinder, viz., piston, connecting rod, and crankshaft, and there are no valves exposed to the extreme temperature of the burning gases. The exhaust is scavenged with pure air under pressure, which effectually sweeps out the burnt gases before the new charge of explosive mixture enters.

The control is by a throttle operating on both the explosive mixture and scavenging air. This, with the advance spark lever, enables the speed to be controlled within wide limits. The lubricating oil is fed under pressure through sight feeds direct to all bearings, the amount to each being regulated by needle valves.

The exhaust gases are cooled and condensed in the silencer by a copious jet of water, and are then discharged under the surface. The exhaust is thus rendered practically noiseless and entirely unobjectionable.

The exhaust silencer is arranged to connect to the motor and outboard fitting by means of two universal joints, which dispense with the bending of pipes, etc.

Messrs. Cunliffe and Croom Ltd., Manchester, show one of their full universal milling machines, capacity 18½ in. by 5½ in. by 14½ in., self-acting in all its traverses, fitted with improved universal dividing heads, telescopic elevating screw, and all the latest improvements. This machine is shown fitted with a vertical milling and rack-cutting attachment, and represents the smallest full universal machine made by the company.

The plain, back-geared self-acting milling machine shown by this firm has a capacity of 21 in. by 6½ in. by 16½ in. It has a self-acting transverse traverse with auto trip, hand across, and vertical feeds, fitted with telescopic elevating screw and all latest improvements.

The all-gear full universal milling machine, capacity 30 in. by 7½ in. by 20 in., is self-acting in all its traverses. This machine is shown fitted with a vertical milling and rack cutting attachment and other accessories, and is driven by a constant-speed pulley and friction clutch. This machine is of an entirely new type; it is the largest full universal milling machine made by the firm, and embodies the latest practice in high-speed milling machine construction.

Other machines exhibited are an 8-in. stroke self-acting shaping machine, box-body pattern, with arrangement for adjusting the stroke whilst the machine is in motion; an improved standard pattern 20-in. swing upright single-speed drilling machine, self-acting feed, with auto-trip motion, hand feed by worm and wheel, also sensitive feed by lever; a self-contained counter-driving apparatus; and a 14-in. disc surface grinding machine for accurately finishing by grinding the surfaces of forgings, cast iron and brass, complete with all accessories.

Messrs. Alfred Herbert, Limited, Coventry, show on their stand a selection of five of their well-known machine tools. Four out of these five machines are exhibited in actual operation, viz., a hexagon turret lathe, fitted with ball-bearing pulley for driving the all-geared head; a capstan lathe with new type of eight-speed single-pulley head; a four-spindle ball-bearing drill, a machine in which every running bearing is composed of single track journal ball bearings, which require lubrication once a year only; and a single-pulley plain horizontal mill; also a vertical mill with all-geared drive—not shown under belt. Some details of these machines will be given in a future issue of *The Practical Engineer.*

Messrs. The Morton Gas Syndicate Ltd., Hyde, near Manchester, have a patent suction type gas plant for using common coal, supplying a gas engine, 42 maximum brake horse power on producer or 55 maximum brake horse power on town's gas. The generator is of the down-draught type, and is actuated by induced air and steam. These plants are made to work directly off the gas engine for power only, the gas being made in the generator by air and steam induced or drawn through it by the out or suction stroke of the gas engine; or, a power-driven gas exhauster replaces the gas engine, and the gas from the exhauster is discharged into a gas-holder, from where it is distributed.

type. The boiler is of the locomotive type, and is worked at a pressure of 175 lbs. per square inch, and has a total heating surface of 317·27 square feet, with a grate area of 6·38 square feet. The engine can be driven from either end of the carriage, so that in whichever direction it is travelling the driver is always at the front. Three tanks for carrying water are attached to the engine truck, and one is fitted under the carriage body, the total capacity being 455 gallons, and the coal capacity of the bunkers in the engine compartment is 16 cwts. The weight of the carriage when the tanks and boiler are full is 43 tons 8 cwts., of which weight 27 tons 8 cwts. are carried by the engine truck, and 16 tons on the carriage truck. The wheel base of the engine truck is 8 ft. 6 in., and the carriage truck 8 ft., the total wheel base being 46 ft.

RIVER FRONTAGE.

[PHOTO. BY FRANK AND SONS, SOUTH SHIELDS.

The carriage is fitted with the automatic vacuum brake and hand brake, and is lighted throughout by electricity.

THE PRODUCTION OF SOUND WAVES.

The following article refers to improved construction of apparatus for producing sound waves in air, water, or other medium, the principal object being to produce a more uniform directional distribution of vibration and to provide apparatus in which the operative parts can be completely enclosed, so that the same can be used under water.

In the illustrations, fig. 1 shows an arrangement for exciting a cylinder by means of six wound poles or pole pairs. Fig. 2 shows in elevation, and fig. 3 as a section of the line 3/3 of fig. 2, another construction in which the vibratory body expands and contracts around its whole periphery. Fig. 4 is a diagram illustrating the kind of effect set up by the form shown in figs. 2 and 3. Figs. 5 and 6 represent in part sectional elevation and plan, respectively, an arrangement in which the nodes are caused to travel around the body by means of rotating magnets. Fig. 7 is a part sectional elevation, and fig. 8 a sectional plan of a modified form in which three pole pairs are employed. Fig. 9 illustrates a modification of a vibratory body with a stiffening rib to give rigidity without great extra weight.

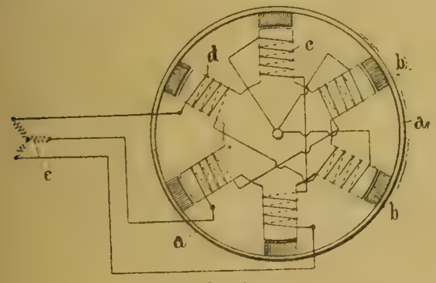


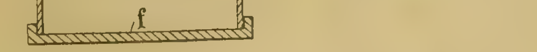
Fig. 1.

A hollow vibratory body *a*, fig. 1, in the form of a figure of revolution, namely, a cylinder, has mounted thereon a number of laminated armatures *b*, in this case six. For co-operation with these armatures poles *c* are provided wound with windings *d* connected in star connection to an alternating-current generator *e*.

An arrangement of this kind sets up elliptic vibrations with four nodes, but at the same time causes the nodes to rotate round the cylinder with a frequency twice that of the alternating current. The effect of this rotation of the nodes is to cause the sound waves to be radiated equally in all directions in the vibrational plane.

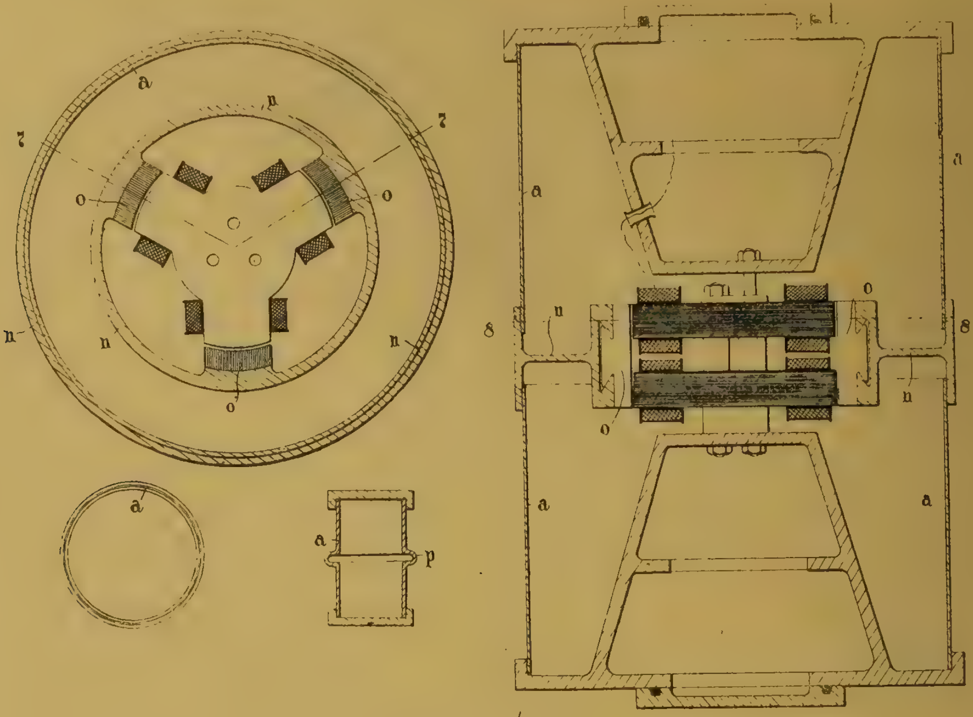
It will be understood that in the form such as that illustrated above either single poles *c* may be employed or pole pairs, in which latter case it is convenient to arrange them one below the other in the vertical plane.

Referring now to figs. 2 to 4, the vibratory body is again taken as a cylinder *a* of elastic magnetic material, and in this form is screwed into end caps *f*; the vibrator consists of a coil *h* wound in a recess in the laminated ring *g*. Alternating or pulsating currents applied to this coil will vibrate the cylinder in the manner shown in fig. 4; that is to say, will contract its diameter evenly and then release it, producing a change in the cross sectional area of the enclosed space. This mode of vibration is especially useful in connection with high frequencies, such as a frequency of 1,000 to 2,000 per second.

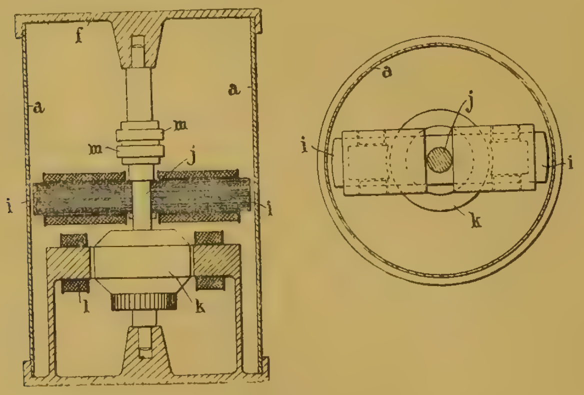


Figs. 2 and 3.

The form illustrated in figs. 5 and 6 is a form more especially suited to low frequency work. In this case a cylinder is chosen by way of example as the vibratory body. The vibrator consists of a pair of magnets *i* mounted on a spindle *j*, which is rotated by the rotor *k* of a motor, the stator of which is represented at *l*. An arrangement with two poles of this kind will produce four nodes which will travel around the vibratory body, but any convenient number of poles may be employed according to the number of travelling nodes desired. Alternating current can be carried to the coils of the magnets *i* by means of slip rings *m*. For best effects the speed of rotation should be sufficiently high to prevent beats being heard as the nodes travel.



Figs. 4, 7, 8, and 9.



Figs. 5 and 6.

The construction illustrated in figs. 7 and 8 includes a cylindrical vibrating body *a*, to which girder pieces *n* are attached to carry laminated armatures *o*. This form is shown as having three pole pairs and may conveniently be wound with windings for three-phase current. A convenient structure is included, to which the poles can be bolted, or other convenient structures may be employed as desired.

A further construction, in which a modified cylinder is employed, is shown in fig. 9, in which the cylinder *a* has an expanded part *p* situate at the part near which the armatures are placed for the purpose of strengthening the cylinder without adding great weight.

The improvements above described are due to Messrs. Evershed and Vignolles and Mr. H. Pearce.

OPENING OF NEW MECHANICAL LABORATORY, DARLINGTON TECHNICAL COLLEGE.

The opening of the new mechanical laboratory and the annual distribution of prizes took place on the 20th October before a crowded gathering. The opening of the new laboratory was performed by the Hon. C. A. Parsons, who also distributed the prizes, and before the latter ceremony delivered an address on the "Place of Mechanical Laboratories in Engineering Teaching."

In the early part of last century engineering, said Mr. Parsons, was principally guided by traditional rule and trade knowledge, handed down from father to son, and from master to apprentice. In recent times, when engineering had gradually assumed a more important place, its field of operations had become wider and more complex, and it had become imperative to institute, instead of the old and primitive methods, systematic technical training of the young. There was probably no field of work in modern times where so great an amount of well-ordered experimental investigation had been undertaken as in engineering. Advance in engineering was necessarily slow and tentative, and the great general course of advance was one of gradual evolution. Regarding the advantages of technical and engineering schools and workshops, knowledge, more especially of the practical side, was a kind that must be acquired when a man was receptive, and at such an age when ideas and impressions then acquired became so ingrained as to constitute intuitive and guiding principles in after-life. The students were brought face to face with materials and machinery for dealing with them and for discovering their characteristics. In such a surrounding he gradually acquired a familiarity with practical engineering, and the power, so to speak, to think with engineering materials, and to form a mental picture when he tried to design a new or improve an old machine, or design new methods of work. By the help of good technical training there was no doubt that a very much larger proportion of men of high standard were produced than would be the case without it—men of knowledge, capable of taking the lead, capable of commanding, and who would deal fairly with their subordinates.

THE MANUFACTURE OF ROLLED "H" BEAMS*.

(Continued from page 564.)

J. L. Seaman, Patent No. 400495 (1889), describes a single reversing universal mill having a pair of horizontal rolls and a pair of vertical rolls with their axes all lying in one vertical plane, the two horizontal rolls being unlike each other but individually symmetrical, whilst the two vertical rolls are both alike but individually unsymmetrical, figs. 4 and 5. Thus, as in the Sack mill, the positions of the flange edges are changed relatively to the gaps between the rolls by tilting the bar half round after each pass, and thereby rolling down in one pass the surplus metal extruded between the gaps in the rolls in the previous pass. Or he proposes to attain the same result, without tilting, by using a three high universal mill having rolls of exactly similar construction to those described above, and with the top and bottom rolls alike and the centre roll different, fig. 6.

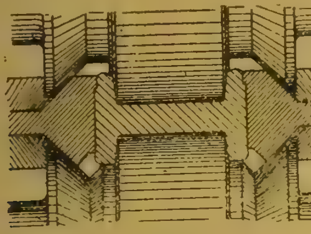


Fig. 4.—Two-high Rolls, Open.

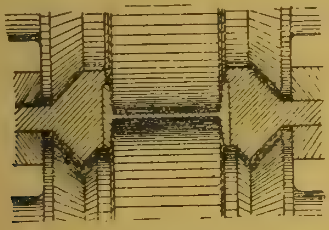


Fig. 5.—Two-high Rolls, Closed.

In this mill the bar is developed with straight flanges lying in a plane at right angles to the web, so that no subsequent straightening is required, and the bar may be finished in the one mill only.

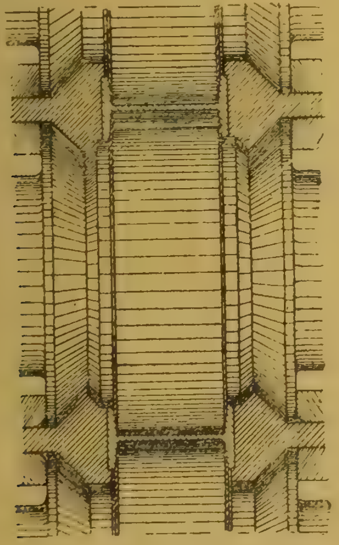


Fig. 6.—Three-high Rolls.

J. Kennedy and H. Aiken, Patent No. 410107 (1889), describe a series of mills comprising three different types, each having a function distinct from that of the others.

The first is a reversing, roughing, universal mill, having adjustable horizontal and vertical rolls, with their axes all lying in one vertical plane, fig. 7. In this it is proposed to reduce the ingot or bloom into approximately the finished form of beam required by passing it several times backwards and forwards through the rolls, and adjusting the latter together after each pass. When the bar emerges finally from the mill the sides and edges of the flanges are still rough, and it has consequently to undergo a further operation in the next mill.

The second mill, fig. 8, is a non-reversing universal mill having non-adjustable horizontal and vertical rolls, with their axes all lying in one vertical plane and intended to reduce the sides of the flanges only. It is proposed to pass the bar through these once, and in order to secure effective co-operation between these and the subsequent rolls and to prevent the formation of fins, it is proposed to roll slight depressions in the centre of each flange which the next operation will obliterate.

The third mill is a non-reversing two high mill having non-adjustable horizontal rolls only, intended only to reduce the edges of the flanges, fig. 9. It is proposed to pass the bar through them once to bring it to its finished form and to shape the edges, whereby the slight depressions formed along the centres of the flanges in the previous mill will be exactly filled in this operation, and no fins will be left on the finished bar.

L. D. York, Patent No. 410724 (1889), covers a single reversing universal mill having a pair of horizontal rolls and a pair of vertical rolls with their axes all lying in one vertical plane, the horizontal rolls being both alike and symmetrical, and the two vertical rolls similarly both alike and symmetrical, fig. 10. It does not transpire how the formation of fins is avoided, but some supplemental means would be required, as gaps must necessarily occur between the rolls until they have been adjusted to their ultimate positions prior to the final pass, and fins would inevitably be formed on the edges of the flanges of the bar.

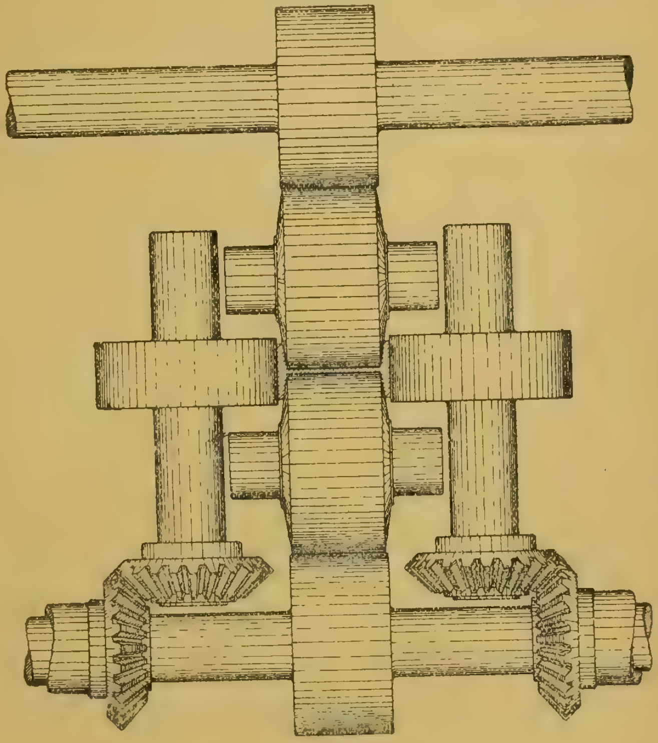


Fig. 7.—First Mill.

E. M. Butz, Patent No. 499651 (1893), describes a series of non-reversing universal mills, each having a pair of vertical rolls being similarly alike and symmetrical, fig. 11. The rolls are non-adjustable, having the fixed pass, and the bloom is reduced by passing it once only through each set of rolls, the pass of which is narrower in each set than in the preceding set, until in the last set of rolls the pass has the exact contour of the finished beam. Thus, as many mills must be used as number of passes necessary to reduce a bloom into a finished beam, each mill having its rolls shaped according to the reduction required to be given in each pass.

The rolls being fixed and the adjacent surfaces of the horizontal and vertical rolls being suitably shaped so that they are almost in contact with each other it is probable that no very pronounced fins will be formed on the bar; but as it is not practicable entirely to close the gaps between the rolls, particularly as during rolling considerable deflection takes place and the pass somewhat opens out, it is certain that at least beads, if not fins, would be formed on the corners of the bar flanges.

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* Paper read by Mr. G. E. Moore at the Iron and Steel Institute.

Consequently, to obviate this, Butz proposes to use supplementary means to roll down the corners of the beam flanges adjacent to the gaps between the rolls. These consist of two small idle rollers, one on each side of the beam as it emerges from the main rolls, as shown dotted on the sketch, fig. 11, and so adjusted that at each successive rolling operation the pass between the main rolls would be only just filled up at those corners, and there would not be sufficient metal to flow into the gaps and form fins. It appears, however, as if this arrangement would necessitate some means of supporting the flanges, as otherwise they would become bent, and consequently the corners would not be rolled down in the manner intended.

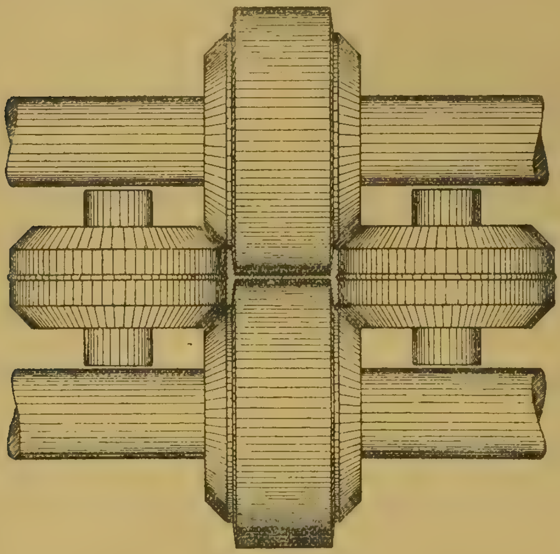


Fig. 8.—Second Mill.

H. Gray, Patent No. 587958 (1897), describes a reversing universal mill having a pair of horizontal rolls and a pair of vertical rolls with their axes all lying in one vertical plane, the two horizontal rolls being alike and symmetrical, and the two vertical rolls being similarly alike and symmetrical, fig. 12. This mill works in combination with a second mill having a pair of symmetrical horizontal rolls only. The first mill has rolls for shaping the web and sides of the flanges of the beam, but not the edges of the flanges, and the second mill has rolls for shaping the edges of the flanges only.

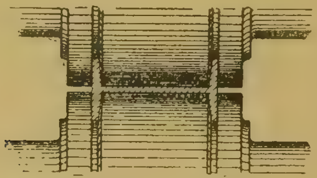


Fig. 9.—Third Mill.

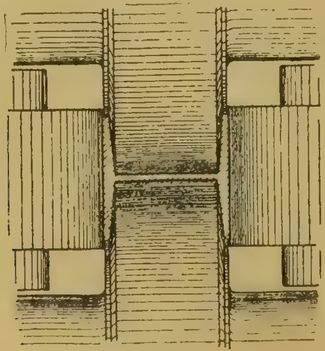


Fig. 10.

The two mills are situated as close together as possible, and have their driving and adjusting mechanisms connected together so that the bar passes through both sets of rolls as nearly simultaneously as possible with such an arrangement. Thus on one portion of the bar the flanges are being shaped on their edges, whilst a short distance farther on the sides of the flanges and the web are being formed, and the resulting beam is free from fins and presents a good appearance.

The foregoing systems of rolling beams devised by different inventors have been chosen as typical and to illustrate the means which experience teaches or ingenuity suggests might be adopted to overcome the chief difficulties which were mentioned at the beginning of this paper, each pointing out the direction in which the endeavours of the inventor were brought to bear, and each possessing features which, although involving complications as compared with the ideally simple plant represented by a pair of horizontal grooved rolls, yet to be considered, for the time being at least, as having their justification in the better quality of the product obtainable thereby, or in the ease, cheapness, or speed of production.

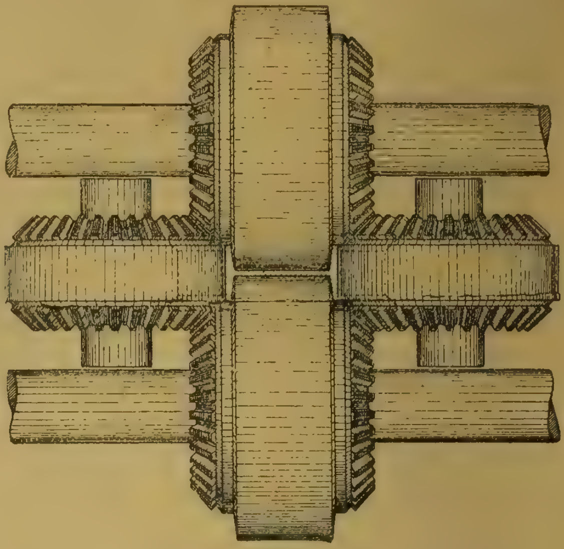


Fig. 11.

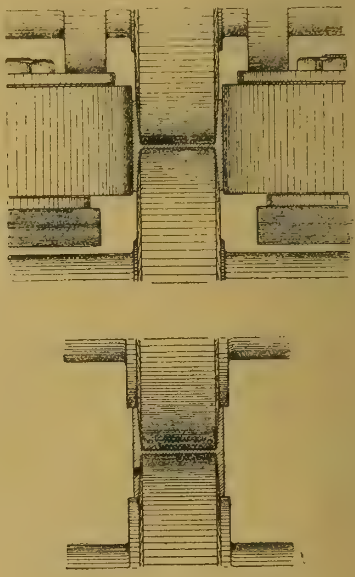


Fig. 12.

(To be continued.)

Lubrication for Dry Hydraulic System.—The following lubricant, which lubricates the rams and valves and prevents packing from becoming hard, is given by our American contemporary the *American Machinist.* Secure a clean, empty barrel. Into the empty barel place 5 lbs. sal soda (the addition of 5 or 10 gallons of hot water will readily dissolve the soda), then fill the barrel half full of water, agitating same, so that the soda and water will be thoroughly mixed and dissolved. When done, and not before, add three gallons of mineral lard oil. This mixture will turn white, resembling milk; then fill balance of barrel with water, mix well, and the solution is ready for charging the hydraulic system.

LAUNCHES AND TRIAL TRIPS.

Ascanius.—On the 29th October Messrs. Workman, Clark, and Co. Ltd., of Belfast, launched from their North Yard the new steamer Ascanius, which is the second of three vessels being built and engined by them for the well-known Blue Funnel Line, owned by Messrs. Alfred Holt and Co., Liverpool. The Ascanius is 509 ft. in length, with a gross tonnage of about 10,050, and complies with the requirements of the British Board of Trade for a first-class passenger certificate. The cargo space is divided into six spacious holds, free of obstruction and capable of receiving the largest type of consignments. One of these holds, together with the after 'tween decks, has been carefully insulated and prepared for the carriage of frozen meat, fruit, and dairy produce. For the preservation of this cargo and the steward's perishable stores an extensive plant of refrigerating machinery on the carbonic anhydride system has been arranged. For the speedy loading and discharging of the vessel two and three steam winches with the necessary derricks are provided at each of the hatchways which have been made extra large. The propelling machinery includes two sets of carefully balanced triple-expansion engines, with all the latest improvements in auxiliaries, and three large double-ended steel multitubular boilers working under forced draught. The vessel is fitted with an installation of wireless telegraphy.

Star of India.—The new steel twin-screw steamer Star of India, the latest addition to the Star Line fleet of steamers owned by Messrs. J. P. Corry and Co., of Lodon, left Belfast Harbour on the 29th October, and proceeded down the lough for adjustment of compasses, after which she underwent her speed trials over the measured mile course. The results attained were highly satisfactory, and the vessel subsequently left for Barry to take in coal, and will then proceed to London to load cargo preparatory to leaving on her initial voyage to Australia. The Star of India is 486 ft. in length, with a gross tonnage of 7,316, and has been built under Lloyd's special survey for the highest class in their Registry; also fulfilling the requirements of the Board of Trade for a first-class cargo steamer. She has been specially designed and equipped for the conveyance of frozen meat, fruit, and other products from the Australian and New Zealand colonies. Three of the five holds into which the cargo space is divided have been carefully insulated and fitted up for carrying cargoes of chilled and frozen meat. For the preservation of this cargo during the voyage a large refrigerating plant has been installed. Each of the holds is furnished with a large hatchway worked by deck machinery and cargo gear of the most up-to-date character capable of dealing with a full cargo in the most expeditious manner. The propelling machinery consists of two sets of improved triple-expansion engines, complete with all the necessary auxiliaries, steam being supplied by four single-ended steel multitubular boilers working under an approved system of forced draught.

Cramond Island.—Messrs. Mackie and Thomson Ltd., Govan, launched on October 17th the steam trawler Cramond Island, which they have built for the Leith Steam Fishing Co. Ltd., Granton. The vessel is 112 ft. in length, 21 ft. 10 in. in breadth, 12 ft. 4 in. in moulded depth, and of about 200 tons gross. She will be fitted by Mr. W. V. V. Lidgerwood, Coatbridge, with triple-expansion surface condensing engines of 450 I.H.P., having cylinders 12 in., 20 in., and 33 in. diameter respectively, and a stroke of 23 in., capable of giving a speed of 10 knots, and supplied with steam by boilers designed for a working pressure of 180 lbs.

Roturia.—Many merchants interested in the Australian and New Zealand passenger traffic visited the Royal Albert Dock on October 19th to inspect the new steamer Roturia, built for the New Zealand Shipping Co., which later left for Plymouth to embark her first company of passengers for Australasia. The vessel, the second of her class, is driven by a pair of twin-screw reciprocating engines and a low-pressure turbine. She is expected to maintain an average speed of 16 knots.

NAVAL NOTES.

Von der Tann.—An official communiqué has been issued in Berlin pointing out that the armoured cruiser Von der Tann on her latest trials achieved a speed of 27·4 knots. This figure was obtained as the average speed of six tests on a six knots measured course at Neukrug, where the depth of water is about 65 metres. The official records, however, show that the absolutely highest speed reached was 28·124 knots. The engines developed 80,000 H.P. It may therefore be calculated that in water over 100 metres deep, with her engines working at full pressure, the cruiser has a speed of 28 knots. The speed of the British cruisers of the same class as the Von der Tann is: The Invincible, 26·65 knots; the Indomitable, 26·1; the Inflexible, 26·5 knots. It can therefore rightly be said that the Von der Tann possesses a higher speed and greater engine power than any other armoured cruiser, and therefore greater than any other ship in the world.

New Destroyers.—The tenders for the construction of the three destroyers remaining to be ordered of this year's programme are now, according to the *Glasgow Herald*, under consideration at the Admiralty. The competition for the work promises to be much more interesting than usual, as there is great variety in the propelling machinery proposals. The tenders for the armoured ships were due to be in on November 1st.

TRADE CATALOGUES.

We have received from **Mr. Percy Pitman,** 3, Willcott Road, Acton, London, W., a publication describing and illustrating his impulse water wheels, which are now being extensively used, and are suitable for any fall of water from 25 ft. to 2,500 ft.

We have received from **Mr. W. F. L. Beth,** 39, Victoria Street, Westminster, S.W., copies of their circulars on dust removal and dust collection for coal-screening plants, and on dust removal and dust collection by "Beth" filters and "Beth" fans.

We have received from **Messrs. B. R. Rowland and Co. Ltd.,** Climax Works, Reddish, near Manchester, a copy of their illustrated catalogue of emery and corundum grinding wheels and machines. The publication, which runs into 120 pages, profusely illustrates the numerous specialities made by the company, and contains, besides descriptions of the various machines and wheels, much useful information relating to the manufacture, selection, and uses of grinding wheels. Special attention may be directed to the "Vitrite" brand of vitrified wheels now being manufactured by Messrs. Rowland, which type of grinding wheels can be advantageously used for nearly all general purposes. The vitrified bond consists of a mixture of the abrasive with vitreous clays and other alkaline materials suitably proportioned. This mixture is shaped in moulds and burned in a kiln in much the same manner as pottery, and by suitably varying the proportions of the various materials employed and certain modifications in the process of manufacture a very large range of wheels from the hardest to the softest can be obtained. All those interested in the use of grinding wheels and grinding and polishing machines should secure a copy of this catalogue.

We have received from **Messrs. The A.E.G. Electric Co. Ltd.,** of 133-135, Oxford Street, London, W., a card illustrating their flame arc lamps. The company are specialists in arc lighting.

We have received from **Messrs. John Davis and Son Ltd.,** Derby, and 8, Friday Street, London, E.C., a copy of their new catalogue of mathematical drawing instruments, slide rules, and drawing office materials.

We have received from **Messrs. The St. Helens Cable and Rubber Co. Ltd.,** of Warrington, a copy of their interim price list of rubber wires and cables. The other specialities of the company comprise cotton-covered wire, ebonite, C.T. sheathed trailing cable, insulating gloves, insulating matting, motor inner tubes, and rubber tyres.

Messrs. David Bridge and Co. Ltd., Castleton, Manchester, and 35 Queen Victoria Street, London, E.C., have favoured us with a copy of a publication, entitled "Souvenir of the Rubber Section of the Brussels Exhibition, 1910." The work is copiously illustrated, and nicely printed, runs to 83 pages, and contains "Modern Rubber Machinery," by Mr. Robert Bridge, managing director. This is practically a most interesting treatise on the subject dealing with the use of rubber on the estate and forest, and showing the latest and most approved processes of tapping, collecting, transporting, and coagulating rubber latex. The washing, crêpeing, sheeting, drying, blocking, etc., of rubbers o fall kinds are also dealt with, and additional notes are given for estates with mixed crops, on the drying of cacao, coprah, coffee, ground nuts, etc., by the Hamel-Smith rotary dryer. The various types of machinery used for the above made by Messrs. Bridge are illustrated and described, also the numerous hand tools and accessories used. The book will be found of great value to all those interested in the manufactures indicated. We have also received from Messrs. Bridge copies of the following: "Modern Rubber Machinery for Both Plantation and Wild Rubber," arranged by Mr. Robert Bridge; "The Da Costa Process for Rubber Coagulation in Bulk"; and circulars descriptive of the Da Costa patent "rapid" rubber latex coagulator, and of Bridge's improved rubber plantation machinery.

TRADE NOTES.

The Corporation of Ashton-under-Lyne have accepted the tender of **Triumph Stoker Ltd.** for stokers and coal elevator for the electricity works.

Tugs, Dredge, and Crane.—H.M. Embassy at Constantinople report that the "Société Anonyme Ottomane de Navigation Fluviale et d'Irrigation du Soussourlou," a company formed for the purpose of exploiting the resources of the Soussourlou River (Vilayet of Hudavendighiar), is now offering its shares to public subscription. The authorised capital of the company is £T110,000 (£99,000), but it is intended at present to carry out works at a cost of £T22,000 only. The following purchases, among others, are to be made: One tug boat of 50 H.P., £T2,600 (£2,340); one tug boat of 20 H.P., £T1,200 (£1,080); one dredge, £T3,000 (£2,700); one steam crane, £T1,000 (£900).—*Board of Trade Journal.*

Orders for Cruisers.—It is understood that the Admiralty have placed five cruisers of the "Yarmouth" type—one each with Messrs. Brown Ltd., Clydebank; Messrs. Beardmore and Co., Dalmuir; the London and Glasgow Engineering Co., Govan; Messrs. Cammell, Laird, and Co., Birkenhead; and Messrs. Vickers, Sons, and Maxim, Barrow. The cruisers will be fitted with Parsons turbines, except that to be built by Messrs. Brown Ltd., Clydebank, who will instal the Curtis turbine. The latter has proved very successful in the cruiser Bristol, which ran 27 knots on a recent trial.

Water Turbines.—We hear that **Messrs. Jens Orten-Boving and Co.** have lately received orders for water turbine plants including four turbines of 1,500 H.P. under 20 ft. head, complete with governors, for the Trenton Power Co., Canada, and two turbines of 4,500 H.P. under 75 ft. head for the Chicoutimi Pulp Co., Canada.

Shaping Machines for Italian Railways.—**Messrs. The Selson Engineering Co. Ltd.** have received an order from the Italian State Railways for 31 of their high-speed shaping machines. The order for these machines, which are constructed at the company's Coventry works, was secured in competition with 25 other makers, European and American. The Railway have already three of these machines.

Gas Lighting of Workshops.—**Messrs. James Keith and Blackburn Co. Ltd.** have recently fitted some important installations of gas lighting on their system in industrial works in and around Glasgow. One of them, comprising about 112,000 candle power is in the erecting and the wheel and machine shops of the Caledonian Railway Co. at St. Rollox, and another is in an erecting shop recently added to the works of Messrs. Watson, Laidlaw, and Co. In these installations rotary compressors are arranged to give 54 in. water column pressure; and inverted lamps are used ranging in candle power from 60 c.p. to 1,500 c.p. per single burner. By means of a pre-heating device for the gas and air mixture, as it enters the burner, an efficiency of 60 candle power per cubic foot of gas is obtained.

Railway Material.—The *Diario Oficial* contains particulars of a contract entered into between the Mexican Public Works Department and the "Compania Ferrocarriles Nacionales de Mexico," by which the latter is granted a 99 years' concession for the construction and working of a railway in the State of Michoacán, from Pénjamo to Zacapú with the option of extending the line southwards as far as Ajuno or Ario. Work must be begun within six months, and the line completed as far as Zacapu in 4½ years. Five years are allowed for the importation of constructional materials free of duty, in accordance with the usual Mexican procedure in the case of new railways. The same journal contains a decree granting, in favour of the Ministry of Communications and Public Works, a credit of 500,000 milreis (about £37,000) to meet expenses in connection with the construction of the Itacurussa branch of the Central Railway of Brazil ("Estrada de Ferro Centrl do Brazil"). Another decree sanctions, in favour of the same Ministry, a credit of 1,000,000 milreis (about £73,000) for expenses in connection with extensions and new works on the Western Railway of Minas ("Estrada de Ferro Oeste de Minas"). The *Canada Gazette* publishes a notice to the effect that application will be made to the Parliament of Canada at its next session for an Act incorporating a company, under the name of the Niagara, Welland, and Lake Erie Railway Co., with power to construct and work a line of railway from the City of Niagara Falls, New York State, to points on Lake Erie between Fort Erie and Port Dover, to generate electrical energy, etc.

Order for Wheels and Axles.—According to the *Railway Times*, an order has just been placed with the **British Griffin Chilled Iron and Steel Co.** by the Cordoba Central Railway and the Cordoba and Rosario Railway for wheels and axles. The order consists of 2,444 pairs of 30-in. double-plate chilled wheels and axles.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2282. **Safety Valve Design.**—Will any reader give the main points to take into consideration in safety valve design? How is the area of the valve determined? Also outline the design of a spiral spring type valve for a 6 ft. Lancashire boiler, 150 lbs. pressure.—K. T.

2286. **Conical Steel Tubes.**—Could any reader inform me where I could obtain conical-shaped steel pipes as follows: Inside from 6 in. to 14 in. diameter, $\frac{3}{8}$ in. thick, with flanges 12 in. and 18 in. diameter; length of pipe, flange to flange, 12 in.?—A Reader of your Paper.

2287. **Balance Ring Slide Valves.**—I should be glad if some reader would explain the nature, object, and applications of balance ring slide valves; what are the advantages and disadvantages of same, and how far are they used?—M. T.

2288. **Ornamental Hammer Work.**—Information is wanted as to the best sort of material to use when making ornamental scrolls, names, letterings, etc, for what is called ornamental hammer work—that is, the best substance or composition to hammer upon.—Perth.

MISCELLANEA.

To Find the Weight of Bar Iron.—The diameter in quarter inches squared and divided by six equals the approximate weight, in pounds per foot, of a bar of iron.

Brazilian Destroyers.—The Brazilian destroyer Sergipe has now left Messrs. Yarrow's yard at Glasgow to start on her voyage to Brazil. The Parana left recently. These two vessels are the last of the 10 destroyers ordered by the Brazilian Government from Messrs. Yarrow, and their departure marks the completion of an important and efficient addition to the Brazilian fleet.

A paper on the effect of time on the testing of steel was read at a meeting of the Physical Society on the 28th October. In the discussion one of the speakers showed that the phenomena connected with the breakdown of steel yet require much more investigation. Especially is it required that all the recent extensive researches should be grouped together in book form by some expert on the subject, if only for the sake of reference.

A "Wireless" Feat.—According to a Glasgow telegram a wireless telegraphy feat, understood to be the first of the kind, was accomplished by the new steamer Drumcraig, which has just left the Clyde for the River Plate. The vessel while lying in Glasgow harbour picked up by wireless the homeward bound Anchor liner Caledonia 700 miles west of Malin Head. This is stated to be the first instance of wireless messages being exchanged between an inland port and a vessel 850 miles at sea.

The Matter and Forces of Nature.—The author of a brochure upon this subject published by Messrs. Dunot et Pinat, Paris, gives us a new theory on primary causes based on a limited number of hypothetical assumptions, created in order to explain the phenomenon of gravitation; it applies both to the interpretation of the laws of electrical attraction and repulsion. The theory resolves itself to the following, viz.: That the principle of all forces resides in the pressure of the ether.

Novel Gas Plant in Russia.—The Power Gas Corporation Ltd. have just erected a gas plant near Moscow. The ceremony of starting the plant was very impressive. There was a blessing service over the producers and engine; the priests and choir from the church read prayers and sprinkled the engine and producers with holy water and blessed them, and erected an image of a guardian saint over the producers and another one over the engine. The managing director then officially started up the plant before hundreds of spectators, when everything passed off successfully.

PATENTEES' CHRONICLE
OF
Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

OCTOBER 24th, 1910.

24602 Toaster, etc. Griffiths.
24603 Tables. Betjemann.
24604 Door spindles. Smith.
24605 Necktie frame. Nicolle.
24606 Coke ovens. Jones.
24607 Nitrogen production. Cross.
24608 Polymerised glycerine production. Rintoul.
24609 Furnace.: Askew.
24610 Looms. Duerden.
24611 Electric device. Taylor.
24612 Vacuum cleaner. Coulter.
24613 Vacuum cleaner. Coulter.
24614 Door check. Money.
24615 Dust bins. Holt.
24616 Planing machine. Mason.
24617 Boiler. Tolhurst.
24618 Variable gear. Wooler.
24619 Brick manf. Lupson.
24620 Hat holder. Pryce.
24621 Printing device. Bagdatopulos.
24622 Coal, etc., conveyors. Barker.
24623 Crane, etc. Musker.
24624 Grease cup. Bolton.
24625 Window. Tierney.
24626 Propulsion of ships. Pinckney.
24627 Chairs. Brown.
24628 Mazes. Crowley.
24639 Syringes. Monfa.
24640 Advertisement displaying. Priestley.
24641 Winding machine. Petrie.
24642 Fan. Railing.
24643 Skirt waist adapter. Williams.
24644 Pen nibs. Sharp.
24645 Control of liquids. Binnie.
24636 *Brakes. Whitney.
24637 *Electric lamps.
24638 Dynamo brushes. Cooch.
24639 Talking machine record cleaner. Addis.
24640 *Cuspidor. Schweitzer.
24641 *Oxygen bath. Müller.
24642 Wrenches. Hein.
24643 Pipe guard. Buchholz.
24644 Railway coupling. Sadowski.
24645 Shutters. Jones.
24646 Carburetter. Johnston.
24647 Chamber utensils. Neitzert.
24648 *Cycle forks. Hathaway.
24649 Fastening device. Bizion.
24660 *Rotary dry pans. Penfield.
24651 Incubators. Wegerif.
24652 Manf. of 3·6 diaminoacridine. Ransford.
24653 Wheel. Riley.
24664 Cinematographs. Parker.
24655 Stamp, etc., affixing machine. Abbott.
24656 *Washing machine. Evenson.
24657 Cradles. Wynn.
24658 *Playing cards. Morrison.
24659 *Fishing reels. Howard.
24660 *Rotary dry pans. Penfield.
24661 *Vacuum gauge. Thomas.
24662 *Calender. Evans.
24663 Water closet. Begg.
24664 Cinematographers. Parker.
24665 Boot manf. Boult.
24666 Dust bins. Falkner.
24667 *Liquid purification. Richter.
24668 *Thermo-electric circuits. Darwin.
24669 *Valves. McLachlan.
24670 *Polishing mittens. Hollingshead.
24671 Cutlery manf. Koopman.
24672 *Tyre. Brown.
24673 Spindle machine. Higginson.
24674 Advertisement. Loevenich.
24675 *Cigarette mouthpiece. Benjaminowitsch.
24676 *Carpet beater. Baier.
24677 *Cash box. Pallweber.
24678 *Stable manger shutters. Scolati.
24679 Dressing case. Crutchfield.
24680 Dressing case. Crutchfield.
24681 Liquid measure. Arnold.
24682 Manf. of gallocyanines. Johnson.
24683 Torpedo nets. Bullivant.
24684 Gas producer. Fleischter.
24685 *Motor control. Pelterie.
24686 *Ignition machine. Bosch.
24687 *Ignition device. Bosch.
24688 *Ignition device. Bosch.
24689 *Gun firing.
24690 *Isolating alkali salts of leuco-indigo. Lucius.
24691 Washing apparatus. Redfern.
24692 Lighting device for trains. Leister.
24693 *Teeth cleaner. Misch.
24694 Umbrella holder. Raschka.
24695 *Printing blocks. Bunan-Varilla.
24696 *Electric apparatus. Schiessler.
24697 Aeronautical machine. Hughes.
24698 *Sad irons. Archer.
24699 Chairs. Parsons.
24700 Extracting heat from gun barrels, etc. Brown.
24701 Door locks. Noonan.
24702 Percussion tool. Knight.
24703 Railway signalling. Wells.
24704 Air purification. Hanna.
24705 *Aeroplane. Tampier.
24706 *Padlocks. Marks.
24707 *Artificial silk. Morane.
24708 *Vacuum cleaner. Houlihan.
24709 *Piston pumps. Pratt.
24710 *Treatment of skins.. Stanley.
24711 Non-splash water taps. Parrott.
24712 *Cigar case. Schwieger.
24713 *Polishing device. Frank.
24714 *Measuring instrument.

OCTOBER 25th, 1910.

24715 Wire box cover holder. Balley.
24716 Pneumatic dispatch. tubes. Giles.
24717 Venetian blinds. Thomas.
24718 Toy. Gray.
24719 Calendars. Watts.
24720 Steam cooker. Reavley.
24721 Ladies' wearing apparel. Gaunt.
24722 Milling, etc., machine. Fox.
24723 Distributing oil. Thornton.
24724 Door. Cross.
24725 Cramps. Johnson.
24726 Ladders, etc. Salisbury.
24727 Wheels. Pass.
24728 *Glass house ventilation. Engelmann.
24729 Insulating machine. Brown.
24730 Electric lighting device. Summers.
24731 Cycle lamp. Hoorn.
24732 Draught preventer. Banco.
24733 Inflated inner sole. Hansell.
24734 Wind screen. Page.
24735 Miners' lamp. Ross.
24736 Collar studs. Logan.
24737 Lever box for railways. Wrightson.
24738 Tyre manf. Owens.
24739 Air excluder. Burman.
24740 Gramophones, etc. Sibley.
24741 Target. Kelso.
24742 Salt manf. Webster.
24743 Aerial propellers. Scott.
24744 Photo wrappers. Woolfe.
24745 Locks. Small.
24746 Motor car signals. Everton.
24747 Wheel bearings. Lever.
24748 Umbrella, etc., stand. Young.
24749 Pantographic apparatus. Sibley.
24750 Furnace. Smallwood.
24751 Gasifiers. Smallwood.
24752 Planks for pianos. Titley.
24753 Ships' recorder. Stalker.
24754 *Gas generator. Cross.
24755 *Hood joint. Weller.
24756 Marine turbine drain system. Surtees.
24757 *Lubricating device. Demolder.
24758 Coal cutters. Paterson.
24759 *Lead seal. Heidemeyer.
24760 Brake. Clarke.
24761 Carriage door lock. Clarke.
24762 Signalling device for pit cages. Butler.
24763 Tyre bands. Barnett.
24764 Tyres. Barnett.
24765 *Tube cleaner. Gibson.
24766 *Firearms. Thurler.
24767 *Roller blinds. Meyden.
24768 Safes. Pallweber.
24769 Ships' course indicator. Rickcord.
24770 Music leaf tabs. Lendon.
24771 *Construction of scaffolding. Naylor.
24772 *Exhaust silencer. Bishop.
24773 Light protector. Maximoff.
24774 Illustrated signs. Potterton.
24775 Pedestals. Robinson.
24776 Mortice gear wheels. Barker.
24777 Furnace. Middleton.
24778 Resilient wheels. Beaven.
24779 *Projecting coloured pictures. Oliver.
27780 *Wool cleaner. Milson.
24781 Kettle. Hall.
24782 Boots, etc. Boult.
24783 Boot manf. Boult.
24784 *Balloon sheds. Boult.
24785 *Hospital furniture. Down.
24786 Manf. of isoprene, etc. Perkin.
24787 Manf. of isoprene, etc. Perkin.
24788 Manf. of isoprene, etc. Perkin.
24789 Manf. of methylene ketones. Perkins.
24790 Coutchouc manf. Matthews.
24791 Treatment of acid. Hale.
24792 *Gas, etc., engine. Woodworth.
24793 *Treating coffee beans. Klein.
24794 *Internal-combustion engine. Woodworth.
24795 *Flying machine. Ruth.
24796 *Paper, etc., cutter. Salcedo.
24797 Airships. Elieson.
24798 Ball throwing, etc., device. Mat.
24799 Internal-combustion engine. Fowler.
24800 Water chutes. Melliss.
24801 Ash tray. Sawers.
24802 Game. Rickman.
24803 Gramophones. Parr.
24804 Musical instrument. Parr.
24805 *Game. Maunders.
24806 *Fastening for ladies' clothing. Creutz.
24807 Spinning, etc., frames. Mackie.
24808 *Electrically-operated mechanism. Thompson.
24809 Advertising apparatus. Bishop.
24810 Electric lamp manf. Knight.
24811 Cinematographs. Middleton.
24812 *Centrifugal pump.
24813 *Calculating machine. Biane.,
24814 *Telescopes. Beyer.
24815 Producing theatrical sounds. Moorhouse.
24816 *Razor stropper. Hayden.
24817 *Treating carbides of barium, etc. Bollo.
24818 *Electric lamp support. Nèple.
24819 Treatment of ores. Cassel.
24820 *Indigo manf. Lucius.
24821 Fabric treatment. Lisboa.
24822 Cinematographs. Middleton.
24823 Boats. Reynolds.
23834 Typewriters. Sharp.
24825 Separation of nickel and cobalt. Sefton-Jones.
24826 Steam engine valves. Abbott.

OCTOBER 26th, 1910.

24827 Holder for crochet balls. Jones.
24828 Braces. Brain.
24829 Tobacco plug cutter. Banks.
24830 Feeding bottles. Redington.
24831 Game. Jameson.
24832 Driving belts. Rothwell.
24833 Electric starting switch. Wright.
24834 Studs, etc. Bywater.
24835 Golf clubs. Simpson.
24836 Siphonic apparatus. Killon.
24837 Collapsible box. Baker.
24838 Door lock. Thomason.
24839 Croquet mallet. Tickell.
24840 Scribing blocks, etc. Cronkshaw.
24841 Dyeing apparatus. Shaw.
24842 Balloon construction. Smith.
24843 Aeroplane. Pickergill.
24844 Motor cycle side car. Tomson.
24845 Boring machine. Morgan.
24846 Puzzle box. Taylor.
24847 Ammonia production. Lane.
24848 *Hair puffer. Strange.
24849 Picture hanging device. Marshall.

24850 Portable urinals. Lish.
24851 *Electrical commutators. Société “ Phi.”
24852 Gun sights. Eastwick.
24853 Furnace, etc., construction. Armstrong.
24854 Stair treads. Powley.
24855 Chimney pots. Aklroyd.
24856 Postal envelopes. Vittery.
24857 *Pole protectors. Konopinski
24858 Single arm rheostat. Bailey.
24859 Walking stick stool. Alsop.
24860 Sound reproducer. Bleakley.
24861 Capstan handle holder. Merrett.
24862 Burning factory waste. Gibbins.
24863 Valves. Robert.
24864 Valve gear. Robertson.
24865 *Production of alkaloids. Heinrici.
24866 Internal-combustion engine. Stone.
24867 Inkstand. Sayers.
24868 Draught prevention. Stephens.
24869 Electric furnace. Soloman.
24870 Knobs. Harrison.
24871 *Indigo manf. Cartier.
24872 *Ortho-nitro-benzaldehyde manf. Cartier.
24873 Alloys. Duke.
24874 Pipe filler. Stevens.
24875 Motor cars. King.
24876 Boot sewing machine. Ward.
24877 Boot sewing machine. Ward.
24878 Boot sewing machine. Ward.
24879 Coke ovens. Jones.
24880 *Vaccum cleaner. Clifton.
24881 *Power transmission. Lake.
24882 *Aeroplanes. Piestrak.
24883 Dye manf. Johnson.
24884 Preparation of coffee, etc. Roessler.
24885 Oxydising gases. Phillips.
24886 *Dye manf. Lucius.
24887 Typewriter. Cooper.
24888 Typewriter. Cooper.
24889 *Hat bands. Clark.
24890 *Moistening textile goods. Venter.
24891 *Tooth brush. Trayne.
24892 Sandwich board. Andrews.
24893 “ Tear-off ” blocks. Hymans.
24894 Bag locks. Hymans.
24895 Memo tablets. Hymans.
24896 Brick manf. Thorougood.
24897 Illuminated sign. Butler.
24898 Boots, etc. Payne.
24899 Ladies' pith hats. Dorrien.
24900 Feeding bottles. Miller.
24901 Potato digger. Blackstone.
24902 *Signalling device. Mumford.
24903 Gas fires. Davis.
24904 Gas fires. Davis.
24905 *Filter carbon. Richter.
24906 *Bolt. Wagner.
24907 *Document sorter. Frost.
24908 *Aeroplane signalling. Bourdelles.
24909 *Lamp protector. Widner.
24910 Stoves. Cayless.
24911 *Electric contact. Houskeeper.
24912 Pump governor. Westinghouse Brake Co.

OCTOBER 27th, 1910.

24913 Envelopes. Maggs.
24914 Sound instruments. Raymond.
24915 Pipe cleaner. Sobotka.
24916 Electric air condenser. Sobotka.
24917 Variable gear. Houlding.
24918 Artificial teeth. Round.
24919 Valve gear. Arnott.
24920 Valves. Shovelton.
24921 Furniture securing. Davis.
24922 Calcium carbide blocks. Hill.
24923 Cycle driving. West.
24924 Kilns. Schwarz.
24925 Warp beams. Hodgson.
24926 Silver cans. Noton.
24927 Sanitary towels. Bleazard.
24928 Tables. Malcolm.
24929 Fuel economiser. Horabin.
24930 Securing device. Stirling.
24931 Show room. Rankin.
24932 Wheels. Bill.
24933 Cycle locks. Hiles.
24934 Fireproof composition. Merryless.
24935 Governor. Huntington.
24936 *Scaffolding. Sistermann.
24937 Hat band. Niblock.
24938 Furnaces. Niblock.
24939 Casting apparatus. Merrick.
24940 Motor starter. Douglas.
24941 Pumps. Phillips.
24942 Bottle closing. Fingerhut.
24943 *Knife cleaner. Hodges.
24944 Fastening. Rotherham.
24945 Flying machine. Benton.
24946 *Floating bodies. Sayer.
24947 *Fixing bristles in stocks. Zielinski.
24948 *Gas governor. Grieve.
24949 Dynamometer. Harrison.
24950 Collars. Mathews.
24951 Calico printing. Sutcliffe.
24952 *Warp threads. Hirth.
24953 Internal-combustion engine. Langster.
24954 Brake. Wood.
24955 Boot heel plates. Craig.
24956 Motor car, etc., hoods. Aston.
24957 Billiard chalk. Barker.
24958 Buckets. Lester.
24959 Door, etc., fastening. Hallsworth.
24960 Tin opener. Ward.
24961 Garden syringe. Greaves.
24962 Puzzle. Ritchie.
24963 *Carding engine. Barnes.
24964 Clutch. Martin.
24965 Rubber restoring. O'Regan.
24966 Fire escape. Tomlins.
24967 Billiards scoring. Webb.
24968 *Ticket printing. Ohmer.
24969 Key chains. Gordon.
24970 Showcase. Sharp.
24971 Gas collecting device. Cassinet.
24972 Gear. Grice.
24973 *Gas lamp. Ehrich.
24974 Speed gear. Tardy.
24975 Resilient pad trimming. Gunton.
24976 Brakes. Holden.
24977 *Surgical apparatus. Krull.
24978 *Detonating pellets. Polster.
24979 Lacing studs. Shipley.
24980 Non-cellulose formates. Newton.
24981 Medicinal soap. Newton.
24982 Bating hides, etc. Becker.
24983 Postcard, etc., clip. Bliss.
24984 Sweetmeat. Green.
24985 Inclinometers. Rowley.
24986 Tyres. Prestwich.
24987 Spark arrester. Kasimir.
24988 Machine belting manf. Alkin.
24989 Wheels. Hubbard.
24990 Taximeters. Rogers.
24991 Air gas production. Egerton.
24992 *Water softener. Erith.
24993 *Vice. Vevnet.
24994 Electric switch. McLean.
24995 *Telephone system.
24996 Football game. Cooke.
24997 Tyres. Lacy.
24998 Cooking stoves. Rolph.
24999 Boot protectors. Carah.
25000 Heel tips. Carah.
25001 *Pipe joint. Hume.
25002 Cots. Holme.
25003 Dust collector. Catchpole.
25004 Boot manf. Bates.
25005 *Lock. Atkinson.
25006 *Fire extinguisher. Graaff.
25007 *Dye manf.
25008 *Electric coils. Bosch.
25009 *Supply pipe. Schroeder.
25010 *Internal-combustion engine. Diesel.
25011 Cement slabs. Vogt.
25012 *Conductors. Jones.
25013 Cinematographs. Brewer.
25014 *Telemeters. Beck.
25015 *Toy. Metall.
25016 *Change registering device. Thompson.
25017 *Spinning mill cans. Holmberg.
25018 Calculating machine. Robert.
25019 Paper manf. Hutchinson.
25020 Stretchers. Patten.
25021 *Shirt collars. Hood.
25022 *Shirt collars. Hood.
25023 *Construction of neckties, etc. Hood.
25024 Electric fan. Baker.
25025 Talking machine. Bishop.
25026 *Electrical machine. Société “ Phi.”
25027 Mirror frames. Williams.
25028 Bottle stoppers. Hurst.
25029 *Submarines.
25030 Treatment of ores. Schwabacher.
25031 *Metal casting. Weintraub.
25032 *Boronised conductors. Weintraub.
25033 *Chemical compounds. Weintraub.
25033 *Chemical compounds. Weintraub.
25034 *Corsets. McGrath.

OCTOBER 28th, 1910.

25035 Motor number plate. Everard.
25036 Dynamos. Fawcus.
25037 Corrugated tubes. Bolton.
25038 Acetylene gas generator. Guy.
25039 Knife. Heycock.
25040 Boots, etc. Rushton.
25041 Frost cogs, etc. Perks.
25042 Cocks. Cox.
25043 Ozonator. Oddey.
25044 Reflector. Hubbard.
25045 Casement window. Marshall.
25046 Scissors, etc. Rogers.
25047 Envelopes. Jameson.
25048 Street sweeper. Whittome.
25049 Combustion device for gases. Thorp.
25050 Compression valves. Routledge.
25051 Paper manf. Jackson.
25052 Cycles. Oldham.
25053 Rifle sight. Wallace.
25054 Shirt collars. Hill.
25055 Boxes. Andrewson.
25056 Winches. Holloway.
25057 Wheels. Tweedale.
25058 Renewal stud, etc. Doel.
25059 *Boiler. Binns.
25060 Spinning rollers. Loxam.
25061 Tooth powder. Dickinson.
25062 Desks. Chatham.
25063 Liquid fuel. Lewis.
25064 Aeroplanes. Chidell.
25065 Transformers. Miller.
25066 Air gas manf. Pace.
25067 Cycle forks. Readhead.
25068 *Fret saw frame. Jewson.
25069 Building wiring. Waterhouse.
25070 Clutch. Bouce.
25071 *Paper manf. Leuthans.
25972 *Spring mattress. Lagneau.
25073 Heel seat trimming. Ward.
25074 Animated pictures. Reece.
25075 Tyres. Hurban.
25076 Electric switch. Joyce.
25077 Pulling over machine. Bates.
25078 Head coverings. Lorrimer.
25079 Advertising device. Mathews.
25080 Pipe manf. Siegwart.
25081 *Milking machine. Lindstrom.
25082 Tyres. Currin.
25083 *Concrete structures. Huntington.
25084 Aeroplanes. Clare.
25085 Water pipe emptying. Kenyon.
25086 Gun sights. Dawson.
25087 *Rubber manf. Reynard.
25088 *Carburetter.
25089 *Furnace. Pfoser.
25090 Sluice opener. Dodd.
25091 Flour improving device. Tildesley.
25092 *Iron deposits. Langbein.
25093 Gas meter. Berry.
25094 *Pump. Praest.
25095 *Fertiliser mixers. Pickett.
25096 *Cash registers. Janik.
25097 *Cash registers. Janik.
25098 *Cash registers. Janik.
25099 Oxide of barium manf. Swan.
25100 Sodium, etc., manf. Swan.
25101 *Bottle closing. Jung.
25102 Tyres. Child.
25103 Valve. Morrison.
25104 Advertising device. Pridney.
25105 *Cigar holder. Schmolcke.
25106 *Steam generator. Wiart.
25107 Seed dressing. Edmund.
25108 *Utilising brewery waste. Dickson.
25109 Aeroplanes. Mellander.
25110 Car indicators. Agnew.
25111 Cycle forks. Bode.

OCTOBER 29th, 1910.

25112 Brake lever. Crocker.
25113 Match holder. Gillard.
25114 *Steel pen. John.
25115 Corn removing. Banthien.
25116 Brush envelope. Baker.
25117 Coupling. Marriage.
25118 Condensing plant. Morison.
25119 Pottery. Toft.
25120 Rubber matting. Hookham.
25121 Chatelaines. Fulton.
25122 Boring machine. White.
25123 Hand brakes. Williams.
25124 Carburetter. Cox.
25125 Boxing gloves. Fagan.
25126 Motor cars. Dod.
25127 Trousers stretchers. Wilson.
25128 Gas regulator. Corbett.
25129 Looms. McClarnon.
25130 Potato digger. Fleck.
25131 Clip fastening. Henderson.
25132 Hatpin protector. Boag.
25133 Brake. Foster.
25134 Bar lock. Grimshaw.
25135 Stationery. Jarvis.
25136 *Dipping rods. Edwards.
25137 Wheels. Cryer.
25138 Carburetter. Every.
25139 Two-speed gears. Slaughter.
25140 Jewellery pin. Murrle.
25141 Coal discharging wagon. Bennis.
25152 Cement manf. Lowry.
25143 Dynamometer. Clegg.
25144 Spinning machine. Heathcote.
25145 Water heater. Hocking.
25146 Brake. Robins.
25147 Dabbing brush. Thompson.
25148 *Coupling. Lee.
25149 *Inlaying device. Cohen.
25150 *Liquid distributing device. Leigh.
25151 Cycle saddle cover. Counter.
25152 Cycle pedals. Yoxall.
25153 Cycle pedals. Yoxall.
25154 Cycle pedals. Yoxall.
25155 Bearing. Grigg.
25156 Curtain suspenders. Wolff.
25157 *Automobiles. Fischer.
25158 Inkpots. Neumann.
25159 Camera stands. Biernath.
25160 *Lamps. Jones.
25161 Pontoons. Seddon.
25162 Nut blanks. Reynolds.
25163 Driving axle. West.
25164 Spectacle stake. Sanders.
25165 Broom handle. Milner.
25166 *Pipe joints. Tutton.
25167 *Dynamo. Krupp.
25168 Tyres. Smith.
25169 Luncheon case. Scott.
25170 Projectiles. Mordhorst.
25171 Rope drums. Rohberg.
25172 Governing mechanism. Glover.
25173 Tyres. Shelley.
25174 Map producer. Palmer.
25175 *Timber drying. Alcock.

25176 Boxes. Lubszynski.
25178 Gas meters. Fowler.
25178 Gas fittings. Richey.
25179 *Signalling device. Manny.
25180 *Sorting device. Zuczakow.
25181 *Emptying dustbins, etc. Klemone.
25182 Cranks. Liebenberg.
25183 *Anthraquinone derivatives manf. Ullmann.
25184 *Dye manf. Lucius.
25185 *Goods packing device. Archer.
25186 *Goods packing device. Archer.
25187 Manhole. Lamplough.
5188 Hoods for carriages. Hutchinson.
25189 *Sterilisation of victuals. Rutter.
25190 *Paper box. Cippico.
25191 *Paper fastener. Cousins.
25192 Tobacco pipe, etc. Fowler.
25193 Colliery haulage clip. Stokoe.
25194 Internal-combustion engine. McCulloch.
25195 *Concrete piles. Hume.
25196 *Textile machinery. Neelemans
25197 Hair drying. Otto.
25198 *Hose coupling. Roberts.
25199 *Bullets. Mauser.
25200 *Steam generator. Reichling.
25201 *Rubber manf. Reynaud.
25202 Mounting boards. Pattle.
25203 Speed indicator. Gilbert.
25204 *Talking machine. Haenel.
25205 *X-ray picture. Bauer.
25206 *Internal-combustion engine. Dawes.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to December [illegible]th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

10251 Rhodes: Chimney tops. [Post-dated September 22nd, 1909. Request under Section 19 of the Act not granted.] 14740 Neff and Brandes: Apparatus for treating feed water for steam boilers. [Request under Section 19 of the Act not granted.] 14925 Patterson: Automatic signalling system for railways. [Date applied for under International Convention, June 27th, 1908.] 14933 Bethell: Fire screen. [Post-dated November 10th, 1909.] 15040 Tabulo: Blocks or hoisting gear. 17642 Johnson (Badische Anilin and Soda Fabrik): Manf. of ammonia. 19315 Vickers, Sons, and Maxim Ltd., and Remington: Airships, with a view to preventing loss of weight resulting from consumption of fuel. 19318 Gledhill: Cash registers, indicators, and check tills. 19359 Patterson: Electric safety lamps for use in mines or other like places. [Cognate Application. 5818, 1910.] 19383 Wakefield: Automatic regulators for acetylene gas generators. 19395 Zohrab and Dunham-Massey: Treatment of peat. 19594 Littler, Brandt, and Heller: Bottle-filling and stoppering machines. 19467 Adamson: Collapsible wash tub bench. 19751 Barrow: Measuring spirit tap. [Post-dated December 13th, 1909.] 19778 Ripley: Valve mechanism for internal-combustion engines. 19946 Storey: Machines for shaping metal. 20035 Feld Bros. and Co., and Sobotka: Electrical connectors. [Post-dated February 28th, 1910.] 20299 Radmore: Covers for bowls. [Post-dated March 2nd, 1910.] 21490 Cooper: Speed alarms suitable for motor vehicles. [Post-dated March 16th, 1910.] 21555 Rees: Ejectors, condensers, and air pumps or compressors. [Cognate Application. 7828, 1910.] 21591 Curtis: Rubber boot for sheep for use in treatment of foot rot. 21650 Hartmann: Apparatus for adapting small arms for using miniature ammunition. 21686 Farmer: Traversing mechanism of warp and beam mills and all kinds of winding machinery as used in the textile trades. 21700 Hallett: Automatic poultry feeder. 21720 Bowley: Method of and means for repairing pneumatic tyres and the like. 21769 Simpson and Woods: Apparatus for measuring the flow of liquids in closed conduits. 21779 James: Method of realising in a furnace the full calorific value of any hard fuel. 21782 Day and Allen: Means for displaying advertisements by day and night. 21833 Huth: Bakers' improved peel head and peel holder. 21850 Walker: Linings for pits, shafts, and the like. [Cognate Application. 26820, 1909.] 21898 Winter: Machines for operating upon soles of boots and shoes. [Date applied for under International Convention, September 28th, 1908.] 21921 Shepherd: Vapour burners. 21946 Higel and Heintzman: Pneumatic actions for musical instruments. 21955 Parkinson: Steam engine slide valves. 21977 Winter: Machines for operating upon soles of boots and shoes. [Date applied for under International Convention, September 29th, 1908. Application for Patent of Addition to 21898, 1909.] 22021 Lund: Steering and controlling device for screw-propelled vessels including airships. 22026 Weiser, and British Mannesmann Tube Co.: Pilger rolling mills. 22050 Sutherland: Coin-freed gas meters of the wet type. 22064 Parkes, Peel, and Chapman: Lifting blocks and the like. 22072 Heitman: Apparatus for vibratory and electric treatment of the body. 22076 Fraser and Hamilton: Mechanism for retaining objects parallel to a constant plane while revolving. 22089 Belling: Pipes used for tobacco smoking and the like. 22092 Le Petit: Manf. of fermented liquids. 22093 Le Petit: Manf. of temperance beer. 22115 Dawson and Buckham: Elevating and loading gear for ordnance. 22156 Lee: Automatic carburetters for internal-combustion engines. 22177 Schwartz and Schwartz: Preparations for use in the making of table delicacies. 22218 Freymuth: Treatment of lac. 22253 Koenig: Ball joint for piping. 22294 Pogany: Tighting and loosening devices for girths. 22301 Boult (Tristram): Device for slinging horses or like animals. 22314 Cross: Oil engines. 22315 Cross: Oil engines. 22371 Lee: Carburetters for internal-combustion engines. 22374 Cowper-Coles: Electro-deposition of metals. 22403 Cloetens: Organs, harmoniums, and like musical instruments. 22416 Crompton: Road locomotives, tractors, and the like. 22421 Richards and Pringle: Carriers for use in apparatus for the distillation of coal or other carbonaceous material. 22455 Fielding: Production of dextrine, British gums, and the like. 22464 Vincent and White: Adding and listing machines. [Date applied for under International Convention, October 5th, 1908.] 22471 West: Discharging and charging machine for gas retorts. 22474 Warren, and Dental Manufacturing Co.: Manf. of dental plates. 22537 Fennelly: Inverted umbrella stand for domestic use and also for use in warehouses, showrooms, shops, and the like for storage or show purposes. 22543 Ogden: Tool for facilitating the removal and replacement of pneumatic tyre covers of wheel rims and the like. 22580 Webb: Telephones and sound-reproducing devices.

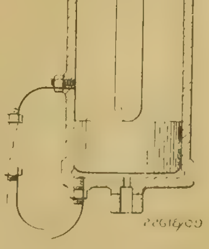
22611 Leitner: Systems of electric train lighting. [Cognate Application, 3435, 1910.]

This invention relates to systems of electric train lighting wherein several coaches or groups are lighted from a lesser number of equipments than there are coaches and wherein each equipment aids but does not interfere with any other equipment. The invention consists essentially in systems of electric train lighting of the kind wherein a practically uniform lamp voltage is obtained by means of a looped lamp connection, the use for effecting the looping of switches or the equivalent thereof in series with each other on the generator coaches and in parallel with each other on the dependent coaches.

22616 Potter and Tilbury: Bottle seals or closures. 22617 Headland and Headland: Electric fire alarms.

22618 Aiton: Valves.

This invention relates to valves, and particularly to automatic atmospheric exhaust valves, back pressure valves, isolating valves, and the like. Such valves have hitherto been controlled by a dashpot which offers no resistance to the opening movement of the valve, but only acts to prevent the valve violently seating itself. The present

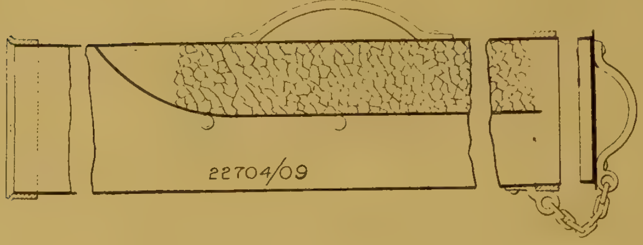


invention consists in so adapting the dashpot and its parts that it will not resist the opening of the valve until it has moved through a certain definite distance, upon which it then comes into action and brings the valve to rest quietly in its open position, the dashpot acting directly however any attempt is made to close the valve.

22633 Elder: Method of separating water from steam in pipes for steam whistles and the like. 22640 Burns: Transmitters for signalling by electro-magnetic waves. [Cognate Application. 1476, 1910.] 22672 Messel: Manf. or production of sulphur dioxide, sulphuric anhydride, and sulphuric acid.

22704 Rees: Spelter condenser nozzles.

This invention relates to improvements in spelter condenser nozzles of the kind which contain coke or other filtering material and are disposed externally of the condenser. The object of the invention is to provide improved means whereby the escape of the fumes and the entry of air at the junction of the nozzle with the condenser may be avoided, and to obviate the liability of injury to the workmen should the cover of the nozzle be blown off in consequence of an explosion occurring within the nozzle. The invention consists essentially of the combination with a spelter condenser nozzle of the kind referred to of a ferrule which encircles and is securely attached to the nozzle and projects beyond the extremity of the latter and which is provided with a trumpet-shaped mouth adapted to accurately fit on the condenser and to be readily luted or otherwise sealed in place.

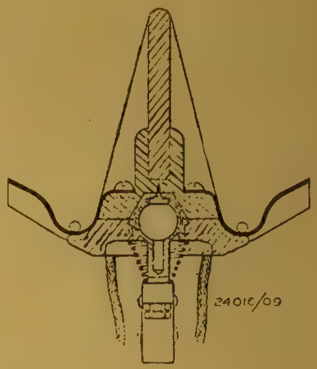


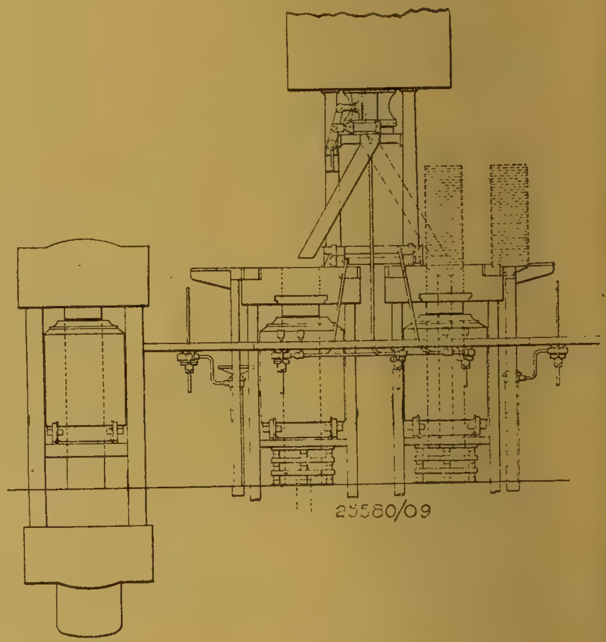
22712 Wiking: Unloading of barges and the like. 22727 Edwards: Girders or beams, more particularly for use in connection with aerial craft. 22849 Marshall: Valves and valve gears of internal-combustion and other engines. 22965 Layton: Syphons for the collection and removal of liquid in gas mains or pipes. 23215 Kuzel and Wedekind: Process for the production of zirconium and other rare metals. 23233 Kruger: Method of and means for embossing and colouring paper, more particularly wall paper, and apparatus therefor. 23321 Matthews, Potter, and Tilbury: Apparatus for filling bottles and other receptacles with liquids. [Date applied for under Rule 13, October 4th, 1909.] 23407 Schantz: Recording apparatus. 23408 Maeder: Valve cocks. 23486 Benn: Shaft couplings. 23621 Webster: Seats for carriages, dog carts, traps, and similar vehicles. 23658 Harsanyi: Internal-combustion engines. [Date applied for under International Convention, October 17th, 1908.] 23691 James Pollard Ltd., and Pollard: Apparatus for removing and collecting dust, fibres, and like foreign bodies or substances. 23720 Preuss: Manf. of woollen carpets or other fabrics. 23924 Stewart: Machine for levelling the surface of roads laid with blocks of wood or the like.

24016 British Thomson-Houston Co. (General Electric Co.): Current collectors for electrically-driven vehicles.

This invention relates to electrically-driven vehicles which are adapted to run over a highway without tracks and to receive their power from an overhead conductor. The invention is particularly applicable to such a system such as is shown in a prior patent wherein the overhead conductor comprises two parallel wires conveying current respectively to and from the vehicles. The trolley head has a central insulating block which extends upward between the conductors and carries outwardly extending contact shoes adapted to engage the under side of the conductors. Flexible conducting wires are connected to the shoes and convey the current to and from the vehicle motor. The invention consists essentially in a current-collecting device for trackless vehicles comprising a substantially conical or pyramid-shaped head of insulating material connected by a ball joint to the trolley pole and contact shoes secured on opposite sides of the head.

24091 Wareham: Automatic grip handles for exercising and muscle-developing apparatus. 24136 Poate, and Fawcett, Preston, and Co.: Pressure pumping machinery. 24447 Francklin: Prepayment or coin-freed gas meters and analogous machines. 24482 Turpin and Wright: Apparatus for sharpening the knives of chaff cutters. 24681 Fleming: Nozzle for fire hose. [Cognate Application. 4797, 1910.] 24739 Brown: Firebars and method of and means for casting them or the like articles in chills. 24755 Hollingworth (Crompton and Knowles Loom Works): Thread-cutting mechanism for automatic weft-replenishing looms. 24900 Riebel: Machine for cutting and affixing hinges having fastening points. [Rights under Section 91 of the Act not granted.] 24913 Freeman: Spanners. 25057 Abingdon-Ecco Ltd., and Gray: Frames of motor cycles. 25215 James: Safety stirrups. 25224 Pratt: Horn tips for sewing machines. 25265 Blackstone, Carter, and Carter: Fuel-spraying valves for internal-combustion engines. 25294 Bornand: Talking machines. 25410 Taylor and Brown: Manf. or production of metal rim for cycle or like wheel. 25433 Young: Means of slicing fish preparatory to curing. 25463 Bichler: Ice-making machines. [Date applied for under International Convention, November 5th, 1908.]





25580 Hopper: Hydraulic oil presses,

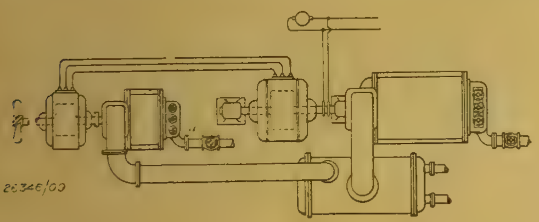
This invention has reference to hydraulic apparatus for pressing and extracting oil of the kind which employs separate devices for the preliminary and final compressions.

The invention consists in oil presses in which the compressed cakes are ejected from the preliminary compressors in piles, the employment of tables arranged beside the preliminary compressors, of means for transferring the piles of cakes after ejection from the preliminary compressors laterally on to the tables, and of means for raising and lowering the tables.

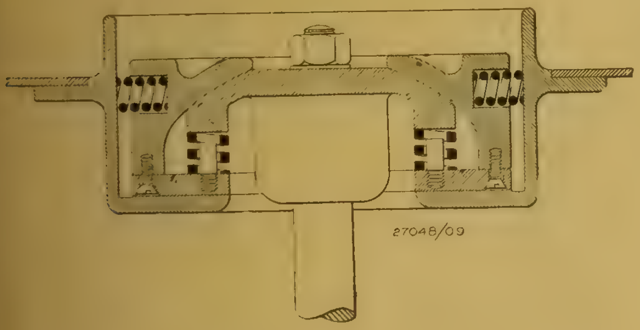
25621 Abingdon-Ecco Ltd., and Gray: Adjustable grooved belt pulleys. 25704 Littlewood: Method of and means for automatically feeding water and shot or other abrading materials to stone-sawing machines. 25937 Wineberg: Locks for cycles, motor cycles, and the like. 26031 Lynch: Grinding machines. 26077 Wyles-Roberts and Sleight: Ball bearings for vertical revolving bollards, fairleads, and the like. 26080 Teanby: Device for use with pie dishes and the like. 26082 Mitton: Machinery for scouring needles, pins, and similar articles made from wires. 26263 Freeth and Cocksedge: Manf. of ammonium chloride from ammonium sulphate and common salt. 26329 Sayer: Driving and steering vessels and the like. [Post-dated November 13th, 1909.]

26346 British Thomson-Houston Co. Ltd. (General Electric Co.): Propulsion of ships.

This invention has for its object to improve and simplify the system of ship propulsion described in a former Application in which the propeller shaft is reversed by reversal of the direction of rotation of the electric generator. According to the present invention the result is accomplished by providing a separate reversing turbine which is coupled to the propeller shaft either directly or through a suitable speed-reducing gear. This reversing turbine may be driven by steam from the boilers or by exhaust steam from the other turbines.



26367 Kosinski: Grindstones for disintegrators for minerals and the like. 26392 Owen: Tobacco pipes. 26638 Aked and Scholes: Vehicles for use in amusement devices on any structure with inclined planes. 26662 Thornton: Domestic fireplaces or stoves. 26721 Cole: Automatic scrubbing, washing, and rinsing machine for fruit or vegetables. 26739 Rosenthal: Talking machines. 26770 Bunn: Locking joints for motor car wind screens. 26783 Fyfe and Fyfe: Valves. 26820. *See* 21850, 1909. 26926 Fergusson: Instep supports for boots and shoes. 27027 Mackenzie (Internationale Eisenbahn Fahrkarten-und Billet Ausgabe Ges.): Apparatus for stamping letters and delivering receipts for the same. 27028 Newton (Farbenfabriken vorm. F. Bayer and Co.): Dyeing and printing.



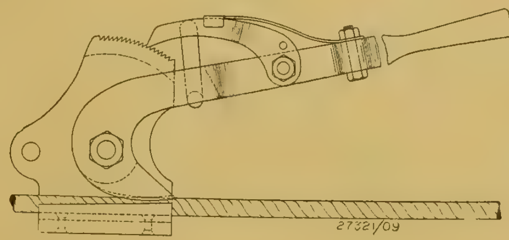
27048 Robertson: Centrifugal machines. [Cognate Application. 28214, 1909.]

This invention relates to buffer-bearing devices for centrifugal machines in which two distinct members are employed between the centrifugal machine spindle and its support, the one to control oscillation of, and the other vibration of that spindle, the improved device being such as to render the application of a belt pulley or other driving means or of a brake at or near the point about which the spindle oscillates more readily possible than in hitherto known constructions. According to the invention the spring-controlled spherical part and its spherical seating are inverted—that is to say, the centre from which the spherical parts are struck is beneath their co-acting surfaces, instead of as hitherto in this type of bearing above them. Between the spherical seating and the spherical part within and beneath it are arranged springs of sufficient power to support the load and give adequate controlling friction between the surfaces.

27050 Robertson: Centrifugal machines. 27066 Clegg, Hartley, and Slingsby: Apparatus to be used in the dyeing of felt. 27306 Otto: Pin-hole cameras.

27321 Campbell: Rope haulage clips.

This invention relates to rope haulage clips of the kind in which one jaw comprises a gripping plate formed with teeth adapted to be engaged by a pawl pivotally connected to a hand lever which is fulcrummed on the plate and is curved to form the other jaw. According to the invention the improved clip comprises a hand-operated lever pivoted to a plate which in turn is pivotally connected to the hutch or the like which is to be clipped temporarily to the haulage rope. The hand lever is formed beyond its pivot with an extension, the outer surface of which is preferably serrated or roughened for engagement with the upper edge of the rope whose lower edge is adapted to be gripped simultaneously by a lower preferably serrated or roughened upturned portion of the plate, which plate is also formed with teeth adapted to be engaged by a spring-pressed pawl pivoted to the hand lever whereby, when the lever is actuated, the haulage rope is gripped simultaneously by the serrated portions of the plate and the lever. In order to release the gripping devices from engagement with the haulage rope, a projection on the pawl engages with a stationary member located in convenient position. When the pawl is disengaged from the teeth of the plate, the lower end thereof drops out of engagement with the rope.



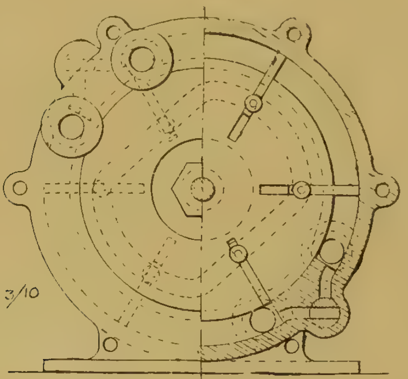
27335 Bousfield: Electrical standard resistances. 27373 Cox: Stencil printing machines. 27413 Cleland: Centrifugal machines. 27443 Stroh: Hard metal seals for closing boxes and the like. 27460 Westerheide: Apparatus for washing dishes and the like. 27463 Bauder: Boxes or cases. 27623 Holland: Fountain pens. 27687 Scherl: Maintenance of the equilibrium of vessels or other unstable bodies by gyroscopic action. [Date applied for under International Convention, November 10th, 1909.] 27855 Corbett and Goldsmith: Apparatus for cutting and slicing roots, vegetables, or the like. 27981 Langley: Spring tyre for the wheels of road vehicles. [Post-dated March 24th, 1910.] 28049 Gadsby: Steam generators or the like. 28069 Roberts: Crane buckets for use in coaling, excavating, building, and other operations. 28097 Dalman, Dalman, and Howles: Adjustable or variable-speed pulleys for motor cycles and the like. 28182 Neumann: Method of treating haemoglobin. 28214. *See* 27048, 1909. 28367 Gese: Windlasses or the like. 28380 Siebert and Kuhn: Physical and/or chemical apparatus for containing substances to be observed and capable of withstanding high temperatures specially though not exclusively applicable to thermometers. 28605 Peek, Frean, and Co. Ltd., and Hounsfield: Biscuit-cutting machines. 28659 Barber: Construction of physical exercising apparatus. 28671 Broughton: Punch-ball stands. 28768 Robertson: Umbrella runners. [Post-dated, April 8th, 1910.] 29040 Smart, Gann, and Wark: Window sashes.

[Application for Patent of Addition to 14873, 1908.] 29185 Blenkinsop: Manœuvring gear for marine steam turbines. 29410 Lee: Spring road wheels for use upon motor and other road vehicles. 29413 Ryland: Cocking mechanism of drop-down guns. 29530 Jameson and Hall: Bird toy. 29658 Neville: Travelling and like handbags. 29694 Westacott: Kilns for the treatment of China clay. 29947 Phillips: Igniting of the charges in internal-combustion engines. 29957 Newth: Glaziers' diamonds. 29960 Keith and Tuson: Ventilators. 30057 Wearing: Whip sockets. 30104 Gibb and Menzies: Self-discharging skips. 30105 Hough: Model airships and flying machines and the mechanism and propelling medium for working the same. 30239 Cake: Ball bearings for the wheels or rollers of roller skates. 30252 Robinson: Machines for adzing and boring railway sleepers and the like. 30297 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new azo dyestuffs. [Request under Section 19 of the Act not granted.] 30417 Brennan: Lubrication of bearings for gyrostats. 30489 Evans: Pneumatic tyres. 30498 Kapper: Orthopaedic foot-supporting soles. [Date applied for under International Convention, December 30th, 1908.]

1910.

3 McClelland: Rotary engines. [Post-dated April 25th, 1910.]

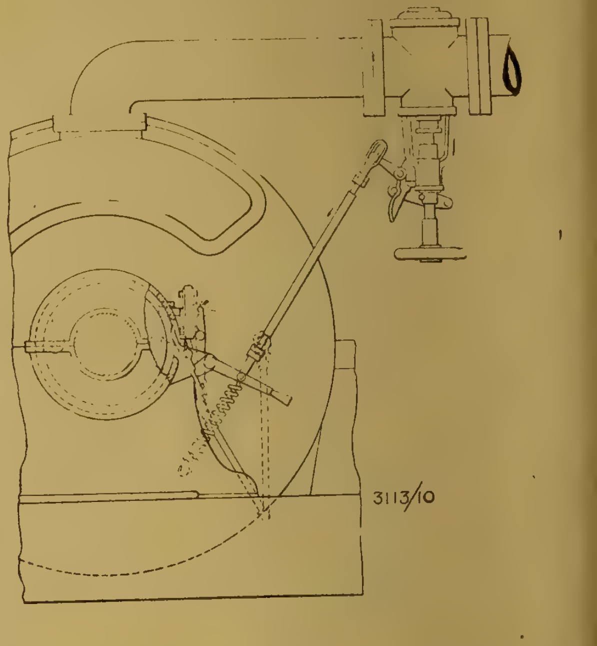
This invention relates to rotary engines of the type in which a piston revolves on or with a shaft and carries a series of vanes capable of reciprocating motion in radial direction. In carrying out the invention the shaft is provided as usual with a drum piston to receive radially sliding vanes fitted with rollers running in cam grooves formed in the side plates of the cylinder or casing. The space between the piston and cylinder is divided as usual into two crescent-shaped chambers by abutments. Formed in the abutments are duplex steam inlet ports controlled by rotary valves contained within valve casings having inlet branches. Near the ends of the crescent-shaped chambers exhaust ports are provided. These ports are relatively large in cross sectional area, being of the full depth of the chambers so as to provide for an efficient exhaust.



210 Huth: Flying machines. [Date applied for under International Convention, January 5th, 1909.] 321 Dean and Coker: Football boots. 330 Harris: Combined steriliser and steam cooker. 595 Gilbert: Means for manipulating carbon sheets in conjunction with typewriting machines and the like. 750 Nelson: Regenerative hot blast stoves. [Date applied for under International Convention, January 16th, 1909.] 900 Dean: Apparatus for treating cloth or yarn with liquors and hot air or the like. 1113 Lauterbach and Lauterbach: Incandescent vapour lamps. 1214 Gansen and Von Lossan: Channelling machines. 1300 Burkhalter, Fuog, and Kohler: Automatic pressure-regulating devices for water and the like. 1312 Bushell: Cruet, caster, or other such receptacle. 1389 Leigh: Tobacco pipes. 1476. *See* 22640, 1909. 1705 Robinson and Beldam: Packing for piston rods or the like. 1719 Weaver: Device for preventing chimneys smoking. 1772 Newton (R. Hoe and Co.): Numbering mechanism. 2471 Barker: Pneumatic tyres. [Request under Section 19 of the Act not granted.] 2670 Bisset: Mechanism for reciprocating the work bench in sawing machines. 2716 Hillman: Shirt stud and necktie fastener. 2720 Morck: Method of preparing preservable food from fruits. 2733 Lake (Simmons): Machines for preparing and delivering food for animals. 2786 Woods, Casartelli, and Casartelli: Casings for thermometers used in taking the internal temperature of meat, provisions, and other goods. 2868 Appleby: Cable and like gripping mechanism. [Application for Patent of Addition to 15543, 1909.] 2875 Michel: Settling and filtering apparatus. 2899 Steynis: Insulating devices. 2998 James (Compagnie Generale de Phonographes, Cinematographes, et Appareils de Precision): Electric machine for cutting out stencil bands for colouring cinematograph films.

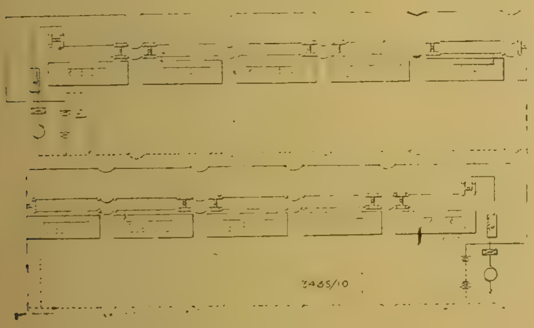
3113 Warwick Machinery Co. (General Electric Co.): Emergency-governing mechanism for turbines.

This invention relates to elastic-fluid turbines, and consists of a valve for controlling the supply of motive fluid to the turbine, mechanism for tripping the valve to close it suddenly under emergency conditions, and means responsive to a predetermined rise in pressure in a given region of the turbine which effects the tripping of valve and thereby shuts down the turbine, the means including a casing, a diaphragm mounted in the casing, a lever pivoted intermediate its ends on the casing with one end adjacent one side of the diaphragm and the other end adjacent the mechanism, a device which tends to keep the first-mentioned end of the lever in engagement with the diaphragm, a conduit leading from the region and opening into the casing at the opposite end of the diaphragm, and a valve controlling the flow through the conduit that opens when the pressure in the region rises to the predetermined value and permits the pressure to act on the diaphragm and thereby cause the lever to operate the tripping mechanism.



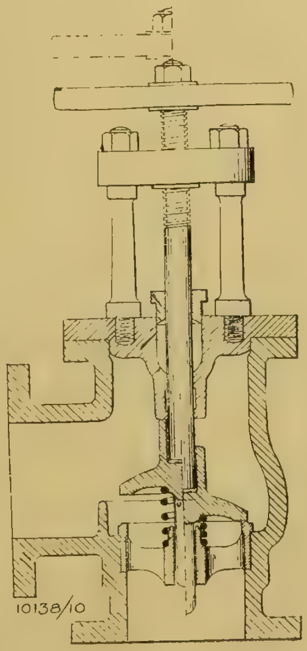
3177 Davey: Ladders more specially intended for spiral-guided gas holders. 3225 Clark: Wheels for vehicles. 3275 Reichwald (Fried. Krupp Akt.-Ges.): Percussion fuses for projectiles. 3281 Schmidtmann: Combined ironing board and step ladder. 3399 Gasch: Tools for applying pneumatic tyre covers to the rims. 3435. *See* 22611, 1909. 3485 Kessler: Gas engines. [Date applied for under International Convention, February 23rd, 1909.] 3556 Sherratt and Gray: Netting needle or netting shuttle. 3568 Schmidt: Receptacles for storing photographic film negatives. [Date applied for under International Convention, April 8th, 1909.] 3623 Crump: Pneumatic tyres. 3870 Moon and Moon: Projecting lantern. 3884 Morton: Means for the attachment of hat guards to dress button holes. 3888 John Lysaght Ltd., and Palmer: Skylights, side lights, louvred ventilators, and the like in corrugated or plain sheet metal. 3900 Stevenson: Boxes for containing incandescent gas mantles, incandescent electric lamps, and other fragile articles. 4431 Moore: Safety device for small arms. 4432 Wildner: Sealing device for bottle stopper fastenings. 4567 Pescatore, and Tudor Accumulator Co.:

Ventilation of electric accumulator cells. 4685 Grant, Giusti, and Agretti: Air compressors. [Date applied for under Rule 13, November 11th, 1909.] 4696 Olmsted: Systems of and apparatus for the control of electric circuits. 4756 Vicart: Body of motor cars. [Date applied for under International Convention, February 26th, 1909. Application for Patent of Addition to 15840, 1909.] 4797. *See* 24681, 1909. 4820 Olsen: Carburetters. 4853 Dean and Howorth: Manf. of buffer straps used in looms for weaving. 4861 De la Celle: Variable treadle driving gear for cycles. 4899 McLaren: Blinds for carriage and other windows. 5161 Geb. Siemens and Co.: Protecting wall for apparatus which are subjected to a high temperature. [Date applied for under International Convention, March 17th, 1909.] 5250 Reeves: Apparatus for adding liquids to water in predetermined quantities. [Date applied for under Rule 13, October 1st, 1909.] 5386 Ferrari and Gallo: Medical radiator for use in beds. 5494 Balbiani: Pneumatic tyres for vehicles. 5696 Lyman: Railroad rails. [Date applied for under International Convention, March 5th, 1909.] 5710 Aeschbach: Variable-speed gearing. [Date applied for under International Convention, April 27th, 1909.] 5818. *See* 19359, 1909. 5822 Davidson: Liquid-fuel heating lamps. 6085 Leash: Refuse destructors. [Cognate Application. 7549, 1910.] 6203 De Proszynski: Portable cinematographic cameras for taking films by hand. 6361 Tas: Mechanism for displaying advertisements or other information. 6384 Sundell: Composition for the manf. of artificial stone and a method of hardening articles made from such composition. [Date applied for under International Convention, March 15th, 1909.] 6787 Brown: Wire chain link and blank therefor. 6977 Arbuckle: Apparatus for treating crushed ore products for the recovery of the metal contents thereof. 6987 Thrutchley: Internal-combustion engines. 7058 Degaille: Printing disc for cash registers. [Date applied for under International Convention, March 29th, 1909.] 7297 British Welding Co. (Dellwik Fleischer Wassergas Ges.): Apparatus for welding joints. 7313 Boult (Ehrhardt and Schemer Ges.): Valves and valve gear for reversing engines, more particularly for engines for rolling mills. [Application for Patent of Addition to 6998, 1909.] 7393 Menzies, Cullon, and Cullon: Variable-speed and reversing mechanism. 7394 Strong: Machines for cutting indexes. 7549. *See* 6085, 1910. 7565 Cooke: Arrangement for locking railway rolling stock wheels to their axles. 7627 Fairweather (Box Office Ticket Machine Co.): Ticket-printing machines. 7689 A. and J. Main and Co., and Millar: Corrugated iron and like roofs. 7750 Banse: Belt buckles. [Date applied for under International Convention, March 30th, 1909.] 7828. *See* 21555, 1909. 7889 Broussouse: Propeller. 7926 Holtkott: Process and apparatus for the manf. of lincrusta. [Date applied for under International Convention, April 8th, 1909.] 7937 Koppetsch: Moistening device for stamps and the like. 8234 Long: Devices for stropping razors. 8332 Chisholm: Telephone system and individual transmitter. 8407 Fox: Mould for moulding wires round the necks of bottles. [Request under Section 19 of the Act not granted.] 8546 Donaldson, Holden, and Griffiths: Sighting mechanism for guns with high trajectories. 8808 Mainguet: Mechanism for actuating the controlling devices or rudders of aerial and aquatic vessels. [Date applied for under International Convention, April 20th, 1909.] 9392 Watson: Water lifts and the like. 9432 McIlvrid: Means for mixing and ejecting grout or other plastic materials. 9483 Huhn: Tube cleaners. 9500 Rehbach: Toy monorail system. 9509 Labryszewski: Propellers for ships. 9514 Dunham: Nut locks. 9724 Tons: Driving belts. 9764 Reutter: Collapsible covers or hoods for motor and the like vehicles. [Date applied for under International Convention, July 23rd, 1909.] 9847 Boorne: India-rubber and like stamps. 9971 Kunde: Cutter for string and the like. 10089 Mackeson: Manf. of aerated waters.



10138 Turnbull: Stop and isolating valves.

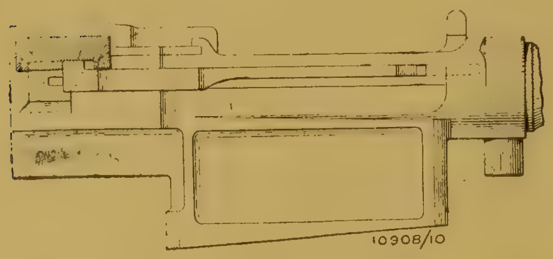
This invention relates to self-closing stop and isolating valves, and consists in providing means whereby the valve may be kept open under normal conditions, and likewise prevent the chattering and wear and tear which usually takes place between the valve and seat faces of such valves. According to the invention a spring or springs are introduced which act upon the valve and are of such strength that while they prevent the valve from being actuated by vibration or slight variations of pressure between the outlet and inlet sides do not prevent its closing should the direction of the flow of the steam or other fluid be suddenly reversed from any cause, such as the rupture of the pipe or boiler to which the inlet side of the valve is connected.



10163 Clarke: Safety devices for elevators. 10194 Fowler: Golf clubs. 10198 Derbyshire: Process for making ornamental perforated designs. [Date applied for under International Convention, April 26th, 1909.] 10216 Haddan (Alpine Maschinenfabrik Ges. vorm. Halzauersche Maschinenfabrik Ges.): Pneumatic separators for granular substances. 10665 Fried. Krupp Akt.-Ges.: Field gun road carriages. [Date applied for under International Convention, July 30th, 1909.] 10747 Bauer: Means for attaching supporting brackets to beams and girders of ferro-concrete. [Date applied for under International Convention, June 1st, 1909.] 10780 Etablissements de Dion-Bouton (Soc. Anon.): Attachment device for the distributors of magneto ignition machines. [Date applied for under International Convention, May 25th, 1909.] 10797 Littig: Trousers hanger. 10805 Lefort: Apparatus for vaporising the heavy volatile oils or essences in internal-combustion engines. [Date applied for under International Convention, April 30th, 1909.] 10827 Nobbs: Plate-warming fitting for gas and other stoves. 10899 Wenck: Indicator for scoring with table billiards. 10903 Diver: Screening or filtering apparatus for drying wet materials. [Date applied for under International Convention, May 4th, 1909.]

10908 Mauser: Safety apparatus for the firing pins of recoil loading firearms with fixed barrels. [Date applied for under International Convention, March 10th, 1910.]

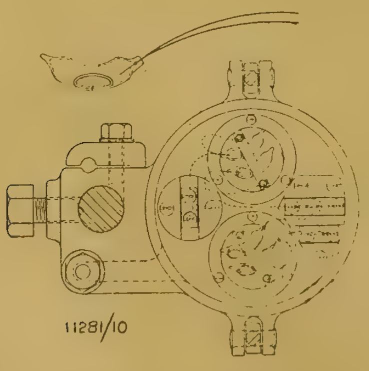
This invention relates to a safety apparatus for firearms having a fixed barrel, a rectilinearly moving breech block, swinging locking levers, and a cam plate actuating the levers, and comprises locking mechanism which, when the breech is being locked, holds the firing pin behind the face of the breech bolt until the latter has arrived in the closed position, so that the point of the firing pin cannot project beyond the face of the breech bolt and consequently cannot be released until after the locking of the breech has actually commenced. The invention consists essentially of means operated by the sliding cam plate for positively actuating the detent which holds the point of the firing pin behind the breech bolt, so that the firing pin can only assume its firing position after the locking of the breech has actually commenced.


10908/10

11236 Harvey and Coppleston: Driving gear for the music feed and take-up rolls of mechanical piano players.

11281 McKenzie and Holland Ltd., and Wood: Electric contact makers.

This invention relates to electric contact makers, and consists essentially in the combination of a glass tube having a flattened or otherwise closed end, platinum or like contact wires secured in the end of and projecting into the tube, a body of mercury in the tube adapted to make contact with the platinum wires, and copper or like wires joined to the platinum wires at a point within the closed end of the tube, the glass of which holds the copper wires in position.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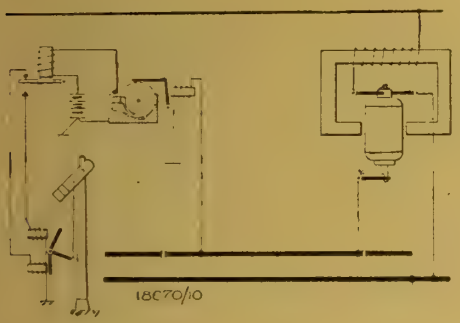
11364 Falding and Cathcart: Process for the recovery of valuable products from iron-pickling liquor and gas liquor. 11484 Nydahl: Devices for injecting water and fuel into the cylinders of internal-combustion engines. [Date applied for under International Convention, July 13th, 1909.] 11582 Heimann and Schaffer: Method of working arc lamps in series with incandescent lamps. [Date applied for under International Convention, November 10th, 1909. Application for Patent of Addition to 748, 1910.] 11685 Lagoutte: Bolt lubricator with reservoir. [Date applied for under International Convention, August 11th, 1909.] 11764 Taylor: Fall-bar firegrates and kitchen ranges. 12117 Hayden: Developing apparatus. 12134 Soc. Anon. des. Anciens Ateliers Gamain and Co.: Roller skates. [Date applied for under International Convention, December 6th, 1909.] 12148 Dwight, Mercer, and Baker: Portable deck chairs. [Date applied for under International Convention, December 14th, 1909.] 12179 Borinski: Process for the manf. of shoes, and more particularly camel-hair shoes. 12249 Lake (Winchester Repeating Arms Co.): Small arms. 12315 Bergmann: Cartridge-extracting mechanism for automatic firearms. 12323 Fear: Ornamental mount for sending picture post cards and the like through the post. 12421 Bach: Vices. 12585 Stockford: Locking washers. 12609 Freiberg: Electric lamp holders. 12666 Hofmann: Backing plates of safety razors. 12716 Robson: Apparatus for lubricating corve axles. 13120 Hutchings: Steam cookers. 13268 Richter: Machine for unhairing, smoothing, sleeking, or similarly treating skins and hides. [Rights under Section 91 of the Act not granted.] 13314 Shoberg and Greenfield: Flash-light apparatus. 13374 Moore: Invention to prevent people from entering a house or shop through the door without being heard. 13379 Bass and Broughton: Apparatus for unstoppering ball-stoppered bottles. 13412 Von Mrokowski: Floors and flooring for buildings. 13429 Resch and Gutsch: Apparatus for washing and rinsing clothes and the like by means of benzene. [Date applied for under International Convention, June 4th, 1909. Application for Patent of Addition to 18448, 1909.] 13555 Sangster: Stands or supports for motor cycles. 13745 Gilfillan and Hunter: Spring balances. 13793 Mitchell: Dress fastenings. [Date applied for under Rule 13, April 13th, 1910.] 13887 Wedell: Reel holders for eyeglass chains. [Date applied for under International Convention, June 9th, 1909. Application for Patent of Addition to 9549, 1909.] 14067 Petersson: Method of photographing maps. 14459 Von Pindtershofen: Process and apparatus for the manf. of insulating tubes. 14492 Julius Pintsch Akt.-Ges.: Ignition device for inverted incandescent gas lamps with central chimney and travelling flame kindled by a pilot flame. [Date applied for under International Convention, June 16, 1909.] 14724 Mistigry: Apparatus or means for revolvably mounting cars on airships. [Date applied for under International Convention, June 19th, 1909.] 14747 Kinney: Rotary motors and pumps. [Date applied for under Rule 13, October 1st, 1909.] 14842 Malmsten and Thorssell: Apparatus for emptying superphosphate chambers. 14922 Lemon and Page: Toys. 15257 Marston and Mitchell: Locks. 15427 Nelson: Brakes for automobiles and the like. [Date applied for under International Convention, July 16th, 1909.] 15612 Fried. Krupp Akt.-Ges.: Barrel recoil ordnance. [Date applied for under International Convention, October 8th, 1909.] 15727 Reynolds: Sanitary closets. 15751 Gibb: Means for holding the cords of venetian blinds. 16161 Robacher: Filtering apparatus particularly adapted for use in the cyanide process of extracting precious metals from their ores. [Date applied for under International Convention, May 13th, 1910.] 16228 Stiff: Floor tiles or blocks for bacterial filter bed and like purposes. [Application for Patent of Addition to 8590, 1908.] 16273 Ruth: Manf. of colour screens for colour photography. [Date applied for under International Convention, July 10th, 1909.] 16320 Grieve: Circular knitting machines for the production of seamless hosiery. 16396 Adams: Railway rail joints. [Date applied for under International Convention, July 9th, 1909.] 16902 Fried. Krupp Akt.-Ges.: Spade-attaching devices for wheeled gun carriages. [Date applied for under International Convention, October 12th, 1909.] 17836 Taylor: Automatic fire extinguishers or sprinklers and apparatus therefor.

18670 Siemens and Halske Akt.-Ges.: Railway traffic protecting device. [Date applied for under International Convention, August 27th, 1909.]

This invention relates to railway traffic protecting devices, and comprises an arrangement by which the release of the signal, as well as its retention in the "line clear" position is dependent upon the flow of a fluid set up by a supervisory appliance. The stoppage of this movement in this case places the signal to the "danger" position.

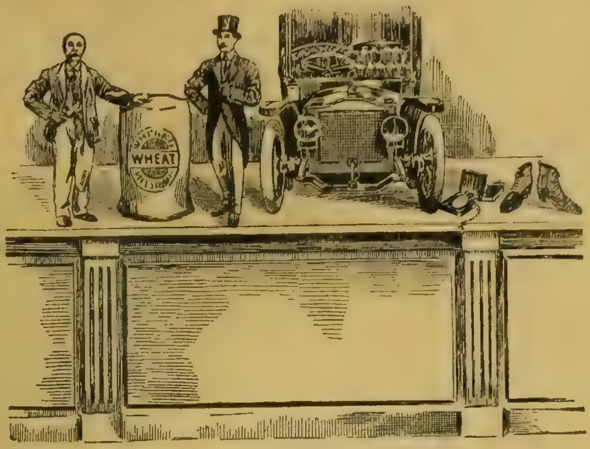


19506 Cox: Pencil and pen cases. 21203 Heard, and Reid Brothers Engineers Ltd.: Hoos for railway shunters' poles.

Complete Specifications Open to Public Inspection before Acceptance, under the Patents Act, 1907.

1910.

2633 Spalazzi: Electrical device for transmitting to a distance continuous or intermittent angular movements. 6371 Soc. Francaise de l'Ondulium: Machines for manufacturing corrugated papers or cardboards. 7054 Heath: Internal-combustion engines. 10952 Ramel: Automatic device for actuating the stabilising planes and vertical rudders of flying machines. 14859 Presser: Electric welding process. 15749 Elia: Torpedo boats, cruisers, and the like. 16275 Aluminium Industrie Akt.-Ges.: Process for the manf. of hydrocyanic acid. 16986 Koepe: Method of petrifying in section water-bearing strata. 18460 Boch: Process for causing the emanations of radio-active substances to act on living bodies. 18930 Forel: Manf. and production of artificial leather. 19155 Dr. C. Otto and Co.: Treating distillation gases for the recovery of tar and ammonia. 19408 Schiechel: Means applicable for use in separating minerals and the like from earthy and other matters. 19496 Galvanostegie Ges: Device for cleaning the surface of tubular and other objects adapted to be galvanised. 19630 Thiro: Tubular boilers. 20255 Bunte and Remmler: Portable vacuum cleaning apparatus. 20306 Sagaer: Igniting magnetos of internal-combustion engines. 20364 Lafleur: Nut locks. 20422 Steuer: Process and apparatus for sprinkling liquid. 20682 Heydemann: Perambulator. 20794 Bayer: Method for purifying and cooling gases. 21039 Schellenberg: Target support. 21221 Hanss: Tidal hydraulic power plants. 21412 Klein and Seitter Ges: Carry-over mechanism for calculating machines. 21488 Winter: Apparatus for measuring the form of bodies



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and in particular the form of the human head. 21564 Vietor: Hardwood dowel head for railway sleepers. 21591 Turler: Warp dressing and sizing machines. 21696 Wilcke and Graff: Propeller for aerial vehicles. 21697 U. Ahlgrimm and Co.: Steam laundry boiler. 21703 Russell: Rail joints. 21711 Pieper: Valves of internal-combustion engines. 21721 Nitrogène Soc. Anon: Apparatus for producing endothermic chemical reactions in gases. 21740 Carangelo: Incandescent electric lamps. 21744 Morel: Vertical tubular mill for fine grinding. 21745 Le Dantec: Propeller. 21746 Hessling: Method of compressing air and other gases and apparatus therefor. 21801 Tentschert: Latticework for window frames and other purposes. 21803 De Csongradi-Schopf: Device for fastening neck-ties. 21831 Forest: Internal-combustion engines. 21864 Carl Zeiss: Toric spectacle glasses. 21925 Mallet: Means for steering automatic vehicles. 21931 Wegner: Providing worn-out fishplates with new contact surfaces. 22031 Pokern-Markworth: Safety razors. 22035 Beurrier: Concentrical circular wings with opposite motion. 22114 Petri-Palmedo: Type line-casting machines. 22125 Porri: Construction of railway permanent ways. 22126 Jaubert: Process of and means for extracting the free hydrogen contained in industrial gases. 22186 Bossingham: Annealing boxes.

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VOL. 42. FRIDAY, NOVEMBER 11, 1910. No. 1,237.

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THE PAYMENT OF BONUSES.

IN most businesses nowadays, when operations reach fairly considerable proportions, involving the conduct of a number of departments under different managers, the question of bonus payments arises. Sometimes the principle is found to work very satisfactorily in businesses of a smaller description, where by the cordial co-operation of two or three capable and intelligent men and their employer a large and profitable turnover is handled. There are times in some businesses, which have grown from small beginnings, when old salaried officials, who have stood by the firm year after year, are put on a new footing as a sort of reward for long and faithful service, and, as employers, who were once the heart and soul of the business, begin to feel the effect of passing years, and gradually take a less active interest, the "share-of-the-profits" idea is an added incentive to those who take an additional burden of responsibility. It is true that when men remain for a lengthy period in one employment they are apt to get into a groove. Even that is not altogether an evil thing for some businesses where a continuance of certain policies and methods seem essential because changing years have not brought anything better along; we admit that this does not apply to many classes of concerns, and men who have "got into a groove" must not take too much comfort to themselves from our remarks that it is not always an evil condition into which to settle. But even men who have got into grooves have been pulled out of them by the new interest that the prospect of a bonus brings. It is remarkable what a fertility there is for new ideas, what slumbering spirit of enterprise, what amazing ingenuities, can be brought into play, even in old "hands" that appeared to be rusty, when this new factor influences every consideration. There was no neglect of legitimate duty previously probably, and they were regarded as performing their service in a most exemplary fashion, but a new interest entered into life when they came to face the new position, which meant that whereas in the past they had laboured because they must, in order to keep the business of their employer going, so that, primarily, they might continue to gain a livelihood, now they had a personal interest in making the business a greater success than ever before. Human nature being what it is, and the needs of life not becoming materially less until one has passed well into the third score years, who will regard this as either strange or unworthy?

We are not thinking now so much of that larger question which sometimes looms so largely in the discussions of capital and labour problem in great industrial centres, or in such cases as occur to one, of the Livesey gas employés, or the Christopher Furness co-operative proceedings. These are matters which require a somewhat different treatment from what one would expect to find in connection with the many comparatively small engineering businesses, with office staffs and workshop chiefs, whose interests sometimes languish for want of suitable encouragement.

There can be no doubt that as the tendency is growing for capital to be rewarded with a lower rate of compensation in the form of interest or profit, the bonus principle will be more widely adopted for various grades of employés. It seems to be growing in connection with public undertakings operated by municipalities. Time will tell what the general effect will be. In cases we have in mind, stokers have been led, by the inducement of a bonus for so doing, to reduce the quantity of coal consumed by an electricity works bcause they have rendered more efficient service in their particular capacity. It may be argued that the result has proved that they were not performing a reasonably efficient service before, but the result being a saving many times the cost of the bonus is considered to justify the means. Again, car-drivers connected with the tramway system have been able to save electrical energy consumption when bonuses have been offered for so doing. The more careful they are nowadays by the aid of the check meter, which is being experimented with in a number of cases, they not only waste less energy, but by doing so they save the wear and tear on the equipments. No doubt by the aid of the meter check improvement will be effected in many cases without any pecuniary inducement to motor men, but in cases where such has been offered the result has been highly spoken of. Just now the Aberdeen Corporation has had under consideration the desirability of allowing bonuses to its electricity department employés, but its decision is against the suggestion. On the other hand Marylebone Borough Council, which is nothing if not aggressive on the selling side of its electricity department, has decided that five of its chief officials shall share between them, in addition to good salaries which are yearly to advance, a profit percentage when the profit exceeds a certain figure per annum and the charges to consumers fall by a certain percentage annually. The arrangement is only a few months old, but we shall watch with interest to see how it works.

New North-Western Passenger Locomotive.—The *Times* states, on the authority of Mr. Bowen Cooke, Chief Mechanical Engineer of the Lorndon and North-Western Railway Co., that next year will witness the 5,000th locomotive at Crewe works. The 1,000th engine was turned out in 1866, Mr. Ramsbottom being chief engineer, and the 4,000th was completed March, 1900, by Mr. Webb. Sixty-seven years ago the first locomotive was built at Crewe. The 5,000th engine will most likely be a new type of passenger tank engine, having the uncommon 2—6—4 arrangement of wheels, and will exceed in size any other tank engine that has been constructed as yet for passenger traffic on any British railway, except the now defunct Great Eastern decapod. Twenty engines of this class are to be constructed. They will be fitted with the water pick-up apparatus, with the addition of an extra scoop to allow of a supply being taken up when travelling bunker first. The cylinders will be 18½ in. in diameter, and the coupled wheels 5 ft. 6 in.

Direct Overhead Line Through Bradford.—The *Railway Gazette* states that the Bradford Corporation, after a lengthy discussion, have recently determined to agree to an arrangement with the Midland Railway regarding the construction of a direct overhead line through Bradford, which will put the city on the main line. In consideration, paying £8,000 a year for 20 years, the Company undertakes to apply to Parliament this session for the necessary powers and to proceed at once with the work when authorised.

Large Installation of Marine Evaporators.—An installation of marine evaporators has just been completed for the turbine steamer France (built at St. Nazaire) by Messrs. Richardson, Westgarth, and Co., of Hartlepool, which is said by the *Shipping World* to be the largest yet made. There are four separate units in the installation, each having a capacity of 200 tons per 24 hours. One of these evaporators was tested, and an average output of 222 tons per day was produced.

A Reversible Turbine.—A reversible De Laval turbine is said to have been devised by G. De Laval and E. Fagerstrom. It consists essentially of a vaned wheel which carries two concentric sets of oppositely curved vanes. Steam is conducted to these vanes through passages provided between concentric conical shells with helices in these spaces so as to form sets of nozzles discharging the steam against the vanes for either "forward" or "astern" direction. These conical passages receive steam from annular chambers, into either of which it is admitted at will by means of a hollow conical-plug-shaped steam valve, having suitable ports cut in its sides. An exhaust chamber is provided, and the gearing and shafts, etc., are those usually employed with De Laval turbines.

Palmers and South Durham Works.—There are rumours, says the *Newcastle Daily Chronicle*, that the acceptance of the chairmanship of Palmer's Shipbuilding and Iron Company by Lord Furness is likely to lead to some closer relationship between the great Jarrow firm and two others with which Lord Furness is closely identified on Teeside—the South Durham Steel and Iron Company and the Cargo Fleet Iron Co., of both of which Lord Furness is chairman. The South Durham Steel Company is one of the largest producers of steel plates in the country, and the Cargo Fleet Iron Company is a large producer of pig iron and also of steel by the Talbot process.

Locomotive Competition.—The London and North-Western Railway Co. lately made a test run on the line from Carlisle to Preston with the North-Western and the North British type of heavy express locomotives. A train of 293 tons weight was taken from Carlisle to Preston and back by a four-coupled "Atlantic" type of North British engine, and the same train was taken the same run by a North-Western six-coupled "Experiment." The timing was the same for both trains, but detailed records were made of pull, coal consumption, speed, etc., and the result showed that the North-Western engine worked with a ton less coal than the North British. It is understood that the test was undertaken at the instance of Mr. Whitelaw, the deputy chairman of the North British and chairman of the Highland Railway, who believes that six-coupled engines are better suited for heavy express work than four-coupled, but the difference in the coal consumption is very striking.

STEAM ENGINE DESIGN.—XXIX.

(Continued from page 515.)

Balancing by Rotating Weights.

The method given at the end of the last article of "over-balancing" the reciprocating parts by means of rotating weights is that usually adopted in practice for one-crank engines and for those in which the crank angles and piston line weights cannot be arranged in such a way that the total out-of-balance effect is small. Overbalancing is applied alike to both forces and couples.

It is not usual to balance out the whole of the reciprocating parts, generally two-thirds is taken.

Let W_1 = weight of reciprocating parts in pounds,
W_2 = weight of rotating parts in pounds,
R = crank-pin radius,
W_0 = weight of balance weight at a radius R_0.

Then, $$W_0 \times R_0 = (W_2 + \tfrac{2}{3} W_1) \times R;$$

or, $$W_0 = (W_2 + \tfrac{2}{3} W_1) \times \frac{R}{R_0}.$$

One half of W_0, in double-cheeked cranks, is placed on each cheek.

In estimating the weights, the "equivalent at crank-pin radius" must always be taken. Thus, for the valve gear, if

$$\frac{\text{valve travel}}{\text{stroke}} = \frac{1}{x},$$

and w = any rotating or reciprocating valve weight, equivalent at crank-pin radius $= \frac{w}{x}$.

In allocating reciprocating and rotating parts, the following division is advisable; the rules are given for reversible slide valve engines, and they can be readily modified for non-reversible engines. For drop valve and Corliss engines the valve gear is neglected.

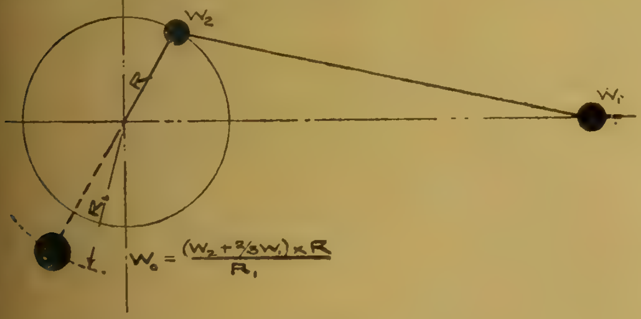


Fig. 155.

Reciprocating parts: Ahead valve line = valve spindle + die block + links + $\frac{1}{2}$ (drag rods) + $\frac{4}{10}$ (eccentric rod and straps); astern valve line = 1 (drag rod) + $\frac{4}{10}$ (eccentric rod and straps); piston line = piston rod + piston + crosshead + small end brasses + $\frac{1}{3}$ (connecting rod).

Rotating parts: Ahead or astern valve line = eccentric sheaves + $\frac{6}{10}$ (eccentric rod and straps); piston line = $\frac{2}{3}$ (connecting rod) + big end + crank pin + crank cheeks.

As example in balancing a single crank slide valve engine, and also to show the method of tabulation which should always be made, the following will be taken. In the Schedule (I.) the leading weights are given in the first column; these are given as equivalent weights in the second, and are duly allocated in the remaining columns.

On many engines the effect of valve gear is neglected, in which case the balance weight is placed diametrically behind the crank pin, as in fig. 155. For the example, it will be supposed that the engine is of the slide valve type, having the eccentric 130 deg. ahead of the crank, and that the valve travel is $\frac{1}{8}$ × travel of piston. Setting out the cranks as in fig. 156, and drawing in the force diagram, resultant X Y, or balance weight = 795 lbs. at crank pin radius and in direction O A.

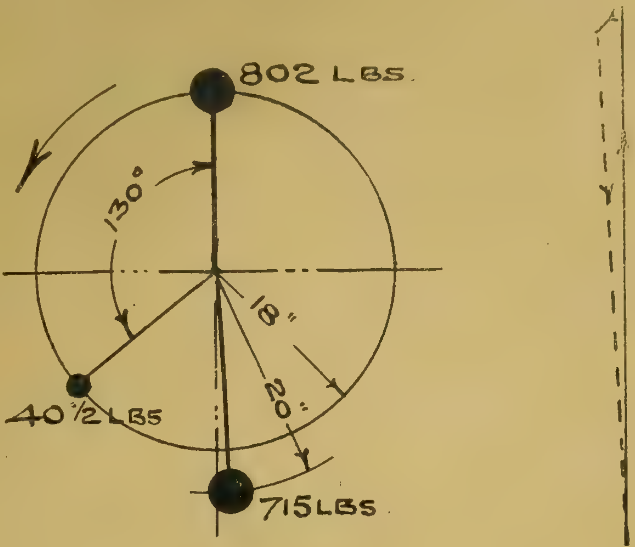


Fig. 156.

If the crank pin radius is 18 in., and the balance weight be placed at 20in.,

$$\text{Balance weight} = 795 \times \frac{18}{20} = 715 \text{ lbs.}$$

Two-crank Engines.

Two-crank engines usually have their cranks disposed at either 90 or 180 deg. For the second arrangement, as shown in Case II. of the last article, if the piston line weights are equal, all rotating and primary forces balance. If the piston line weights are unequal, the 180-deg. engine will be much better balanced for forces than the 90-deg. engine.

Considering couples, neither engine is balanced. Rotating couples can be entirely eliminated by means of balance weights, but reciprocating couples can only be overbalanced, and this method is very generally employed.

Hence the rule—for two-crank engines, balance each crank and piston line independently of the other by the method given at the beginning of this article.

Three-crank Engines.

The three-crank engine usually has its cranks at 120 deg., and, as shown in Case III. of the last article, if the piston line weights are equal a complete natural balance of all forces is obtained. Even when the weights are not equal there will still be a certain amount of combined balancing. Couples are in no way balanced; these depend on the distances between the cylinders.

As the reciprocating couples cannot be balanced among themselves, overbalancing is again the only remedy. Some firms prefer to balance each piston line independently of the other, as described in the last section for two-crank engines. This ensures that each weight can be placed practically diametrically opposite to the crank pin, and that it can be made of a simple shape; also in engines having piston lines of equal weight the balance weights will be interchangeable. By the method of combined

Schedule I.

PART.	Weight in lbs.		Equivalent Weights.		$W_2 + \frac{2}{3} W_1$.		REMARKS.
	Actual.	Equivalent at crank, per radius.	Rotating W_2.	Reciprocating W_1	Piston line.	Valve line.	
Piston, rod and crosshead	750	750	....	750	249	....	
Connecting rod and ends	350	350	263	87	293	....	Take ¼ reciprocating, ¾ rotating.
Crank pin.........................	60	60	60	....	60	....	
Crank	376	200	200	....	200	....	
Valve and valve spindle	300	$37\frac{1}{2}$	....	$37\frac{1}{2}$	....	25	Travel of valve = ⅛ × travel of piston.
Eccentric rod and straps	200	25	15	10	....	22	$\frac{4}{10}$ reciprocating, $\frac{6}{10}$ rotating.
Eccentric sheaves	50	$6\frac{1}{2}$	$6\frac{1}{2}$	....	....	$6\frac{1}{2}$	
				Totals =	802	$53\frac{1}{2}$	
Balance weight	715	795	....	....	....	....	Placed at 20 in. radius; for direction see diagram.

balancing about to be described, balance weights are fitted to the two end cranks only, and, as will be seen, the weights are by no means diametrically opposite to the crank, making them of odd shape and difficult to attach; still, less material and labour are necessary.

In the following example the cylinder centre lines and cranks are disposed, as shown in fig. 157. The leading rotating and reciprocating weights are given in Schedule II. For simplicity, the valve lines are neglected. As the piston line weights are not equal, the engine must be balanced for both forces and couples. The complete tabulation given in Schedule I. should be made out for each cylinder, the first three columns of Schedule II. being a summation.

For computation of couples, a reference plane is taken through the L.P. cylinder; therefore there are no L.P. couples to be considered. Draw in the couple diagram, as at *a* in fig. 157, making the sides equal to the values given in the schedule and parallel to their respective cranks. The closing side is shown dotted, and its sense indicated by an arrow. Scaling off, its value is found to be 2,860 lbs.-feet, and if the couple be obtained by placing a balance weight in the required direction behind the H.P. crank, which is 5 ft. 8 in. from the reference plane, then

$$\text{H.P. balance weight} = \frac{2860}{5{\cdot}66} = {\cdot}505 \text{ lbs.}$$

These values should be fully entered in the schedule.

The forces yet remain to be balanced, and, in order not to affect the couples, a balance weight must be placed in the reference plane, *i.e.*, behind the L.P. crank. Draw in the force diagram, as at *b*; the closing side is shown dotted, and, as before, its sense indicated by an arrow. Scaling off, it is found that a weight of 650 lbs. is required.

By drawing the balance weight directions in the crank circle, parallel to the closing side of the polygons, their positions relative to the cranks to which they are to be attached can be clearly seen.

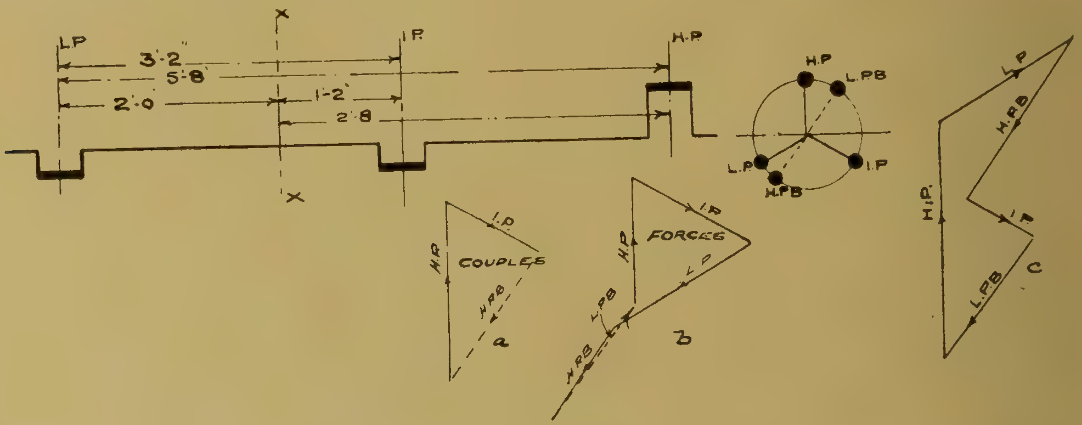


Fig. 157.

Schedule II.

Part.	Equivalent weights at crank pin radius, lbs.			Arm of couple in feet about plane through L.P.	Couple in lbs.-feet.
	Rotating W_2.	Reciprocating W_1.	$N_2 + \frac{2}{3} W_1$.		
H.P.	250	520	590	5ft. 8in.	3350
I.P.	250	560	620	3ft. 2in.	1950
L.P.	250	760	750	....	....
H.P. balance	505	....	....	5ft. 8in.	2860
L.P. balance	650	....	....	....	....

It will, of course, be understood that the weights given are equivalent at crank radius weights, and that they may be reduced to any other radius to suit circumstances. As a proof to the hypothesis, which is the basis of the above and all other calculations in balancing, that if an engine is balanced in one plane it is balanced in any other plane, a new reference plane X X has been taken in fig. 157, and in Schedule III. couples about this plane for the balanced

Schedule III.

Part.	Weight in lbs.	Arm of couple in feet about plane X X.	Couple in lbs.-feet.
H.P.	590	3ft. 8in.	2160
I.P.	620	1ft. 2in.	723
L.P................	750	– 2ft. 0in.	– 1500
H.P. balance........	505	3ft. 8in.	1850
L.P. balance........	656	– 2ft. 0in.	– 1300

engine are tabulated. It should be noticed that couples to the left of X X must be taken as negative, since they have an opposite effect to those at the right of X X.

The couple diagram for this new reference plane has been drawn in at *c*, and, since it closes, the above hypothesis is justified.

Collective Balancing in Four-crank Engines.

From the previous examples it will be seen how impossible it is to eliminate reciprocating effects by ordinary means. With the four-crank engine, complete balance, without the addition of any balance weights, can be obtained, although in practice these conditions are not usually quite obtained. It must be clearly understood that by "complete balance" is meant the elimination of all effects, except the "secondary," which, as pointed out in the last article, can only be eliminated in five and six-crank engines.

four-cylinder engine will be given. The cylinders and cranks are arranged as in fig. 158, and the weights of rotating and reciprocating parts for piston lines and valve gear are given in Schedule IV. To estimate couples, a reference plane has been taken through the aft low-pressure cylinder; the values of the couples are given in the last column of the schedule. Since, in the present example, the settings of a successful engine is merely being checked over, it does not matter which polygon is drawn first, but, as for new engines, the reciprocating force and couple polygons should always be drawn first. That course will be adopted in the present instance.

The force and couple polygons are shown in full lines at B and A respectively, and it will be seen that each fail to close by a small amount. By drawing in the polygons for rotating forces and couples (D and C), also in full lines, it is found that these also fail to close by only small amounts.

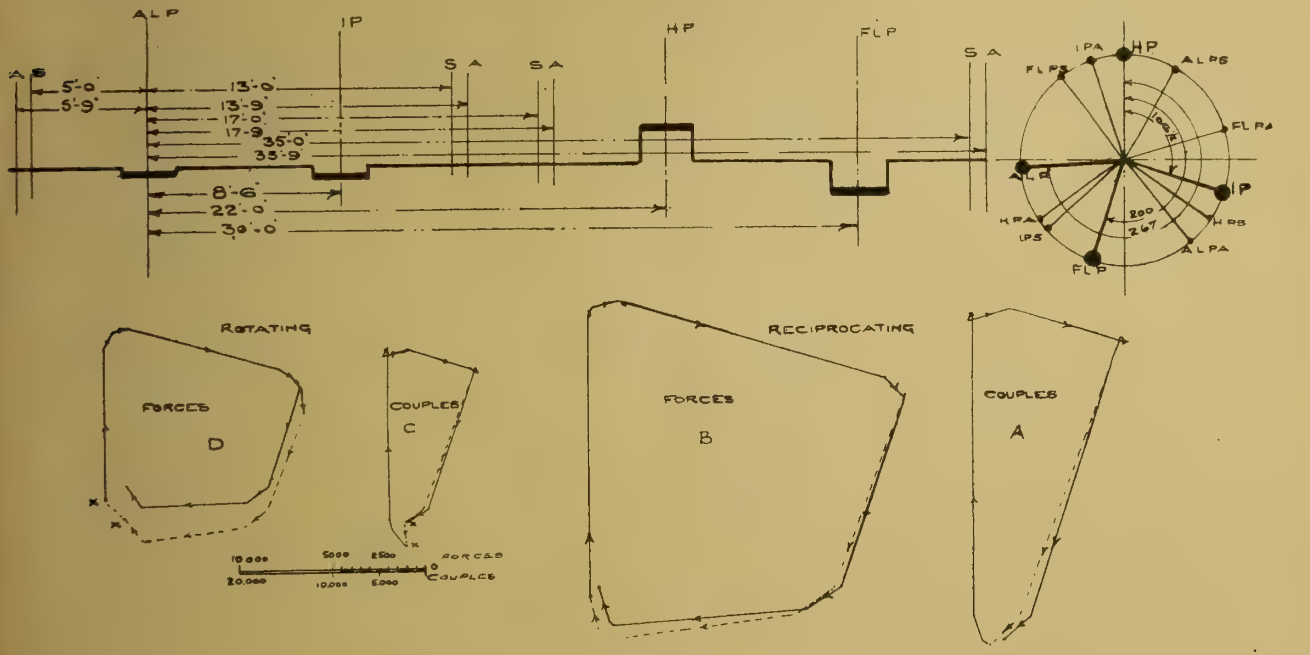


Fig. 158.

In designing an engine there are several variables, as the crank angles, reciprocating and rotating weights, distance between cylinder centre lines, order in which the cylinders are placed, and arrangement of valve gear. The first three are called chief variables.

By a suitable arrangement of these several variables and with due regard to interchangeability of cranks, etc., and making the crank angles suitable for manœuvring, the engine can be given an almost perfect natural balance. Where absolute balance is necessary, as in torpedo boats, this is easily secured by the addition of light balance weights.

For four-crank triple-expansion engines the sequence of cylinders is usually one of the following:—

(1) L.P., L.P., I.P., H.P., forward.
(2) L.P., I.P., H.P., L.P., forward.

For balancing purposes it is always best to get the heaviest cylinders in the middle and to place the lighter L.P. cylinders outside. The first arrangement allows a much neater arrangement of steam pipes and receivers, since the cylinders follow in a natural sequence.

For four-cylinder engines with cylinders to the second arrangement, the crank angles are usually after the style of fig. 158.

To illustrate the method of collective balancing without the aid of balance weights, an example of a triple-expansion

It was decided that balancing was quite good enough, especially as the engine did not run above 100 revolutions per minute, and on trial it ran evenly and without vibration.

Schedule IV.

Part.	Equivalent weights at crank pin in lbs.		Arm of couple in feet about A.L.P.	Couples in lbs.-feet.	
	Rotating.	Reciprocating		Rotating	Reciprocating
H.P.	8,500	15,000	22	187,000	330,000
H.P. ecc. ahd.	800	2,000	17¾	14,200	35,500
,, ast.	700	160	17	11,900	2,720
I.P.	8,500	15,000	8½	72,300	127,000
I.P. ecc. ahd.	800	2,000	13¾	11,000	27,500
,, ast.	700	160	13	9,100	2,080
F.L.P.	5,500	10,500	30	165,000	315,000
F.L.P. ecc. ahd	800	1,300	35¾	28,800	46,400
,, ast.	700	160	35	24,500	5,600
A.L.P.	5,500	10,500	..	..	..
A.L.P. ecc. ahd.	800	13,000	−5¾	−4,600	−7,480
,, ast.	700	160	−5	−3,500	−800

The out-of-balance forces should always be carefully estimated for different crank positions and plotted in the form of a curve; for this estimation the secondary effects must be included.

Taking first the case of vertical forces, these consist of

A—Reciprocating primary force

$$= \frac{W_1}{g} w^2 R \cos \theta ;$$

B—Reciprocating secondary force

$$= \frac{W_1}{g} w_2 \frac{R^2}{L} \cos 2 \theta ;$$

C—Rotating force vertical component

$$= \frac{W_2}{g} w^2 R \cos \theta .$$

Since the term $\frac{w^2 R}{g}$ is common to all, it can be left out of the calculations, and only brought in at the final stage, thus simplifying matters considerably.

(*To be continued.*)

EXPANSION IN STEAM PIPES.

The expansion in inches of a length of metal piping of l feet on rising in temperature through T deg. Fah. is given approximately by:—

$$\text{Expansion} = l \times T \times K \quad \ldots \ldots \quad (1)$$

where K has the following values:—

Cast iron	0·0000747
Wrought iron	0·0000773
Steel	0·0000767
Brass	0·0001250
Copper	0·0001130

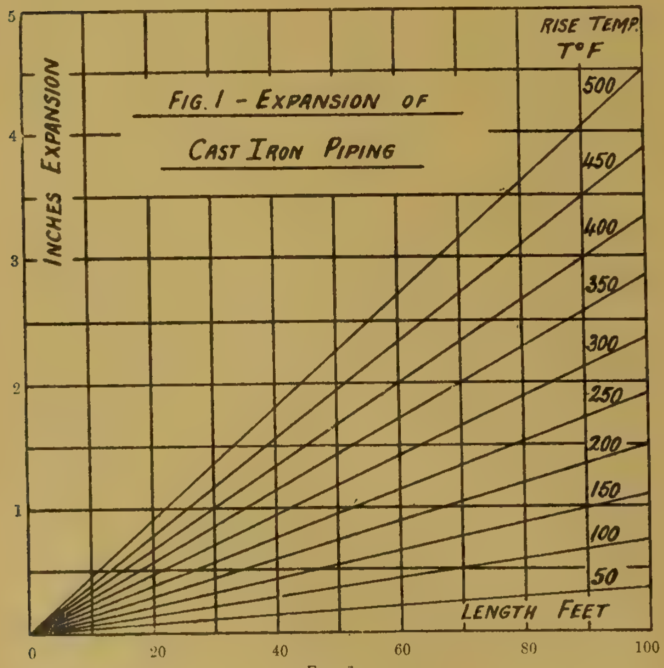


Fig. 1.

The above formula, however, does not allow for the appreciable variations which begin to appear in the value of K when T rises above, say, 300 deg. Fah. The lines drawn in fig. 1, however, do allow for this variation, and form a very convenient graphical representation of the law expressed by equation (1). Fig. 1 refers directly to cast-iron pipes, and to use it for pipe lines of other materials the expansion as determined from the graphs must be increased by

10 per cent for wrought iron and steel } approximately.
40 to 45 per cent for copper }
60 per cent for brass }

A convenient and simple rule to memorise is: "Allow for 1 in. expansion in 50 ft. of iron or steel steam piping." This rule, though approximate, usually errs on the side of safety.

Means of Allowing for Expansion.—As long as a pipe line is fairly freely suspended, and has a number of bends at reasonably short intervals, it is seldom necessary to provide any special means for permitting expansion. Where, however, there are long lengths of straight piping, this should be carried by rollers or rolling bushes on the suspending brackets or hangers, etc., and at a convenient point the piping should be carried up in a semi-circular loop (fig. 2) of as large a radius as possible (within reason, of course). This loop may be of the ordinary piping, bent to shape, or, if space is limited, a flexible copper loop of smaller radius may be employed. In other cases a straight length of corrugated (circumferential ridges) copper or steel pipe may be used. This takes up the expansion by a concertina-like action, but such a device often gives trouble by fracture

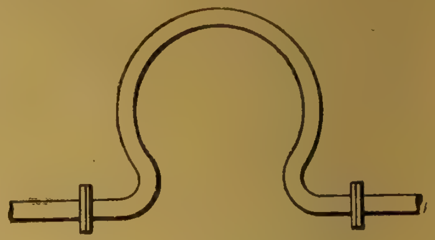


Fig. 2.

Sliding or gland joints may be provided in the pipe line at suitable intervals. These are satisfactory, providing they are kept tight. Guard bolts must be provided to prevent the pipes ever coming clean apart at such joints.

All the above devices are more or less trouble in practice, and it is best to entirely obviate their necessity, when possible, by adopting a suitable system of hanging and good wide sweeps at the bends (efficiency and pipe drainage considerations must not be forgotten, nor must the pipes be so arranged as to cause obstruction). When some additional means of taking up expansion is necessary, a good large "expansion loop" (fig. 2) is usually the simplest and most satisfactory provision for same.

THE JUNIOR INSTITUTION OF ENGINEERS.

At the annual general meeting of this institution held at the Royal United Service Institution, Whitehall, recently, a paper on "The Manufacture of Glass Bottles" was read by Mr. Bernard R. Kupferberg. In opening his paper, the author made extended reference to the construction of the furnaces, comparing the Siemens regenerating system with the old construction. He then entered into the analysis of the composition of the glass, showing the proportion of the different constituents, and followed with the methods in use in connection with the colour and discolouring processes. After considering the various types of floaters the question of temperature was discussed, followed by some observations on bottle blowing. Referring to gas producers, the author showed how the general features of design were determined upon, and gave examples of various types of producers, including one which he had invented himself containing a silo having a storage capacity sufficient for 24 hours, and an ingenious spiral arrangement for ensuring the uniform distribution of fuel as it enters the producer. Questions relating to the quality of gases and the height of the charge were then reviewed, and attention was next directed to the construction and working of annealing stoves. Points in connection with bottle-making machines were briefly considered in conclusion, and an interesting discussion followed.

A MODERN ABSORPTION REFRIGERATING PLANT.

The absorption machine, whilst inferior in efficiency to the vapour compression machine, possesses certain advantages which render it a desirable system for use in certain cases. The absorption machine resembles in its action the vacuum machine, with this difference that instead of water some liquid capable of evaporating at a low temperature without requiring the assistance of a vacuum is used as a refrigerating medium. The absorption refrigerating system described and illustrated below is abstracted from an article by Mr. F. E. Matthews on "The Absorption Refrigerating System," which recently appeared in *Power and the Engineer*, New York, and will be interesting to our readers as exemplifying recent American practice.

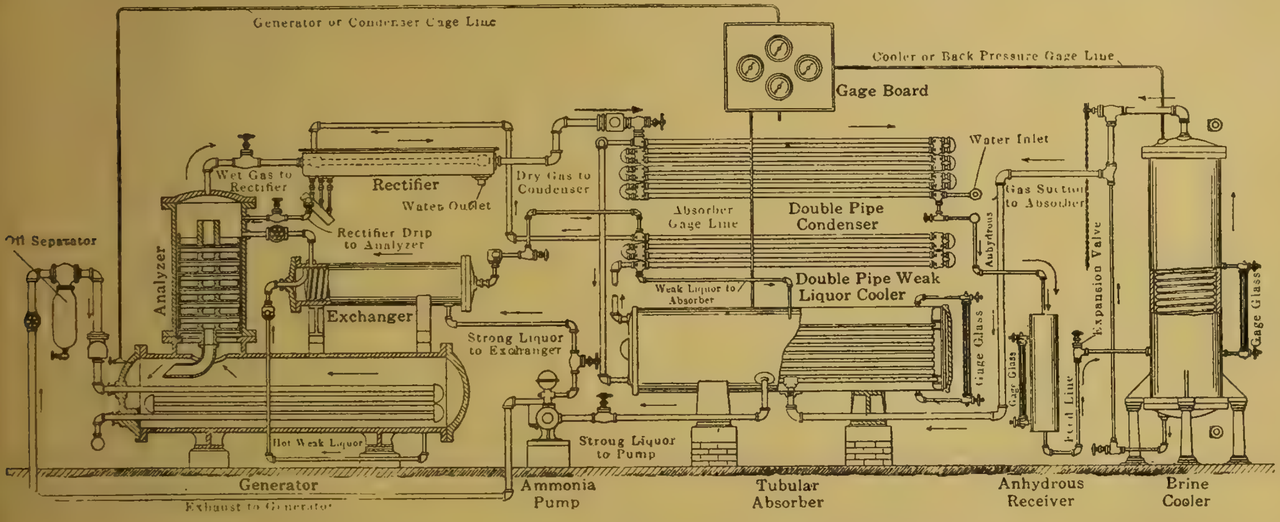


Fig. 1.—DIAGRAM OF COMPLETE COMMERCIAL ABSORPTION SYSTEM.

Fig. 1 is a diagrammatic representation of a modern absorption machine of a well-known make. On account of the similarity of the expansion side of the absorption system to that of the compression system already described in detail, it will be necessary to trace the working medium through only that part of the cycle between the expansion coils and the condenser.

Cooler.—In the type of machine illustrated in fig. 2, the expansion side consists of a brine cooler of the vertical cylindrical or shell type, such as is most commonly used in connection with absorption machines, but to some considerable extent with compression machines as well. The brine, usually calcium chloride, is circulated through nests of spiral coils within the cylindrical shell of the cooler, and the anhydrous ammonia is expanded into the space between the coils and the shell. The amount of liquid present is readily observed by means of a gauge glass. The cold ammonia vapour leaving the top of the cooler passes through the gas-suction line to the absorber, where it is joined by the weak liquor which has just undergone cooling in the double-pipe weak-liquor cooler. Since the absorption of the ammonia gas into the weak liquor takes place with the evolution of a considerable amount of heat, further means for cooling the liquor must also be provided in the absorber.

Absorber.—In some cases the absorber is of the double-pipe type, similar to double-pipe condensers and brine coolers. The type here illustrated consists of a horizontal cylinder containing coils of pipe, through which the cooling water which has previously done duty in the ammonia condenser passes. The cold, weak liquor is admitted at the top of the cylinder, passed down among the cooling coils, and there mingles with and absorbs the cold ammonia gas from the brine cooler.

As the cooling water has already been heated through several degrees in passing through the pipes of the ammonia condenser it is expedient that a counter current cooling effect may be carried out, in which the warmer outgoing cooling water cools the weaker aqua ammonia, and the incoming cooler water is employed to reduce the temperature of the strong aqua ammonia on its way to the generator through the ammonia pump and exchanger.

Exchanger.—The exchanger is a horizontal steel shell capable of carrying the full generator pressure through which the comparatively cool strong liquor is pumped on its way from the bottom of the absorber to the bottom of the generator. This rich liquor is shown entering the shell of the exchanger at the right-hand side, after which it traverses a spiral pipe coil and finally passes out into the top of the analyser, shown just above the generator. The exchanger is provided with nests of pipe coils connected in parallel, through which passes the hot weak aqua ammonia supplied to the manifold at the top of the exchanger by a pipe running to the bottom of the generator. In the counter current flows the hot weak liquor which must eventually be heated when ascending around the coils. By this heat exchange, cooling water is economised in the absorber and steam in the generator.

Analyser.—Leaving the top of the exchanger shell, the cool, rich liquor passes to the top of the analyser. Here it is allowed to trickle down over a set of metal trays, where, coming in contact with the ammonia vapours rising from the generator, the counter current heat-exchanging effect is still further continued. The hot ammonia vapour, entraining more or less aqueous vapour as it rises from the surface of the liquid in the generator in passing up through the analyser on its way to the condenser, encounters the descending rain of cool, rich liquor on its way to the generator. The former, which must eventually be liquefied in the condenser, is cooled, and the latter, which must eventually be boiled in the generator, is heated. This advantageous heat interchange also has the effect of actually condensing and returning to the generator a large percentage of the entrained aqueous vapours passing off with the ammonia, and also of liberating some ammonia gas through the heating of the gas-saturated rich liquor; where ample analyser capacities are employed, the incoming rich liquor should be within a very few degrees of the evaporating temperature by the time it finally reaches the surface of the boiling liquid.

Generator.—The generator, or still, as it is frequently called, is the ammonia boiler for the evaporation of the weak liquor enriched and changed into strong liquor by the absorption of ammonia gas direct from the expansion coils in the absorber. It consists of a substantial steel shell provided with a heavy cast-iron head, through which pass the ends of the steam coils provided for supplying the heat required for driving off the ammonia. The strong aqua ammonia enters at the top, where it remains by virtue of its specific gravity being lower than that of the weaker liquor at the bottom of the generator. The water of condensation from the steam used in the generator is usually returned to the boilers. This can be effected either by an automatically controlled pump or by a suitable high-pressure tap.

Rectifier.—After leaving the analyser, the hot ammonia gas passes to the rectifier, a water-cooled coil of pipes of sufficient area to insure the condensation of any aqueous vapours that may have escaped condensation in the analyser. The liquid condensed in the rectifier is rich, saturated liquor, which is returned to the generator by way of the analyser.

Condenser.—From the rectifier the ammonia gas, which should now be practically free from aqueous vapours, is passed to the condenser. Condensers for absorption machines, like those for compression machines, may be of either the atmospheric double-pipe or shell type as preferred. The anhydrous ammonia liquefied in the condenser passes to an anhydrous receiver, similar to those used in the compression system, from which it is drawn as required for expansion in the brine cooler, its flow through the feed line being regulated by the usual expansion valve. After evaporation in the brine cooler the ammonia gas again passes to the absorber, after which the working cycle is repeated.

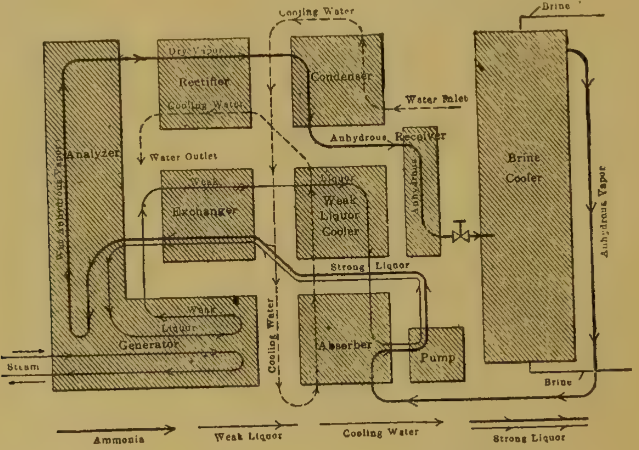


Fig. 2.—Diagram showing Paths of Ammonia, Cooling Water, and Ammonia Liquor through Various Members of Absorption System.

Cycle Traversed by Ammonia.—This can be readily traced by following the course of the heavy arrows in fig. 2. The circuits of both the gaseous and aqueous components of the aqua ammonia refrigerant, as well as that of the cooling water, can be more readily followed out by means of the diagram, fig. 2, in which all mechanical details have been omitted, and the several members of the refrigerating system illustrated in fig. 1 are represented by shaded areas occupying approximately the same relative positions on the diagram. The path of the ammonia is represented by a heavy solid line, that of the water component of the aqua ammonia refrigerant by a narrow solid line, and that of the cooling water by a broken line. The direction of travel in each case is indicated by arrows.

From this diagram, as well as from fig. 2, it will be seen that, as "anhydrous ammonia," the refrigerant starting from the "anhydrous receiver" passes to the "brine cooler," where, in changing to the gaseous state, it performs its sole function of absorbing heat from the brine. As saturated low-temperature ammonia vapour, the refrigerant starting from the brine cooler pases to the absorber, where it enters into solution or is absorbed by the weak liquor from the generator, forming strong liquor. As hot strong liquor the refrigerant, starting from the absorber, passes through the exchanger, where it gives up some of its heat to the weak liquor on its way to the absorber, then on by way of the analyser into the generator, where the ammonia gas is driven out of the strong liquor solution, under high pressure, by the application of heat, and passes through the analyser and rectifier into the condenser, leaving the impoverished aqua ammonia or weak liquor behind in the generator.

In the condenser the heat originally absorbed by the anhydrous ammonia in changing from the liquid to the gaseous state in the brine cooler, as well as that added to increase its temperature and drive it out of solution in the generator, is given up to the cooling water, circulated through the condenser, causing the ammonia to return to the liquid state, after which it flows to the anhydrous receiver, and the cycle is again traversed.

The aqueous component of the aqua ammonia refrigerant, starting from the bottom of the absorber in company with the ammonia in the form of strong liquor, passes through the exchanger and analyser into the generator. Here it is separated from the greater part of the ammonia and returns through the exchanger and weak-liquor cooler to the absorber. Here it again joins the anhydrous ammonia, forming strong liquor, and retraces the path just described.

Path of Cooling Water.—The cooling water is admitted first to the ammonia condenser, where it performs its most important function of removing heat from and liquefying the ammonia gas. After leaving the ammonia condenser it is still cool enough to be capable of absorbing a considerable amount of heat from the strong liquor in the absorber, more from the weak liquor fresh from the generator in the weak-liquor cooler, and still more from the hot ammonia gas fresh from the generator in the rectifier, after which it usually passes to waste.

Still another line might have been drawn on the diagram in fig. 2 indicating the path traversed by the heat from the point of its absorption from the brine in the brine cooler to that of its expulsion with the cooling water from the condenser. Such a line, however, would coincide with that representing the ammonia from the point where the heat and the vapours of the refrigerant leave the brine cooler, continuing to the condenser, where it would cross over and join that representing the cooling water. It would then follow this line through its circuitous passage to the point where, together with the water, the heat flows away to the sewer.

It should be noted that throughout the entire system a counter current effect is carried out between the cooling and the cooled substances.

By these counter current cooling effects, in which the coldest cooled substance gives up its heat to the coldest cooling substance, and the hottest cooled substance to the warmest cooling substance, the outgoing substance is cooled more nearly to the temperature of the incoming cooling substance than would otherwise be possible, thus effecting economy not only in the amount of the cooling substance required, but also in the operation of the system through the reduction in the amount of the refrigerating medium required for a given amount of cooling.

Dundee and Arbroath Railway.—Some misunderstanding has been created as to the future management of the Dundee and Arbroath Joint Railway. To-morrow the line will be controlled and managed jointly by the respective managers of the North British and Caledonian Railway Co.'s at Dundee. The salaries and wages of the staff are to be paid for a period of three years by one company, and for the next three years by the other company. Joint line accounts will be kept entirely separate from the main systems, and an audit office is to be created either in Glasgow or Edinburgh.

AN IMPROVED HEATING AND ANNEALING FURNACE

The furnace described in this article is designed for sheet mills and for tin plate mills of the kind in which a single furnace grate is used for heating both a bar-heating furnace and a furnace or pair of furnaces for open-annealing or reheating sheets, and comprises improved means whereby the grate can be utilised at will for heating the bar-heating furnace only, or the sheet annealing or reheating furnace or furnaces only. The improvements are the invention of Messrs. John Lysaght Ltd., of Orb Ironworks, Newport, Monmouth, in conjunction with Mr. Samuel Whitmore, and our illustrations show in fig. 1 a longitudinal section through a combination furnace, in which the bar-heating chamber is in position between the fire-grate and a pair of sheet-annealing or reheating chambers, the section being taken substantially along the central line of one of the sheet-annealing or reheating chambers and along the central line of the fire-grate. Fig. 2 is a sectional plan view of the furance shown by fig. 1, the upper half being taken substantially in the plane indicated by line $x\,x$, and the lower half substantially in the plane indicated by line $x^1\,x^1$ of fig. 1. Fig. 3 is a vertical section taken on line $y\,y$ of fig. 1. Fig. 4 is a vertical section taken on line $y^1\,y^1$ of fig. 1, and fig. 5 is a longitudinal section, corresponding to fig. 1, showing a furnace in which the fire-grate is between the bar-heating chamber and the sheet-annealing or reheating chambers.

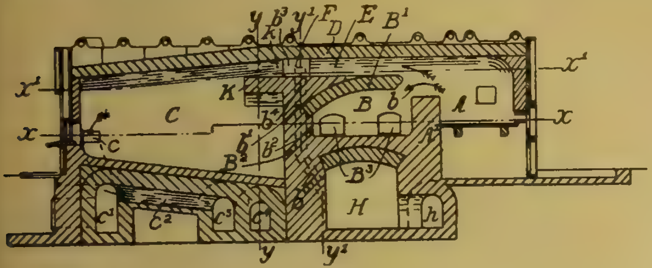


FIG. 1.

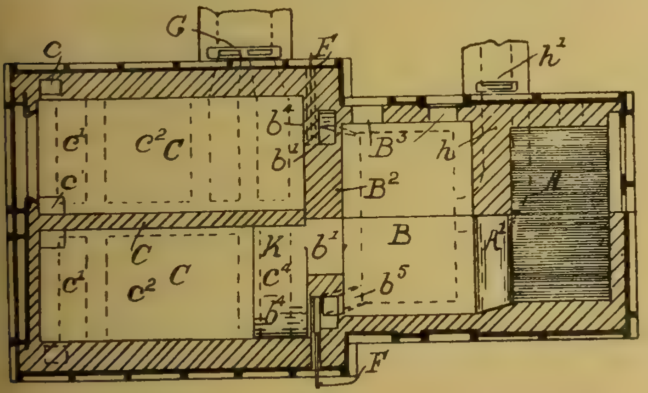


FIG. 2.

A is the furnace grate, B the bar-heating chamber, and C C the sheet-annealing or reheating chambers. D is the furnace crown, which extends from the outer side of the furnace grate to the forward end of the chambers C C. B^1 is an arch which spans over the chamber B, and is curved, both right across between the sides of the entire structure and down towards the back wall B^2 of the chamber B. This arch constitutes a roof to the chamber B, and between this roof and the crown D of the entire structure is a flue E, through which products of combustion may pass from the furnace grate A direct into the chambers C C. An opening b is left between the bridge A^1 of the furnace grate and the roof B^1 of the chamber B, through which products of combustion may pass direct into the chamber B. Flues b^1 are formed within the thickness of the back wall B^2 of the chamber B, with which openings b^2 of the chamber B communicate, these openings being in position low down within the chamber B at opposite ends of the face of the wall B^2, which is exposed within the chamber. The wall B^2 is carried up, as indicated at b^3 b^3, at opposite sides of a narrowed portion E^1 of the flue E, and openings b^4 communicate between the upper ends of the flues b^1 and the chambers C C respectively, and these openings are controlled by dampers F. Products of combustion passing into the chamber B pass out through the openings b^2, flues b^1, and openings b^4, into chambers C C. The products of combustion which pass into the chambers C C, whether through the flue E or the flues b^1, pass out therefrom through flues c at the forward ends of the chambers, low down therein, as is usual, and thence into transverse flues c^1 beneath the chambers, back along flues c^2 into transverse flues c^3 c^4 respectively, each of which is controlled by a damper G, and thence to the chimney. B^3 B^3 are the charging doors into the bar-heating chamber, a pair at each side thereof. The flues b^1 are continued downwards as flues b^5 into a flue H, which is beneath the chamber B, and communicates through a flue h, controlled by a damper h^1, with the chimney. If it is desired to work the chamber B without working the chambers C, the dampers F are closed and also the dampers G, and the products of combustion from the furnace grate A pass entirely into the chamber B and thence through the flues b^5 to the chimney. If it is desired to work the chambers C without working the chamber B, both the dampers F are closed and also the damper h^1, the entire products of combustion from the furnace grate then passing into the chambers C through the flue E. An arch K is turned, as is usual, over the rear ends of the chambers C C, leaving a space k between itself and the crown D for the passage of products of combustion, to ensure that such products will have a tendency to pass along under the crown.

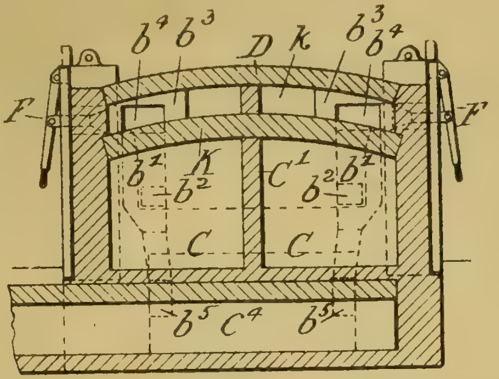


FIG. 3.

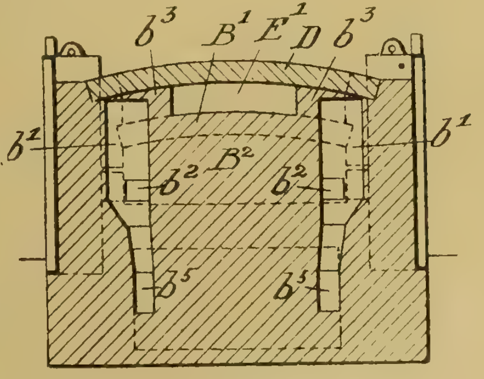


FIG. 4.

In the arrangement shown by fig. 5, the furnace grate A is between the bar-heating chamber B and the annealing chambers C, and the products of combustion pass over a bridge M into the chamber B, thence down flues *m*, corresponding to the flues b^5, into a flue H underneath the chamber, and thence through a flue h^2, controlled by a damper (not shown), to the chimney; and products of combustion pass from the furnace grate over a bridge N into the chambers C. The chamber B or the chambers C may be cut out by simply closing the damper or dampers which controls or control the flue or flues through which gases pass therefrom to the chimney.

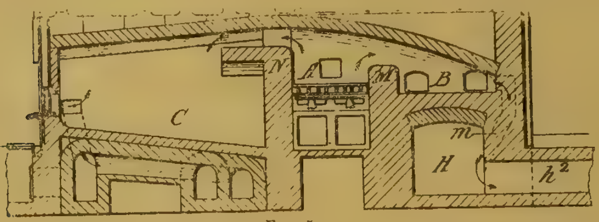


FIG. 5.

In either of the forms shown there may be a single chamber C only, the flues b^1, in the form first described, both opening in such case into such a chamber.

It will be seen from the above that the improvements consist essentially in means whereby products of combustion may pass direct through downward flues from the bar-heating furnace to the chimney without passing into the furnace for open-annealing or reheating sheets.

A NEW COMPUTING DIAL.

THE Payne-Gallwey computing dial, the sole makers of which are Messrs. W. F. Stanley and Co. Ltd., Great Turnstile, Holborn, London, W.C., gives 2,107 answers direct in plain figures which can be seen instantly, no intricate calculations with figures or logarithmetical scales being required.

The instrument is the invention of Mr. Wyndham Payne-Gallwey, and is not an adding, multiplying, or dividing machine; nor are the answers arrived at on the principle of the slide rule by logarithmetical scales composed of a great number of lines from which answers have to be deducted. Within the limits of the capacity of this instrument, it is far superior to the slide rule, insomuch that all answers upon it can be read off in plain figures and decimals, its answers, in a great number of cases, giving the whole numbers and four places of decimals, which can be read instantly, without having to remember intricate rules, to find the number of digits in the answer and position of the decimal point.

It can be used out of doors in bad weather without any figures running or becoming rubbed off. If it becomes dirty from use in the works, the dirt can easily be rubbed off and made clean and easy to read again.

With one setting of an indicating arm of this instrument—for each of the following results—the answer can be read off direct in plain figures over the top edge of the arm. In some cases three or more answers are given simultaneously with one setting of the arm.

The front face gives circumferences from diameters in inches and fractions and vice versa; areas from diameters in inches and fractions and vice versa; millimetres from inches and fractions and vice versa; centimetres from inches and fractions and vice versa; decimetres from inches and fractions and vice versa; parts of a metre from inches and fractions and vice versa; sovereigns and shillings to francs and vice versa; millimetres to the decimal of an inch and vice versa; decimals of an inch to fractions and vice versa; decimals of a foot to the fractions of an inch and vice versa; decimals of a foot to inches and vice versa; decimal of a shilling to farthings and vice versa; decimal of a shilling to pence and vice versa.

The back face gives hydraulic powers at 1,500 lbs. per square inch from diameters in inches and fractions and vice versa; gallons contained in cylinders, pipes, pumps, etc., per foot run, from diameters in inches and fractions and vice versa; weight of gallons of water per foot run in above and vice versa; pounds to the decimal of a hundredweight and vice versa; quarters and pounds to the decimal of a hundredweight and vice versa; shillings to the decimal of a pound and vice versa; shilings and pence to the decimal of a pound and vice versa; hundredweights to the decimal of a ton and vice versa.

The instrument should prove most useful to all those having to make any of the calculations enumerated above, and would be especially valuable to teachers of the decimal and metric systems.

THE ELEMENTS OF ENGINEERING ESTIMATING.

By A. SUGGATE, A.M.I.C.E.

INTRODUCTION.

OF all the various departments that in the aggregate constitute an up-to-date engineering works, the estimating department evidences the least amount of trained thought and fixed principle, applied to the management of and manner or style of its work. The reason of an equal standard of excellence not being maintained in the estimating department is the natural consequence of the larger part of the manufactured work or output of the majority of engineering firms being of a repetition nature, necessitating merely repetition estimating.

But supposing such firms, wishing to enlarge, cater for work other than that they are in the practice of executing, or the trade in a firm's special line falls off, and the owners, with a laudable desire, wishing to retain their men by securing other work, perhaps of a varying description, and quite foreign to that hitherto manufactured by them, tender estimates for same, with the result that the estimating department has to face problems of a nature that its experience affords no data to solve, with the almost unvarying result of the firm losing money, either in getting out the estimate or on the work, if the contract is secured. If, as is sometimes the case, the drawing department be spoken of as the brains of the establishment, certainly the estimating department admits of being described as its heart, and if anything is lacking, so as to hinder its vigorous action, the firm, as a system, suffers in consequence.

Some personal experiences of the writer will illustrate the above remarks. About fifteen years since a firm in the North of England, the larger part of whose trade was ironfounding, and employing some 120 men, desired to enlarge its business in general engineering. With this object in view the firm tendered for every engineering work on the market, sending out quite 300 estimates per annum over and above the number required for their usual trade, and only succeeded in securing orders altogether amounting to some two per cent of the number of estimates tendered, and on one of these orders dropping some £200. The proprietor was manager, well up in foundry prices, and the estimator an ordinary clerk, some twenty-five years of age. As the manager was frequently absent looking up orders, the clerk had a list of the percentage of profits expected to be realised on various work. In another case that occurred about the same time, a firm in the South of England, of deservedly world-renown reputation, lost its senior partner. The junior partner carried on the business with the aid of a general manager specially engaged to take charge of the estimating, his apparent qualification for the post being the introduction to the firm of some electric specialities he had been making in a very small works of his own. The firm tendered extensively for large contracts and heavy work, and any questioning that might arise at their low quotations was set at rest by remembering the firm's renown. In two years' time the firm sold up, having dropped many thousands of pounds.

In happy contrast to the above was the practice of a firm in the south-west of England that commenced business in the early forties of the last century. In about twenty years they were employing some 300 hands, and, wishing to enlarge, they engaged as chief in their estimating department the head clerk out of a large broker's office. This clerk had been an university undergraduate, thus possessing a trained intelligence, but, knowing nothing of cost of work or its manufacture, obtained these particulars from the chief draughtsman, the latter being raised to the post of manager of the drawing office and advisory engineer to the firm. The result of this unusual combination of trained intelligence was the firm securing the order of nearly all the contracts and work they estimated for. Their success was phenomenal, the establishment soon numbered the workpeople by thousands, and only quite recently one member of the firm died a millionaire.

Contrast these three cases. In the first, the results amply showed up the complete inefficiency of the estimating department; in the second case, the disastrous results arising from estimating by erroneous methods the cost of large work, from the cost data, derived from relatively small work, while the third evidenced the great success attending the combination of trained intelligence with high mechanical ability. By "trained intelligence," as here used, is meant the ability to judge correctly the results or effects from known causes, and when possessed by an estimator it enables him to so adjust prices as to ensure the favourable reception of his estimate.

In these articles all the technical information required for ordinary estimating will be given, enabling the young engineer, wishing to qualify himself for this important branch of the profession, to secure an elementary grounding otherwise only obtainable by a lengthy term of service in an office, while the young clerk in an estimating office, who perchance may peruse these articles, is advised to attend evening science classes, to understand the purport and use of squared paper, and familiarise himself with the handling of scales, rule, and set squares.

The reader is cautioned that the prices of wages and materials given in these articles must be regarded as average prices only, the locality of the works being close to docks, mining centres, large iron and steel depôts, or otherwise a distance off same, with extra carriage to pay, will determine the same in each individual case.

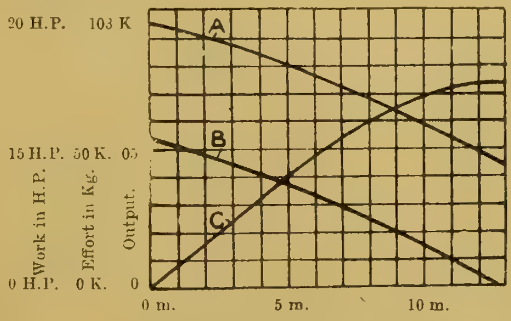
The Meaning of a Cost Estimate.

Where a firm is asked to quote prices for work, the particulars of the new work are handed to the estimating clerk for his department to supply an estimated prime cost of same. The expression "getting out cost of work" does not convey the correct idea of procedure, however much the estimating department may understand the expression so to mean, for the ordinary manner of getting out cost estimates affords no information as to the cost data upon which the prices are based, and on examining an ordinary cost sheet one feels like a man making his way in a flat country towards an object of interest whose altitude enables it to be seen some distance off; he comes to cross roads and, unable to see their endings, takes his chance of selecting the right one, whereas if he possessed a map of the district he could, without any hesitancy, have gone straight at once to the object. So a cost estimate should be a chart of *the amount and manner in which the firm proposes to spend its capital in producing the required work*, and this is the sense in which a cost estimate will be understood and spoken of in these articles. If thus made out, the manager can see at a glance of its accuracy, and when checking the firm's weekly expenditure also to see if the cost of labour in any of the departments is exceeding the amount allowed for in the estimate, and, if so, giving him the opportunity of correcting the data of the estimating department, or otherwise reducing the cost of labour. This view of a cost estimate is not so important when the amount is small, say a few pounds, as when the cost runs into many hundreds and thousands; at the same time, the idea of the cost estimate being a chart of the firm's expenditure in producing the work proposed to be done should always be present in the estimator's mind, and a small cost should be no excuse for neglecting to make the estimate clear in this respect. Estimates thus made are sometimes spoken of as analytical, and adversely criticised on account of the length of time they take to make out, but they are an absolute necessity in the case of estimates of work of a kind the firm has had no previous experience. Afterwards the results obtained from the analytical estimate may be summarised and used for abridging the labour in future estimates for similar work. Examples of the correct and incorrect methods, also of summarising results of analytical estimates, illustrating the remarks in this paragraph will appear in their proper place.

(To be continued.)

AEROPLANE PROPELLERS.

Le Genie Civil, Paris, published some time ago an article containing the results of a number of most interesting experiments made by Captain Dorand at the Calais-Meudore aeronautical laboratories on the actual propelling power of aeroplane propellers. The arrangement used in the experiments consisted of starting in calm air a dynamometrical wagon on a meter track having two inclines in inverse directions with an intermediate level portion. A dynamo excited in shunt connected with two insulated rails operated through chain gearing the propeller to be tested. Registration instruments gave the propelling force P, by a Richard's hydraulic dynamometer. The speed of rotation of the propeller and that of the wagon were obtained by chronographs. The work expended upon the propeller shaft was measured by electrical measuring instruments. Special chronographs permitted of obtaining an absolute agreement of time. The speed of the dynamo was maintained constant. The speed of the wagon was accelerated during the descent; on the level portion a speed of 12 m. per second was obtained. Note was taken of the augmentation of effort due to the weight on the incline, and to the diminution due to acceleration.



A. $P = \phi(V)$ $n = 10$ revs. per second.

B.—$T = \phi(V)$ $n = 10$ „ „

Wooden propeller: 2·50 m. Pitch = 1·875.

Experimental curves: $P = \phi_1(V)$; $T = \phi_2(V)$

Output: $r = \frac{PV}{T}$.

Fig. 1.

Equations of Similitude of Supporting Screws.—D being the diameter, n the number of revolutions of the propeller—

Power on the shaft $P = \alpha n^2 D^4$.

Work consumed $T = \beta n^3 D^5$.

α and β = constant coefficients for similar propellers.

Colonel Renard defines the quality of the propeller by the ratio—

$$\frac{P^3}{T^2 D^2} = \frac{\alpha^3}{\beta^2}.$$

Equations of Similitude of Propelling Screws.—The speed V of transmission of the screw (D n) must be taken into consideration; V^1 D^1 n^1 being the elements of a similar screw, it was demonstrated that the operative angles will be the same if

$$\frac{V}{n D} = \frac{V^1}{n^1 D^1}. \quad . \quad . \quad . \quad . \quad . \quad (1)$$

The surfaces are proportional to D^2 and D^{12}.

The ratio of effort $\frac{P}{P^1} = \frac{n^2\,D^4}{n^{12}\,D^{14}}$.

The ratio of work $\frac{T}{T^1} = \frac{n^3\,D^5}{n^{13}\,D^5}$.

These equations are the same as those for supporting screws, and may be expressed as follows :—

$$\frac{P}{P^1} = \frac{V^2\,D^2}{V^{12}\,D^{12}} \quad . \; . \; . \; . \; . \; . \quad (2)$$

$$\frac{T}{T^1} = \frac{V^3\,D^2}{V^{13}\,D^{13}} \quad . \; . \; . \; . \; . \; . \quad (3)$$

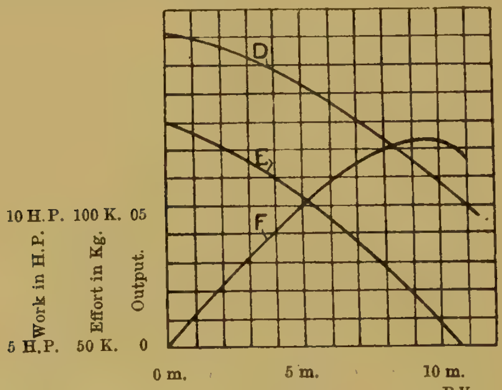
Experimental proof.—Let

$$P = \phi_1\,(V) \quad . \; . \; . \; . \; . \; . \quad (4)$$

and

$$T = \phi_2\,(V) \quad . \; . \; . \; . \; . \; . \quad (5)$$

if the corresponding curves for different values of n be constructed, it will be established that the formulæ (2) and (3) are practically correct.



D.—$T = \phi_2\,(V)$. E.—$P = \phi_1\,(V)$. F.—$r = \frac{P\,V}{T}$.

Wooden propeller : 4·30 m. Pitch = 3·225.
Experimental curves : $P = \phi_1\,(V)_1$; $T = \phi_2\,(V)$.

Output : $r = \frac{P\,V}{T}$.

FIG. 2.

For a similar screw, taking $D^1 = D$, we have

$$\frac{n}{n^1} = \frac{V}{V^1}\,; \qquad \frac{P}{P^1} = \frac{V^2}{V^{12}}\,; \qquad \frac{T}{T^1} = \frac{V^3}{V^{13}}.$$

Captain Dorand has given the curves of two similar screws as 2·50 m. and 4·30 m. See diagrams, figs. 1 and 2.

Output.—The output may be expressed by

$$r = \frac{P\,V}{T}.$$

In tracing the curve for a value n of the number of revolutions it will give a maximum which will be the same, for two similar screws (2) and (3) give

$$\frac{P\,V}{T} = \frac{P^1\,V^1}{T^1} = r.$$

The maximum output corresponds with an angle of inclination of 3 deg. 50 mins. or 3 deg. 57 mins. on the plane of rotation. The working angle for an equal output is the same for similar screws.

Recoil.—The relative recoil is

$$\frac{n\,H - V}{n\,H}.$$

At the highest output with $V = 10{\cdot}80$ m. and $n = 10$ revolutions, this recoil for a screw of 2·50 was 0·29. If V be augmented the recoil diminishes and the output decreases up to zero for $V = n\,H$. An angle of working less than 3 deg. 57 mins.

There remains to be determined the influence of pace and of the area of the planes.

The maximum output does not surpass 75 per cent for the screw, and the output of the whole apparatus, motor, transmission, and screw propeller, 50 per cent as for vessels and locomotives.—Translated from *Le Mois Scientifique et Industriel.*

EXHIBITION AT GREAT YARMOUTH.

HOWEVER advantageous a new innovation may be in connection with an old industry, a vast amount of demonstration work is needed before even a limited adoption can be expected. A case in point is the use of oil motors as auxiliary power for the propulsion of fishing craft during calm weather or adverse winds. The increased earning power owing to the extended field and earlier landing of the fish have long since been proved, yet the adoption of oil motors by the owners of fishing boats still extends but slowly.

With a view to giving an impetus to this development and exhibition of marine oil engines is now being held at Great Yarmouth, the owners and crews of the numerous fishing boats which frequent the harbour at this season being thus afforded an opportunity of studying the various rival designs. The engines exhibited are confined to powers suitable for full-sized herring drifters, whilst the fuel is limited to paraffin or crude oil.

Seven engines are shown running, five of which can be loaded by propellers working in water tanks or by brakes, almost all of the examples having already proved satisfactory for propelling vessels of this type.

The engine shown by Messrs. Blackstone and Co. Ltd. is of the four-cycle type with four cylinders, and develops 80 H.P. at 450 revolutions when fed with crude oil. Air only is compressed, a charge of oil being sprayed into the cylinder by compressed air from a separate reservoir near the end of the compression stroke. This charge is fired by the flame from a hot bulb which is fed by an oil spray. The bulb has to be heated by a blow lamp before starting, the temperature being afterwards maintained by the combustion. Oil for each cylinder is supplied by a separate pump, which delivers into the hot bulb, the overflow being diverted to the main cylinder spray. A 2-H.P. auxiliary engine is used to compress air to 400 lbs. for starting and oil injection. The fuel pumps are controlled by a governor, but enough oil for the hot bulbs is always delivered, thus rendering the ignition independent of the load. To demonstrate this point the engine is run light. This engine reverses by sliding another set of cams into gear, a system which is both simple and effective.

The "Gardner" paraffin engine shown by Messrs. Norris and Henty has three cylinders working upon the four-cycle principle, with an output of 60 B.H.P. at 500 revolutions. Ignition in this case is by L.T. magneto, and the vaporisers are heated continuously by lamps when the engine is running. Control is effected by a powerful shaft governor, which varies the lift of the inlet oil valves down to light loads, when the "hit and miss" principle comes into action, this feature being of great advantage when the propeller lifts out of the water in heavy seas. The engine is shown connected to a "Gardner" reversing gear, to which is coupled a tail shaft and propeller, but no attempt has been made to introduce any load.

Another example of the crude oil engine is shown by the Griffin Engineering Co., the main feature of this motor being a very large vaporiser in which tar is eliminated and recovered. Oil is sprayed into this vaporiser at 20 lbs. pressure, air being supplied by a pump on the crankshaft. Ignition is by the firm's "Cata Thermic" method, whilst a heavy free flywheel is used for starting, in connection with a suitable clutch. This engine is shown working under load by means of a brake on the flywheel.

The British Kromhout two-cylinder engine shown by Messrs. Perman and Co. Ltd. has several interesting features. Starting is by petrol, but so arranged as to eliminate all risk of fire or explosion. The petrol tank is situated on deck, and certain connections are provided for giving a measured charge to each cylinder. Once this charge has been used, no petrol exists below deck, even in the connecting pipes. Of course, with petrol an immediate start can be made at any time without the usual preliminary warm up of the vaporisers by lamps. An arrangement of low-tension oscillating magnets is used for ignition, whilst governing is effected by "hit and miss" in connection with the fuel pump and the exhaust valve, the tappet for the latter being thrown out of gear when the speed rises. By these means the exhaust gases remain in the cylinder and cushion the piston, whilst at the same time they prevent the incoming of air, which would have a cooling effect. Another ingenious feature is the automatic reduction of the water circulation when the reverse lever is in the central position, so that the cylinder shall not be unduly cooled at no load. This engine is shown connected to a reverse gear and loaded propeller, the control arrangements being brought up to an imitation deck. Paraffin is used as fuel, and 56 H.P. are developed at 285 revolutions.

Messrs. Wm. Beardmore and Co. Ltd. are showing the same engine as they recently exhibited at Olympia, hence it has already been fully described in our columns. The engine was, however, shown running in this case, and the working appeared to be in every way satisfactory.

As would be expected from a firm of such world-wide repute, the engine shown by Messrs. John I. Thornycroft and Co. Ltd. was an exceedingly handsome piece of work, and the running left nothing to be desired. The engine has four cylinders of the four-cycle type, and develops 47 B.H.P. at 500 revolutions. Only one vaporiser is used for all four cylinders, and it is heated before starting by the usual blow lamp. Means are taken to retain the heat, so that starting after a stop of an hour's duration is practicable without again warming up. Furthermore, provision is made for varying the heat of the vaporiser according to the quality of the fuel. Alternatively petrol may be used for starting. Ignition is by H.T. magneto, which the makers have found to possess advantages in actual practice on fishing vessels, although low-tension gear can be fitted if preferred by the purchaser. A special feature is the method of lubrication, the oil being pumped from the crank case and allowed to flow through a series of nozzles into corresponding cups. By these means a stoppage can be at once detected and rectified. Reverse gear and a loaded propeller are connected to the engine.

One of the simplest engines being exhibited is the "Bolinder," for which the agents are Messrs. James Pollock, Sons and Co. Ltd. This is a two-cycle engine with two cylinders, having a combined output of 40 B.H.P. Gas and air distribution is controlled by the pistons, which uncover and close certain ports, hence the working parts are confined to a fuel pump for each cylinder. Air only is compressed, the oil being pumped into an igniter bulb at the top of the stroke. The engine is reversed by gear which temporarily cuts out the fuel pumps and introduces a reversing pump until speed is attained in the opposite direction. Crude oil is used with this engine, and starting is effected by compressed air. A propeller immersed in a water tank in included.

This completes our list of marine motors. Other exhibits include the Hesse marine reverse gear, in sizes ranging from 12 to 120 H.P., and a very interesting series of models of Japanese motor fishing boats built in Japan, where this type of craft has obtained extensive adoption.

Altogether the promoters, Messrs. Gray and Crowley Ltd., may be congratulated upon having got together a very interesting and instructive collection of marine oil engines. The exhibition remains open until November 12th.

STEAM TRAPS.

The steam trap is a very necessary and useful part of a steam power plant, its function being, as is well known, to allow of the discharge of the water of condensation from the steam pipe lines, engine cylinders, or other part to which it is fitted, whilst preventing any escape of steam, *i.e.*, it must "trap" the steam. Of all the very numerous traps made, and there are said to be 150 makers in this country, there are few that can be relied upon to efficiently perform their function after a short period of use. In fact, the great difficulty experienced in producing a trap which will discharge water only has led to the production of dribbling appliances in which there are no moving parts dependent for their actuation upon the accumulation of the water of condensation. We refer to that form of appliance in which there is attached to the drip pipe a plug-like member providing a long tortuous path to a freely open discharge outlet of but small diameter. By the aforesaid means it is claimed that all the water of condensation is discharged, whilst no steam escapes, for it is condensed in its passage through the tortuous path to the outlet. This form of appliance—which hardly seems to be a trap—may do well for some services but it cannot deal with a flood of water in the drip pipe owing to the necessarily small bore outlet, and it is always liable to be choked by the smallest piece of sediment of which there is usually plenty. Its cheapness is its greatest virtue.

The conditions under which a steam trap works may be very exacting. For example, the water of condensation may be of but a few degrees less temperature than the steam, the range of steam pressures may be very great (the Admiralty specify a range of 1 to 300 lbs. without hand adjustment of the trap) and there may be impurities in the water which injuriously affect the discharge valve. Still to be a steam trap the appliance must meet these conditions.

There is no doubt that a well-constructed float trap is a very efficient apparatus, but when the pressure in the pipe line being drained is very high, either the discharge outlet has to be of small area or the float has to be of unduly large proportions to perform its function in a thoroughly reliable and efficient manner. There are 2 in. float traps weighing up to 2 cwt. and costing up to £12. In some float traps the pressure of the steam does not directly act against the float, as the trap valve is screwed on to and off its seat by the action of the float as it falls and rises.

The cheaper form of trap for high pressures is the expansion trap which depends for its "life" on the difference between the temperature of the steam and of the water of condensation.

Expansion traps are chiefly of two types, (1) those in which the discharge valve is operated by the differential expansion of two tubes, or a tube and a rod, and (2) those in which the expansion and contraction of one tube alone actuate the valve.

In the former, the two members are set in the manner of the jib and tie rod of a horizontal jib crane, the valve being fitted at the point of union of said members. By this arrangement the expansive and contractile movements of the tubes are greatly multiplied without the use of levers, cranks, etc. In this class of trap, which has been very successful, the tubes are undoubtedly subjected to injurious stresses which have been known to fracture the iron or non-expanding tube. In the latest form of this trap there are a rather large number of springs used to perform or assist in performing various movements. The load upon the discharge valve tending to keep it upon its seat is automatically adjusted by the pressure in the pipe line being drained.

In the form of trap in which the discharge valve seat is directly attached to the expansion tube, it is obvious that if the opening movement of the valve was only due to the expansion and contraction of said tube, it would be a very slight movement indeed, seeing that the tube may be only 12 in. to 18 in. long. Many inventors and makers rest content when they obtain these minute movements and disregard the question of the scoring of the valve seats due thereto and the difficulty in getting the trap to deal with a flood of water. The trap is at the best a dribbler. But in one well-known trap of this type, a pop action is obtained giving a full-bore discharge each time the valve is opened by an arrangement of valve with inner and outer seating surfaces. The expansive movements of the brass (or expansion) tube cause the separation of the inner seating surfaces, when a larger area is exposed to the pressure within the trap than formerly. The spring load on the valve is therefore overcome and the valve fully opened.

In the type of trap which utilises the expansive properties of a volatile fluid to operate the discharge valve, there cannot be anything but a dribbling discharge, as the few degrees of difference which may exist between the temperatures of the steam and water of condensation will not be sufficient to give a large and rapid movement to the discharge valve.

The discharge valves of steam traps need to be of very hard metal—practically pure nickel makes a good valve. Owing, however, to the varying conditions, a valve which suits one service may not suit another. Some valves have means for giving them a swirling movement for grinding them on their seats.

It is important that the trap valve should allow of the discharge of the water of condensation even when the steam pressure is not available, as otherwise there would be a great accumulation of water in the pipes when they are cooling, which might lead to disastrous results when the steam is again turned on.

A form of trap for which there is a growing demand is the vacuum trap which will discharge water into the atmosphere even when a vacuum exists in its interior. This type of trap is required for such services as for use in connection with exhaust turbines and the like. At present there are but few vacuum traps and those are highly priced.

The importance of employing only those traps which give a full bore discharge each time the valve opens, and in which the valve closes tightly when steam is present in the trap cannot be too greatly emphasised, as not only does a dribbling action cause loss of steam but it results in scoring of the valve faces. Further, particles of sediment can readily become lodged between the valve faces and prevent the valve from closing.

Aerial Tramway and Tramway Material.—The *Bulletin Commercial* (Brussels) states, on the authority of the Belgian Consul at Batavia, that the authorities have granted a concession for the construction of an aerial tramway for carrying goods between the towns of Pengalengan, Koppo, and Bandveng (Java). A steam tramway line is to be constructed at the same time over the same route. The same journal announces that the Netherlands East Indian Government intend also to extend the steam tramway line from Tasikmalaja, Singaparna, to Mangoenredja, and to connect it with Garvet. According to the *Oesterreichischer Zentral-Anzeiger* (Vienna) the communal authorities of Salzburg have applied to the Landtag for powers to contract a loan of 7,000,000 kronen (about £292,000), of which amount 1,300,000 kronen (about £54,000) will be devoted to the construction of an electric tramway.—*Board of Trade Journal.*

IMPROVED MECHANISM FOR ADJUSTING BRAKES OF WINDING ENGINES.

This mechanism for adjusting brakes of winding engines admits of the adjustment being effected by hand from the floor level.

The two posts carrying the brake blocks are pivoted to the usual bearings at the lower part, and are connected together at the upper parts by a screwed tie rod and lever, the rod which is connected at one end to one post being screwed at the other end to a nut carried by a lever, which is pivoted to the other post, the lever carrying the brake rod; or the tie rod may be caused to revolve, in which case the screwed nut would be on the other side brake post.

The improvement is the invention of Mr. William Thomas Bell, of the firm of Messrs. Roby and Co. Ltd., Globe Works, Lincoln, in conjunction with Mr. A. J. W. Graham, and our illustrations show in fig. 1 an elevation of a brake mechanism, in fig. 2 a side view of one of the brake posts, in fig. 3 a plan of the socket embodying the mechanism. Fig. 4 shows a side elevation of a portion of fig. 3, fig. 5 an end elevation of fig. 3, fig. 6 a plan of fig. 4, and fig. 7 is a plan of the worm and sprocket wheel and axle.

Fig. 4.

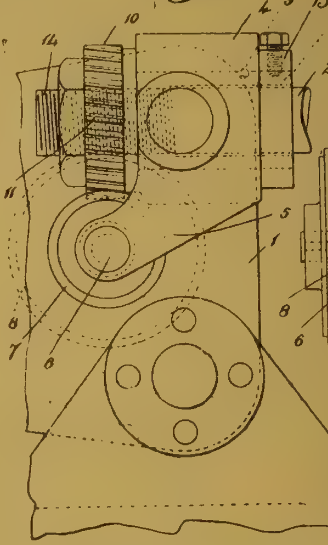


Fig. 5

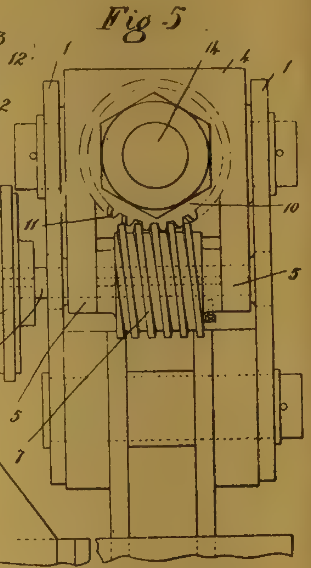


Fig. 6

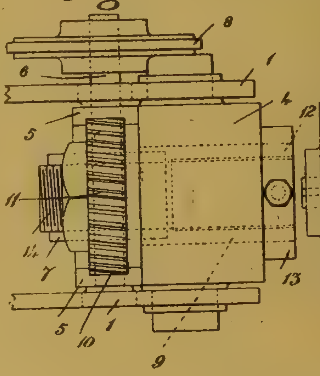
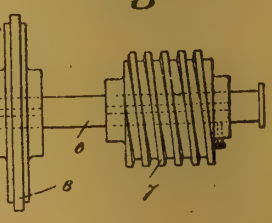


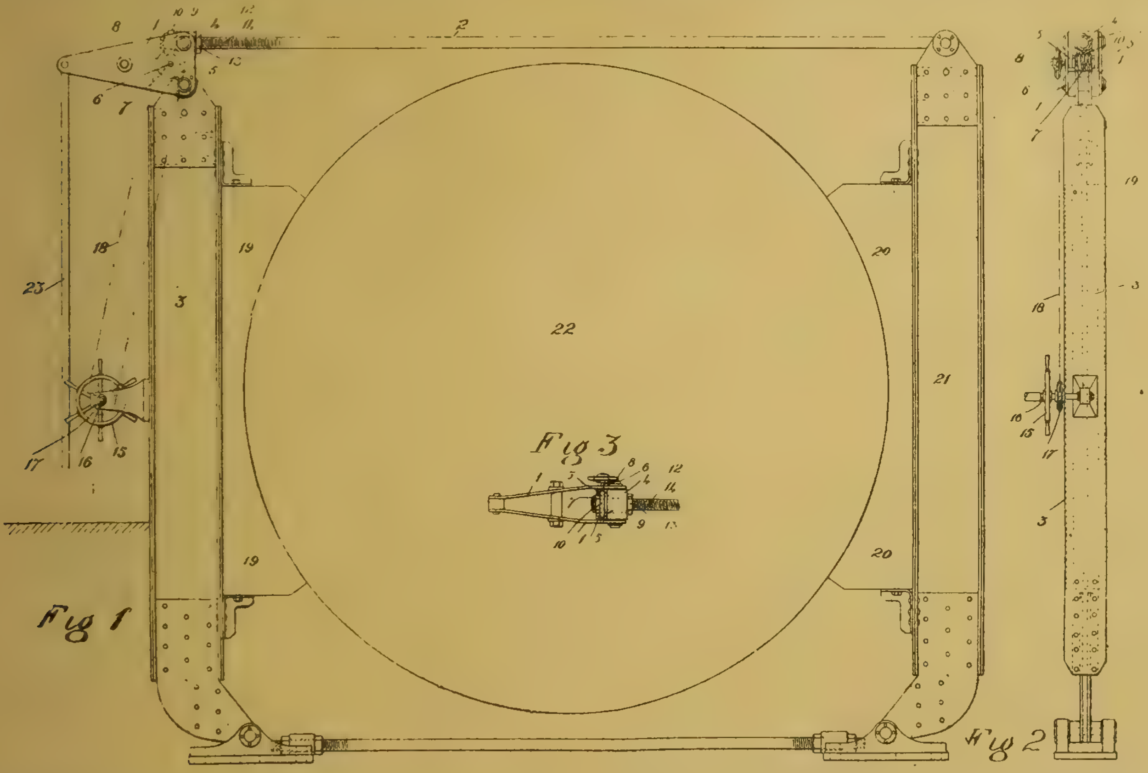
Fig. 7



The lever 1 connecting the tie rod 2 with one of the brake posts 3 has pivoted to it a socket 4, this carrying by lugs 5, 5 an axle 6 having a worm 7 and a pulley or sprocket wheel 8. The socket 4 carries an internal screw-threaded tube 9 having a projecting flanged portion 10 on one side of the socket 4 formed with external teeth 11, which mesh with the worm 7 and a projecting portion 12 on the other side of the socket 4 for engagement of a ring 13, by which, in conjunction with the toothed flange 10, the screw-threaded tube 9 is secured to the socket 4 and is able to revolve within it, the screw-threaded end 14 of the tie rod 2 being screwed into the tube 9.

On the brake post 3 is positioned a hand wheel 15 within reach of the engine driver, and on the axle 16 of this hand wheel 15 is secured a pulley or sprocket wheel 17, which, by an endless cord or chain 18, is connected with the pulley or sprocket wheel 8 on the axle 6 of the worm 7.

The brake blocks 19, 20, with their brake posts 3 and 21, are adjusted with regard to the drum or brake wheel 22 by turning the handle 15 on the brake post 3, and this, by the chain 18, operates the screw 7, which in turn revolves the tube 9 or tie rod 2 and causes the tie rod 2 to bring the two brake blocks 19, 20 nearer to or farther away from each other, and holds them normally in their position, but when the brake is to be applied, the brake rod 23 is pulled, and this cants the lever 1, which pushes over one brake post 3 and block 19 and draws over the other brake post 21 and block 20 to apply the brake to the wheel or drum 22 in the usual manner.



If the tie rod 2 is caused to revolve, the screwed end 14 of the rod 2 moves in a screw nut fixed to the other brake post 21, and the other end of the rod is provided with a toothed flange equivalent to 10, which meshes with the worm 7.

The essential feature of the improvement consists of a lever pivoted to one of the brake posts and provided with an operating rod, a socket pivoted to the lever and carrying an internally screw-threaded tube for carrying one end of the rod connecting the two brake posts and revolvable in the socket and held securely thereto, a toothed wheel on the tube meshing with a worm on an axle carrying a sprocket wheel or pulley, a chain or cord connecting the sprocket wheel or pulley on the worm axle with a sprocket wheel or pulley on the axle of a hand wheel connected to the brake post and within reach of the engine driver.

New Tramways.—The London County Council have before them proposals for seven miles of new tramways, involving an outlay for construction of £163,000. The Council's tramway schemes for the year altogether represent an outlay of £1,183,000.

TRADE NOTES.

Official advices from Ottawa state that **Messrs. Wm. Simons and Co. Ltd.,** Renfrew, have obtained from the Canadian Government a contract for a new Government dredger, for use in connection with the deepening of the harbour at Prince Rupert, the new Pacific terminal of the Grand Trunk Pacific Railway, and also at other places in British-Columbian waters. It is understood that there was very severe competition by leading American shipbuilding firms who specialise in dredger construction, and that the amount of the tender of the successful Scottish firm was £42,000.

Orders for Ships.—It is stated that **Messrs. R. and W. Hawthorn, Leslie and Co. Ltd.,** Hebburn, have recently received an order for the construction of a steamer of about 15,000 tons d.w. According to *The Shipping World*, contracts for new tonnage have been given out by the Royal Mail Steam Packet Co. The new vessel is to be laid down on the slip just vacated by the White Star liner Olympic at Belfast, and will probably be at least 13,000 tons gross. Further, Messrs. Harland and Wolff have secured the order for five of the eight or ten new vessels required by the Royal Mail in connection with their passenger and chilled meat trade between Liverpool and South America. Three of these new vessels will be constructed at Belfast and the other two by Messrs. John Brown and Co., of Clydebank, with whom Messrs. Harland and Wolff work in agreement. Probably the other vessels required will go to the Tyne. It is stated that a contract has just been placed by Mr. Wilhelm Wilhelmsen, of Tonsberg, with Messrs. W. Doxford and Sons, Sunderland, for two steamers of about 8,000 tons deadweight capacity, to steam 12 knots.

Electric Power.—Extensions are being made to the electrical equipment at the Haverton Hill Wells, belonging to the Salt Union Ltd., of Port Clarence, Middlesbrough, in the area of the **Cleveland and Durham Electric Power Co.** The company is putting up a new overhead line with thre cables at 2,750 volts for the purpose of supplying these wells. At the further end of this pole line new sub-station plant is being installed in the existing building. This consists chiefly of three transformers which transform the power from 2,200 volts down to 220 volts and which are controlled by switch gear of the pedestal type on the high-tension side, and protected by fuses of the Reyrolle type on the low-tension side. The power after being transformed to the lower pressure in the sub-station is employed in the wells for driving centrifugal reservoir and well pumps which are driven by three-phase motors running at 440 volts, and at speeds of 755 and 1,140 revolutions per minute respectively. The motors are of the Westinghouse type. The wiring is being carried out by Messrs. Jarvis Bros.

THE USE OF OIL FUEL BURNERS IN THE MODERN FOUNDRY AND MACHINE SHOP.

The kerosene oil burner is utilised with compressed air for atomising to great advantage in the foundry for cupola lighting, as shown in the accompanying illustration, and is also largely used for skin-drying moulds. The oil fuel burner is portable, and can be operated under any pressure with compressed air varying from 5 lbs. to 100 lbs. pressure.

Furnace burners have been designed with compressed air for atomising, using low pressure for various forms of heating, tempering, annealing and enamelling, and melting furnaces.

The portable high-power kerosene burner is instantaneous and powerful in action, producing an intense flame for straightening locomotive frames, rails, truck frames and pilot plates, and beams. They are utilised to special advantage in shrinking and expanding tyres, preheating broken frames or castings preparatory to thermit, oxy-carbi, or other autogenous or similar welding process.

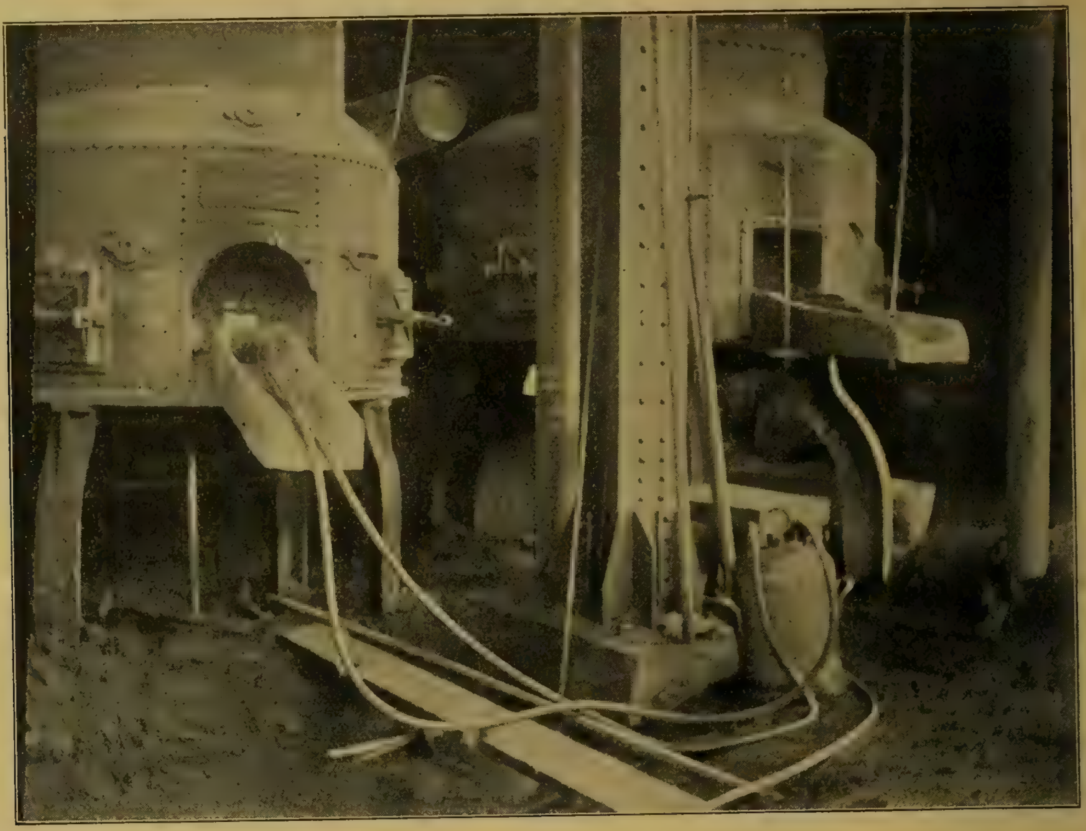
The portable oil burner is employed for repairing steel cars, the frame being driven from any angle and quickly adjusted for various conditions. The usual heating operations require only from two to five minutes, and may be used for heating sills of cars for straightening, and also may be applied to plates, drafts, angles, or channels and similar work.

For boiler work the kerosene oil burner is particularly adaptable, it being possible to concentrate the flame to the exact spot required to be heated without unnecessary heating of finished parts that might be injured thereby.

It is possible for the operator to control the flame perfectly, as it may be directed from any angle with pointed or spreading heat driving into any corner for laying up seams around mud rings on dome flanges or throat sheets.

For straightening buckled sheets and plates the oil fuel burner is employed to advantage, as well as for mud burns, blisters, and distorted rings of boilers, as well as for annealing, preheating, and welding. They are utilised for flanging and off-setting, with a great saving in time and labour. A shell, $\frac{5}{8}$ in. in thickness and 11 ft. in diameter, with off-set 14 in. by 5 in., was completed in nine hours by three men. In this case the heat was confined in a specially constructed box of sheet iron lined with firebrick, and a proper flanging heat of 30 in. length and 14 in. width was obtained within three minutes.

The time required for heating a 10-in. iron pipe and bending it into a 4-ft. radius with a kerosene burner was one hour and ten minutes. It is held by this method an almost continuous heat can be obtained and the heat required and applied just at the required place, only six minutes being necessary for a proper heat to be obtained on a section 18 in. in length.

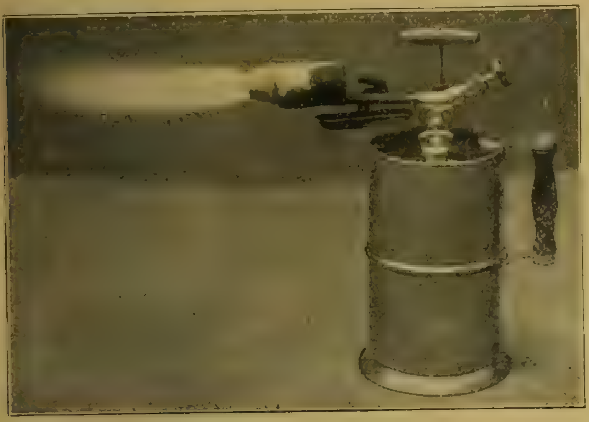


CUPOLA LIGHTING BY OIL BURNER.

For pipe bending the kerosene torch has advantages over coal fires, as there are three distinct operations done away with, including the placing and moving of the pipe on the forge, as well as carrying the heated pipe to the bending plate and fastening it into position, whereby a great amount of heat is lost before the pipe is ready to be bent. The kerosene torch is utilised in the machine shop to advantage for repair work, a piston rod being easily straightened within ten minutes, while the burners have proven efficient in shrinking bands on cracked cylinders, making patches, and expanding or shrinking tyres, as well as melting out Babbitt metal from bearings.

The combined kerosene oil forge is used for brazing seams, one man completing more seams, it is claimed, than two men could braze on two coke fires. It is held that the seam will not warp as they do on the coke fires, owing to the concentrated heat, while the run of the spelter is uniform and thoroughly penetrating. The outer surface of the metal after the brazing is clean, and can be worked without first pickling, and, owing to the perfect combustion, there are no noxious gases arising.

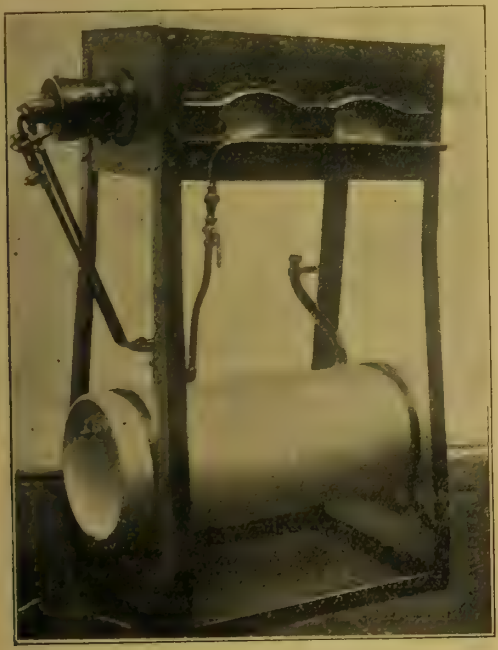
The portable kerosene torch used for brazing cup joints can also be employed for annealing or working in shape such parts as are usually annealed over a coke fire.



Kerosene Brazing Torch.

A number of unique kerosene torches have been devised for various heating operations as annealing, light brazing, and tinning, producing an intense clear flame, as shown in the accompanying illustration.

The small kerosene torch with tank attached is so constructed that the tank will remain perfectly cool while the burner is being operated, only one pound pressure being required on the torch. Heretofore gasoline has been used for torches on account of its highly inflammable properties, and previous attempts to burn kerosene in torches can hardly be considered as having been made on a scientific basis. The kerosene burner shown in operation in the accompanying illustration has been so developed as to produce a more intense flame, it is claimed, than was ever secured with gasoline, and it is said to be absolutely safe and reliable.



Oil Burner Rivet Heating Forge.

It is maintained that there are 22,820 more B.T. units in one gallon of kerosene than in the same amount of gasoline, while the latter is more expensive, and there are no restrictions as to the use of the former fuel or its transportation.

It is held that there is absolute safety at all times in the use of kerosene, while this hardly can be claimed for gasoline. The small gasoline torches holding one-half gallon have an oil consumption of 2½ pints per hour, producing a full frame 12 in. in length, while the torch of one gallon capacity has an oil consumption of three pints per hour, with a length of full flame of 14 in., melting a piece of copper ½ in. by ¼ in. in three minutes and 1 in. brass rod in two minutes.

Oil Burner in Actual Operation Annealing Copper Pipes.

The kerosene burner is utilised to advantage in the operation of bending pipes of even 10 in. or more diameter, and is employed in annealing copper pipe brazing cup joints, and other similar work, a special brazing forge having been devised using oil fuel burners as well as rivet-heating forges of various types.

Oil Burner in Actual Operation on Skin-drying Moulds.

Our illustrations show a kerosene brazing torch, a Hanck rivet-heating forge, and kerosene brazing torches and oil burners at work, as well as a combination brazing forge in operation in the dome department at the Baldwin Locomotive Works

THE MANUFACTURE OF ROLLED "H" BEAMS*.

(Concluded from page 588.)

THE author does not assume, of course, that the systems he has chosen for his illustrations were all intended by their several inventors as means for manufacturing "H" or wide-flanged beams as differentiated from "I" Beams or beams of the ordinary standard sections, but they illustrate some of the features which the practical designer of to-day is likely to take into consideration in evolving a mill suitable for the production of "H" or wide-flanged beams.

For the production of beams with abnormally wide flanges, in short "H" beams, it may be assumed that a universal mill having four rolls, two horizontal and two vertical, all lying in one vertical plane, is the simplest type of machine that can satisfactorily answer the purpose. A single reversing universal mill, requiring a tilting gear on each side with which the bar is turned half round after each pass, is described by H. Sack and also by J. S. Seaman. These mills look simple, but evidently have drawbacks, due partly to the introduction of the tilting gears which are complications in themselves and are apt to require considerable time for their manipulation, particularly when the beam is long and bent, and partly also, perhaps, to the unsymmetrical section developed at each pass which, in the rolls described by H. Sack, would have the tendency to produce a bar bent sideways, and in those described by J. S. Seaman a bar bent vertically, so that very powerful guides would be required in the case of the heavier beams to keep the bar sufficiently straight as it emerges from the rolls to enable the tilting gears to operate satisfactorily. Briefly, in other words, the unsymmetrical rolls probably render other complications necessary in order to counteract their bending effect.

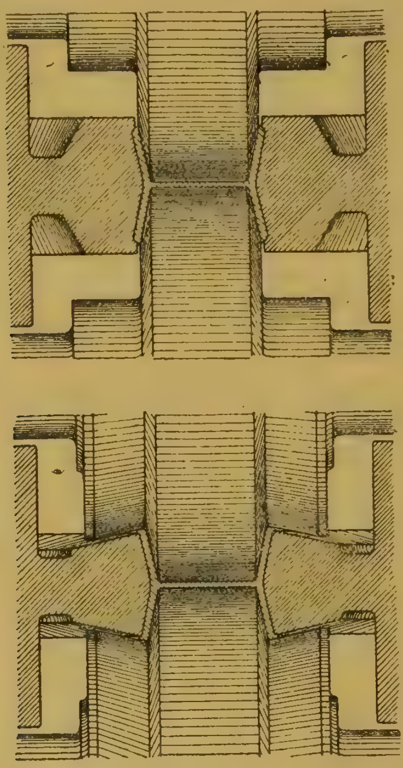


FIG. 13.

A three high universal mill housed within one pair of stands only and requiring a lifting table on each side is described by J. S. Seaman, fig. 6, and this would doubtless be a simple system to adopt if it were practicable to design the details of the roll satisfactorily and simply as regards the accommodation and adjustment of the vertical rolls in particular. Hitherto the author has not discovered a design of such an arrangement which could be considered satisfactory by himself or by the practical man.

Two mills arranged side by side and having rolls such as those of H. Sack or by J. S. Seaman could be adopted, and tilting avoided, by making the horizontal rolls and the vertical rolls symmetrical in each case, but so formed that in one mill the edges of the flanges would be formed by the horizontal rolls only, and in the other mill by the vertical rolls only, fig. 13. Then after each pass the bar could be shifted from the one mill to the other, being rolled alternately in each mill until completely reduced. By this means the formation of fins would be avoided, but the plant would be considerably complicated, and as the centres of the passes in the rolls of the two mills could not conveniently be arranged very close together, the shifting gears would require to be particularly powerful and quick acting in order not to lose much time over this operation.

A plurality of mills having universal rolls or horizontal rolls only, each mill intended for developing a certain portion of the section, is described by J. Kennedy and H. Aiken, and also by H. Grey; but whereas the former leave certain portions of the section to take care of themselves in the initial passes and to be worked upon in the final stages only, H. Grey works upon the whole section at every pass, and his system appears to possess advantages and to combine practicability and simplicity to a greater extent than the other systems hitherto described.

Finally, a series of universal mills, each working upon the whole section of the bar but each adopted for one pass only, is described by E. M. Butz. This system would entail perhaps the maximum outlay on plant and machinery, and would possibly be adapted for the maximum production per unit of time. For rolling rails, of which thousands of tons of one section can be disposed of on a single contract, a plant of this description might possibly be a good investment, but for the manufacture of beams it seems more than doubtful whether it would be profitable to roll a sufficient quantity of each section to justify the expense of the plant and the time and trouble involved in changing so many sets of rolls for each section of beam.

Having dealt at some length with the various means adopted to overcome or prevent the formation of fins, which has been shown to be a matter of great importance calculated to influence enormously the design of the rolls, of the mill containing such rolls, and even of the disposition of the whole plant, some mention should be made of the other features of the designs illustrated for which they have also been specially selected.

J. S. Seaman, J. Kennedy, and H. Aiken, E. M. Butz and H. Grey, have all endeavoured to devise means for driving all the rolls of their universal mills, whereas H. Sack and L. D. York make attempt to drive the vertical rolls, but content themselves with driving both the horizontal rolls and letting the vertical rolls rotate by contact with the moving bar as it is drawn through the pass by the driven horizontal rolls.

J. S. Seaman shows conical surfaces on the horizontal rolls engaging conical surfaces on the vertical rolls, contact being maintained between the two rolling surfaces by the pressure of the bar as it is squeezed between the rolls. This design has such grave defects that it cannot be regarded as mechanically round enough for practical purposes, for, to be effective and avoid excessive wear and tear, the sides of the conical surface should be at such angles that, if prolonged, the apices of the cones represented by the prolonged sides would meet at the centres of the respective rolls, thus maintaining equal peripheral speed throughout the adjoining surfaces in the same way as bevel gearing is designed. This is so obvious that it needs no further illustration; but if the vertical rolls were so designed their conical surfaces would make such acute angles that they would have a powerful wedge action, and, on application of the rolling pressure, component forces of excessive magnitude would occur, resulting in excessive deflection of the rolls, wear and tear, and probably a wrecked mill.

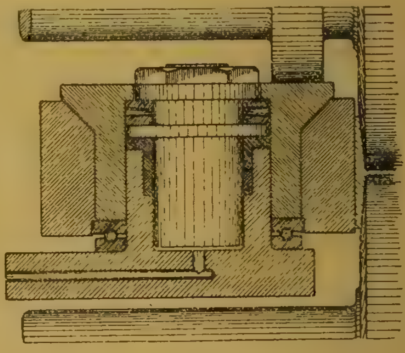


FIG. 14.

H. Grey shows a device whereby conical or cylindrical collars on the top horizontal roll engage by frictional contact with conical or flat surfaces on the vertical rolls, and contact is maintained between the two by means of hydraulic pressure, fig. 14. Like J. S. Seaman's design, this has also the defect that the peripheral speeds of the frictional surfaces are not constant throughout, and this defect cannot be remedied without introducing others as great or greater. Moreover, the driving force imparted to the vertical rolls by such means must be so limited as to render it inoperative for practical purposes. Altogether the device looks too unsound mechanically for practical purposes.

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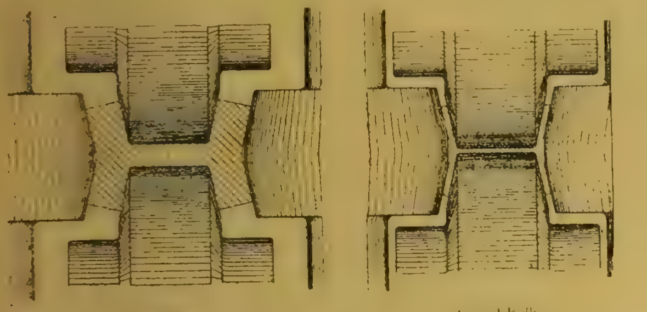
* Paper read by Mr. G. E. Moore at the Iron and Steel Institute.

J. Kennedy and H. Aiken, in their second mill, show in contact conical surfaces which are designed on proper lines, but between which effective contact could hardly be maintained during rolling, for the pressure would cause deflection and spreading of the rolls, nor could sufficient pressure be applied in any case to render such contact very effective. They suggest, however, that the friction cones could be replaced by toothed gearing, and similar toothed gearing is also suggested by E. M. Butz; but in both cases, although a positive drive would be obtained, it would not be possible to adjust the rolls even slightly without interfering with the proper engagement of the gearing.



Open Rolls

Closed Rolls

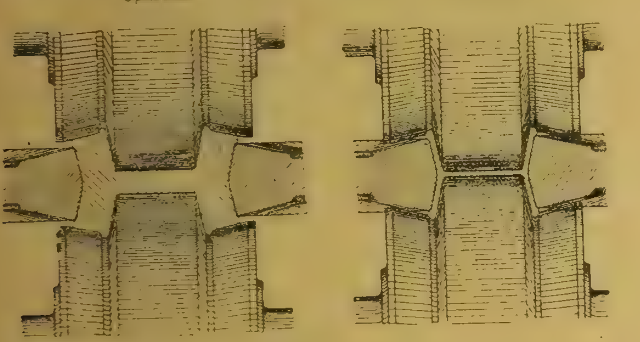


Fig. 15.

The neatest device for driving all four rolls whilst still maintaining adequate adjustment between them is that shown in the first mill by J. Kennedy and H. Aiken. In this case the rolling pressure on the horizontal rolls is directly utilised to furnish pressure to give the requisite frictional contact between the driven and the idle horizontal rolls, whilst the vertical rolls are positively driven by gearing. Such a device would doubtless give satisfactory practical results, although it is doubtful whether the results obtained thereby would compensate for the complications which it involves in the mechanism of the mill.

In the manufacture of "H" beams a bloom is usually first reduced in a blooming mill to a rough I shape, and thereafter operated upon and finished in the universal mill; and the idea that it is necessary to drive the vertical rolls in the universal mill as well as the horizontal appears to be more theoretical than real. The advantage of driving the vertical rolls, instead of letting them run idle, is most apparent before the bar has been gripped by the rolls as it enters the pass, and it is then conceivable that it would be easier to grip the bar if the vertical rolls were driven. Once the bar has been gripped by the driven horizontal rolls there is, however, no apparent drag upon it due to any lagging of the vertical rolls. In fact, if a tendency for the vertical rolls to lag behind were present, no frictional device on the lines of any of those described would be sufficiently powerful appreciably to diminish such a dragging effect.

The best conceivable frictional device for driving the idle vertical rolls is afforded as soon as the bar has been gripped by the rolling surfaces of the horizontal rolls and is in contact with those of the vertical rolls, and, as above stated, an independent frictional drive could only serve a useful purpose providing it were sufficiently powerful, by helping to introduce the bar within the pass before it had been gripped by the horizontal rolls, but not otherwise.

In this connection the fact must not be overlooked that the horizontal rolls do not operate upon the web of the beam alone, but operate equally upon the sides and perhaps also upon the edges of the flanges. Thus it is not a case of the flanges being pulled through the rolls by a force imparted to the web, but as a matter of fact the flanges are directly gripped by the driven horizontal rolls, and the vertical rolls are only a form of surface for resisting the side pressure to participate in squeezing the bar, and have really no appreciable tendency to slip and lag behind. It is obvious, however, that the horizontal rolls will have a better grip upon the flanges the more the inside faces of these are inclined outwardly, and the greater the inclination the greater will be the rolling effect also. Consequently the author ventures to express the opinion that the method described by H. Sack, whereby the section is developed with the flanges outwardly bent from the horizontal centre line, is not only peculiarly well adapted for rolling "H" beams having very wide flanges, but the material in such beams should also be particularly well worked up and free from internal stresses.

The modern tendency is to reduce the inclination of the flanges of beams in order that the material may be better distributed by concentrating it as little as possible in the centre of the section and distributing it more outwards, in order to obtain a higher moment of inertia, and thereby greater strength for a given weight. This applies particularly to "H" beams intended to be used as columns, where the least moment of inertia must be used as a basis for calculating their resistance against buckling, and where the ideal section should have an equal moment of inertia in all directions.

Therefore, by so distributing the material in the flanges that a greater amount than formerly is concentrated on the edges of the flanges, and a proportionately lesser amount at the roots where they join the web, the moment of inertia is increased without increasing the weight of the beam.

Now, with the system described by H. Sack, the flanges can just as easily be made parallel throughout, or without any taper, as otherwise, thus obtaining the advantage of increased strength without adding to the weight of the beam. But in addition to this advantage such beams possess the further advantage that they can be drilled and punched, rivet and bolt heads bedded, and connections with other members made much more easily and cheaply than the ordinary sections having flanges which taper however slightly. These advantages are, moreover, obtained without sacrificing in any way the quality of the materials, but rather the contrary is the case.

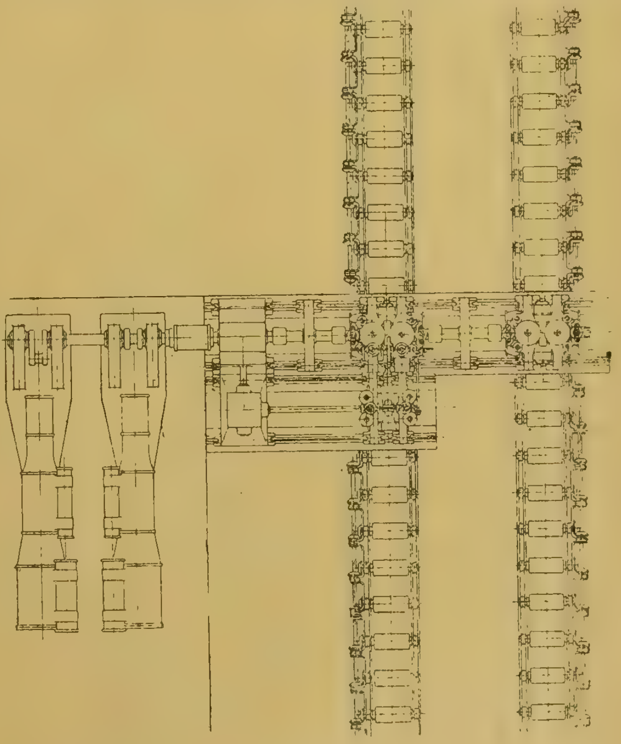


Fig. 16.

With all systems in which the flanges are developed straight—that is to say, with their outside surfaces at right angles to the plane of the web or nearly so—a certain inclination of the inside surfaces is essential to the proper performance of the rolling or reducing operations, and the more this taper is reduced the greater will be the risk of damaging the material by reason of the greater tendency of the sides of the horizontal rolls to scrape away instead of rolling or squeezing away the inside surfaces of the flanges; and not only this, but also the greater will be the friction of the horizontal rolls on the inside surfaces of the flanges, and consequently the greater the wear and tear on the rolls.

It is obvious that the application of the system described by H. Sack will result in a better beam, a stronger beam, a beam with a better quality of material in it and diminished wear and tear of rolls, as compared with other systems which do not develop the flanges in an outwardly bent state.

The author having been intimately associated with the late Mr. Hugo Sack, whom he assisted in the development of his ideas, has had the opportunity of making himself thoroughly conversant with the practical aspects of this particular process, and he feels convinced that no other system at present known is so well adapted to produce commercially "H" beams of a good sound quality as that which the late Mr. Hugo Sack invented nearly 25 years ago, and upon which he brought his masterly mind to bear with such persistent energy and enthusiasm.

The extensive trials carried on at the Rombach ironworks have proved the soundness of the system, and they have shown that the direction in which improvements can still be made lies chiefly in the adaptation of the plant for producing large quantities of material on a commercial basis with a minimum outlay in capital expenditure and working cost. To this end the author has endeavoured to apply the experience he has acquired, and ventures to give the results of his efforts in the succeeding.

From what has been stated in the foregoing it will be understood that in order to produce "H" beams free from fins there is a choice of two distinct systems. First, the mill may be so constructed that one set of universal rolls operates upon the whole of the section except where the unavoidable gap occurs between the rolls, the positions of which gaps must be changed frequently or at every pass, this being attainable with one set of universal rolls forming an unsymmetrical pass as regards the location of the gaps, or with two sets of universal rolls, each forming a symmetrical pass, but each different as regards the location of the gaps—that is to say, using a single reversing mill and tilting the bar half round between the passes, or using two universal mills (which may be reversing or non-reversing), and shifting the bar from one to the other between the passes. Secondly, the mills may be so constructed that one set of universal rolls operate upon the greater portion of the section and are adapted to reduce and elongate the bar as a whole, whilst a second set of rolls operate only upon those portions of the bar which are not operated upon in the first set, and are adapted to reduce the bar locally but not to elongate it or reduce it as a whole—that is to say, using a primary reversing universal mill in tandem with a secondary reversing mill, the two situated so close together that the bar is operated upon by both at the same time, although on portions a short distance apart.

It is with the second of these systems that the author wishes to deal, because the first is already sufficiently well known, and because he believes that the second possesses greater possibilities of development in the direction of economy. H. Grey uses a primary reversing mill with four rolls operating upon the web and the sides of the flanges of the bar, reducing and elongating the bar as a whole, but leaving the edges of the flanges untouched and in tandem therewith a second reversing mill, having two rolls which guide the bar and operate upon the edges of the flanges only. Thus in the tandem mill at every pass the bar is operated upon all over, and the formation of fins is prevented.

Retaining the system of H. Sack, in which the beam is developed with outwardly bent flanges, the author suggests the employment of a primary reversing universal mill having its four rolls shaped to operate upon the web and sides and edges of the flanges, with the gaps between them located somewhat short of the extreme edges of the flanges, and sufficiently wide to prevent the extruded metal from cooling too quickly, and in tandem therewith a secondary universal reversing mill with rolls shaped to guide the bar and roll down only the surplus metal extruded between the gaps of the primary rolls, fig. 15.

Any irregularities which might be left at the edges of the flanges after the last pass in this mill could then be eliminated altogether by properly shaping the rolls, so that the final pass required to straighten out the flanges in the separate set of rolls would roll down or fill up any irregularities, as the case might be, and give the section a final finish all over.

The tandem system of rolling has the advantage that the beam is reduced all over and extrusion of metal beyond the limits of the desired contour rolled down all in one pass so that the mill may work uninterruptedly backwards and forwards and no time be lost in tilting or shifting from one plan to another. The cost of the equipment should be very slightly, if anything, more than that of a single mill of a suitable tilting gear; but even if the cost were considerably greater it would be more than justified by the increased output in the more elaborate manipulation. The plan of such mill is shown in fig. 16.

Where two stands are used and the bar shifted from one to another an increased output might be looked for proportionate to the increase in the cost of the plant and wages, provided that two bars could be rolled simultaneously and a non-reversing engine used; if it is just a question whether the quantity of a given section required to be rolled alone, time would justify the additional capital outlay in the plant required for such an arrangement, having regard to the fact that the rolls in both stands could be adopted for only one size of beam at a time.

INSTITUTE OF MARINE ENGINEERS.

At the Institute of Marine Engineers, 58, Romford Road, Stratford, E., on Monday, October 31st, Sir David Gill, K.C.B., gave his presidential address, dealing principally with the subject of "Accuracy of Measurement." He afterwards presented the Denny gold medal for session 1909-10, and the prizes to the members of the junior section who were successful in the essay competitions.

In the course of his address, which was listened to with intense interest, Sir David said not only was it the first instinct of the scientific mind to measure, and to measure accurately, but the necessity for doing so was impressed upon him by the fact that the value of an observation increased as the square of its accuracy—that is to say, inversely as the square of its probable error. It was only within recent years that the tools and methods of astronomers had been so improved that the determination of the distances of fixed stars became a problem capable of practical solution, and to the mechanician, the optician, and the engineer the astronomer was largely indebted for the success which in recent years had crowned his efforts in that line of research. If accuracy was necessary to the astronomer, it was no less necessary to the engineer, though perhaps in a different degree. Nowadays we were beginning to realise, especially in engineering practice, the necessity for absolute standards. Probably every standard, of whatever substance or metal it might be composed, was subject to change of length by the slow re-arrangement of its constituent molecules in course of time. If we were to have a standard which would be constant for all time, we must have recourse to a natural standard, and incomparably the best of these that had ever yet been suggested was that of Clerk Maxwell, viz., the wave length of some well-defined mono-chromatic ray of light. The red line of the spectrum of cadmium vapour was, so far as we knew, the best defined spectrum line which could be readily observed, and for that reason it had been selected for comparison with the metre.

Of our British standards, in the highest scientific sense, perhaps the less said the better—no man of science would, he thought, refer to them seriously. From the international point of view there could be no question that universal standards for the whole world would be an obvious simplification and its advantages inestimably great, but he did not think it was a practical proposition to suggestion that the world should accept British standards when all the world, except Britain and America, had adopted the metric system. It was high time that such loose terms as "tight fit," "smooth fit," and "easy fit" were abolished. If constructors were to adopt the system of expressing on working plans the required dimensions in decimals, denoting the requisite accuracy by the number of decimals quoted, the whole matter would be simplified. It was certainly desirable that this or some other conventional mode of stating the accuracy on working drawings should be arrived at by common consent. The work might then be given to any number of different workshops and sets of men, and it could all be assembled and put together without difficulty. Perhaps this system had not been sufficiently carried out in practice because of the difficulty of comparing gauges with graded standards, or even of obtaining these standards of the requisite accuracy. That difficulty had now been overcome for our workshops by the establishment of the National Physical Laboratory at Teddington. This admirable institution, under its very able director, Dr. Glazebrook, was now prepared to test or determine the error of any gauge of any kind required in the practice of the arts and sciences.

Railway Material.—The *Diario Official* contains a decree approving the terms of a contract for the construction of a section of the Minas Western Railway ("Estrda de Ferro Oeste de Minas") between the station known as Henrique Galvao and the 45th kilometre of the Goyaz line, and authorising the "Ministerio da Viaçao e Obras Pubicas" to arrange for the carrying out of the work. The *Gaceta de Madrid* notifies that Don Ignacio Coll y Portabella and Don Julio Bielsa y Perun have applied to the "Dirección General de Obras Públicas," Madrid, for a concession for the construction and working of a secondary railway from Alcañiz to Vnaroz. H.M. Consul-General at Budapest reports that the Budapest Budafok Tétény Railway Co. has obtained permission to extend its line to Erd.—*Board of Trade Journal.*

METAL MARKETS.

OCTOBER.

Pig Iron.—The market for pig iron at the end of the month was a strong one, and a considerable amount of activity existed. The values of Cleveland iron rule higher than they have for some time past, and on the whole the prospects may be regarded as satisfactory. The shipments from the Tees to October 31st are better than they promised to be at one time, comparing favourably with last month, but still falling considerably short of those for October last year. The total despatches are given as 91,357 tons last month, the total clearances amounted to 94,053 tons, and for the corresponding month last year to 113,284 tons. At the end of October Messrs. Connal and Co., the warrant store keepers, had in stock at Middlesbrough 485,434 tons.

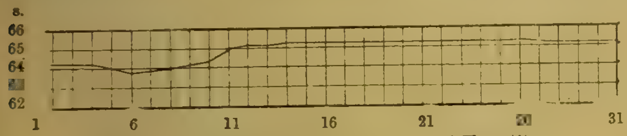


Diagram showing Fluctuations in Prices of Hematite.

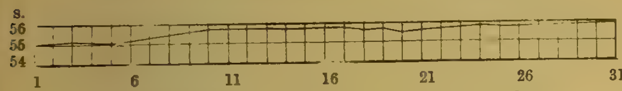


Diagram showing Fluctuations in Prices of Scotch.

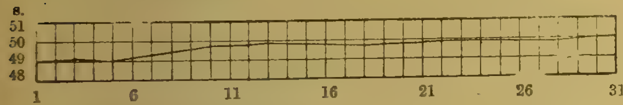


Diagram showing Fluctuations in Prices of Cleveland.

Copper.—But little is being done, but the market has once more shown a tendency to rally owing to the influence of the renewed upward movement in the American share market.

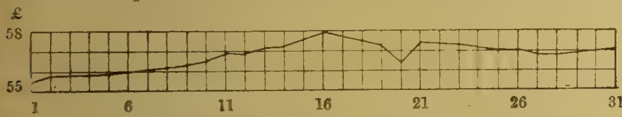


Diagram showing Fluctuations in Prices of Copper.

Tin.—The market for this metal has remained firm during the month.

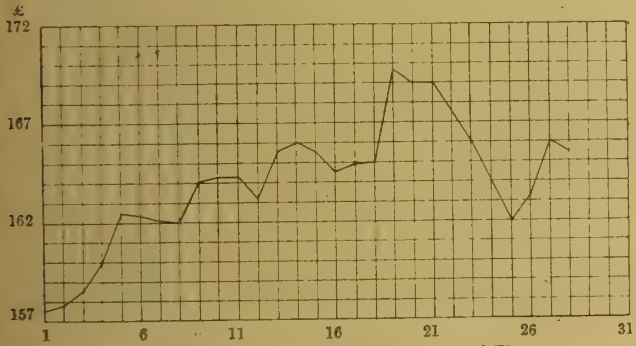


Diagram showing Fluctuations in Prices of Tin.

Lead.—The market price of lead after rising steadily from the beginning to the middle of the month has remained firm. At the end of the month the demand was quiet. Soft foreign was a trifle higher and English steady.

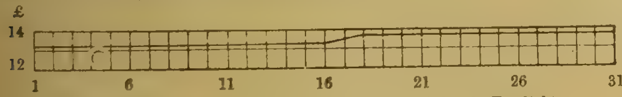


Diagram showing Fluctuations in Prices of Lead (English).

Spelter.—The price of spelter g.o.b.'s rose during the first two days of the month and remained steady for the first fortnight, after which it again rose, and has remained steady to the end of the month. The diagrams below, specially compiled from the metal market reports, show the fluctuations during the month.

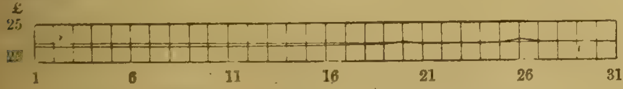


Diagram showing Fluctuations in Prices of Spelter (g.o.b.).

NOTICES OF MEETINGS, &c.

November 11th.—COVENTRY ENGINEERING SOCIETY. A paper will be read by A. E. Bell, Esq., on "Some Recent Examples of Modern Electrical Time Service."

November 12th.—THE MANCHESTER ASSOCIATION OF ENGINEERS. Meeting held in the "Masonic Room," Grand Hotel, Aytoun Street, Manchester, at 7 p.m. Paper on "Humphrey Pumps and Compressors," by Mr. H. A. Humphrey, London.

THE JUNIOR INSTITUTION OF ENGINEERS. Dance and Whist Drive at the Gaiety Restaurant, Strand, at 7 p.m.

GLASGOW TECHNICAL COLLEGE SCIENTIFIC SOCIETY. A paper will be read at the above society, at 7-30 p.m., on "Modern Lathes and Methods," by Mr. Robert Lang, M.Inst.Mech.E.

November 14th.—THE INSTITUTION OF MECHANICAL ENGINEERS (Graduates' Association). Meeting at 8 p.m. A paper will be read, entitled "Foundry Plant, Machinery, and Working," by Mr. E. Timothy.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS. Council Meeting.

INSTITUTE OF MARINE ENGINEERS. Meeting at 58, Romford Road, Stratford, London, E. Fuel test will take place.

BRADFORD ENGINEERING SOCIETY. Meeting at the City of Bradford Technical College, Great Horton Road, at 7-45 p.m. Paper on "Smoke Abatement," by Mr. W. Nicholson.

November 15th.—THE INSTITUTION OF ELECTRICAL ENGINEERS (Manchester Students' Section). Meeting held at the Municipal School of Technology, Sackville Street, Manchester, at 7-30 p.m. A paper will be read on "Recent Electric Locomotive Practice and the H. T. Direct-current Railway System," by Allan Monkhouse, Esq.

THE JUNIOR INSTITUTION OF ENGINEERS. Meeting at the Royal United Service Institute. An address will be given on "The Influence of Pure Science in Engineering," by Sir J. J. Thompson, F.R.S.

November 16th.—THE INSTITUTION OF ELECTRICAL ENGINEERS (Yorkshire Local Section). Meeting at 7 p.m at the University, Leeds.

LIVERPOOL ENGINEERING SOCIETY. Meeting at Royal Institute, Colquit Street, Liverpool. A paper will be read on "Ship Model Experiment Tanks: their Purpose and Application," by Professor W. S. Abell, M.I.N.A.

November 18th.—THE INSTITUTION OF MECHANICAL ENGINEERS. General Meeting at 8 p.m., to be held in the Institute House, Storey's Gate, St. James's Park, Westminster, S.W. A paper will be read and discussed on "The Development of Road Locomotives in Recent Years," by Mr. L. A. Legros.

INSTITUTE OF MARINE ENGINEERS. Bohemian Concert.

THE INSTITUTION OF ELECTRICAL ENGINEERS (Glasgow Local Section). Meeting of the student's section at the Glasgow Technical College, at 8 p.m.

November 19th.—ENGINEERING AND SCIENTIFIC ASSOCIATON OF IRELAND. Visit to Belfast.

LEICESTER ASSOCIATION OF ENGINEERS. A paper will be read on "The Water Supply of Hinckley," by Mr. E. H. Crump, A.M.Inst.Mech.E.

THE BIRMINGHAM ASSOCIATION OF MECHANICAL ENGINEERS. Ladies' Night.

TRADE CATALOGUES.

WE have received from **Messrs. The Hart Accumulator Co. Ltd.,** of Stratford, London, E., a copy of a leaflet describing their storage batteries, patent non-corrosive terminals, etc.

WE have received from **Messrs. S. Redfern and Co.,** of Swan Lane, New Brown Street, Manchester, and 4, St. Mary Axe, London, E.C., a copy of their catalogue of Redfern's patent metallic face packing, spiral split packing, and red "R.R." jointings.

WE have received from **Messrs. W. T. Nicholson and Clipper Co. Ltd.,** King Street, Salford, Manchester, a copy of a booklet published by them, giving instructions for the working of their "Klincha" belt tool fasteners. The book contains a number of illustrations which clearly elucidate the method of procedure.

WE have received from **Messrs. T. Sugden Ltd.,** 180, Fleet Street, London, E.C., a copy of the revised and enlarged edition of their superheater catalogue. The Sugden superheaters are extensively adopted, and we are informed that one firm alone has over 50 at work.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 3rd November, 1910.

Belfast.—*First class :* L. Hauxwell. *Second class :* J. Lockhart.

Cardiff.—*First class :* G. N. Hallett, H. E. F. A. Popham, B. E. Hopgood, T. W. Barnett. *Second class :* J. E. Kennard, I. Ll. Dadds, E. C. Harrison, G. L. Hughes, D. E. Morgan, J. A. Lloyd.

Falmouth.—*First class :* W. A. Rowe.

Glasgow.—*Extra first class :* J. Austin, A. Currie, H. Proudfoot. *First class :* W. Malcolm, J. D. Kerr, T. A. Milne. *Second class :* J. W. Ferguson, G. Gemmell, D. Mitchell, H. L. Newell, J. G. MacOnie.

Hull.—*Extra first class :* C. J. K. Grieve.

Leith.—*Extra first class :* J. Aitken. *First class :* J. McDonald, F. Mitchell, J. A. McKenzie, W. Richardson, W. K. Forbes. *Second class :* D. Craig, J. Cairns, J. Tocher.

Liverpool.—*Extra first class :* G. E. Bond, W. Evans, *First class :* H. C. Best, J. S. Rudkin. *Second class :* F. B. Yates, F. Leonard.

London.—*Extra first class :* S. E. Staines. *First class :* F. E. Millar, J. Birnie. *Second class :* A. R. Millar, J. W. Duprez.

North Shields.—*Extra first class :* N. C. Macdonald, C. Berry. *First class :* S. Barrass, J. W. Elsdon, E. Bradbeer, F. H. Hill. *Second class :* W. D. Charlton, T. Harrison.

Southampton.—*First class :* E. E. Topping. *Second class :* E. L. Miller, H. S. Sketch, C. J. Parsons.

LAUNCHES AND TRIAL TRIPS.

Æneas.—The twin-screw steamer Æneas, the latest addition to the fleet of steamers popularly known as the Blue Funnel Line, owned by Messrs. Alfred Holt and Co., Liverpool, and the 25th vessel built for this line by Messrs. Workman, Clark, and Co. Ltd., Belfast, made its trial trip between Belfast and Glasgow on November 1st. Before the steamer left for Glasgow the official speed trials took place in Belfast Lough, the vessel averaging 16 knots over a measured mile in the Lough. The Æneas is 509 ft. in length, with a gross tonnage of about 10,100, and a loaded displacement of over 19,500 tons.

Arankola.—Messrs. Workman, Clark, and Co. Ltd., of Belfast, have launched from their South Yard the new twin-screw steamer Arankola to the order of the British India Steam Navigation Co. Ltd. The new vessel is 404 ft. in length, with a gross tonnage of about 4,550. As the vessel is intended for service in tropical climates, special attention has been given to ventilation. The cargo space is divided into three holds, each of which is provided with a large hatchway equipped with winches, derricks, and the necessary gear for expeditiously handling a full general cargo. The vessel will be propelled by two independent sets of quadruple-expansion engines, carefully balanced to minimise vibration, and having all the most modern improvements and auxiliaries, steam being supplied by six large steel boilers of cylindrical, horizontal, multitubular type working under an approved system of forced draught.

Hova.—The steel screw steamer Hova, built by Messrs. The Northumberland Shipbuilding Co. Ltd., Howdon-on-Tyne, to the order of F. S. Holland, Esq., left the Tyne on November 2nd for her official trial trip. This vessel is of the 'tween deck type, and is over 390 ft. long by 49 ft. beam, and has been built under Lloyd's special survey to obtain the highest class, and is designed to carry 7,500 tons on a light draught. She is arranged with poop, long bridge, and top gallant forecastle, and has water ballast provided in the cellular double bottom and after peak. She is fully equipped with all necessary appliances in the way of deck fittings and machinery to facilitate the loading and discharging of cargo. The propelling machinery, which has been constructed by the North-Eastern Marine Engineering Co. Ltd. at their Northumberland Engine Works, Wallsend, consists of a set of the latest type of triple-expansion engines having cylinders 25 in., 41 in., 69 in., by 48 in. stroke, the steam being supplied by three large steel boilers working at a pressure of 180 lbs. per square inch.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2289. **Heating Steam Tank.**—Will some reader give me a rule by which I can determine the final temperature assumed by a steam heated water tank (naked steam) into which I feed steam, and from which I draw water at a uniform rate? Express general result in terms of steam used.—Tank.

2290. **Diesel Engines for Power Stations and Ships.**—Will one of your readers please consider the advantages and disadvantages of engines of the Diesel type; state the sizes in which these can be made, and give results of tests on same; in particular, deal with the use of such engines for generating electrical energy? Is there any probability of such engines being used for marine propulsion, and, if so, on what kind of ship?—Coaler.

2291. **High-pressure Water.**—Will some experienced reader give me detailed information concerning the cost of high-pressure water and its value as a source of power? What are the average efficiencies and plant factors of various hydraulic engines?—Hydric.

MISCELLANEA.

A new light railway of eight miles from Bawtry to Haxey is about to be commenced. The line will be a single one and will leave the Great Northern and Eastern joint line at Haxey and unites with the Great Northern main line at Bawtry Station. The proposed colliery at Harworth will be touched by the route. The cost of the line is estimated at about £30,000.

Electrical Exhibition at Olympia, 1911.—An advance prospectus has been issued in connection with the third Electrical Exhibition, promoted by the National Electrical Manufacturers' Association (Incorporated). A strong advisory committee has been formed, and an executive committee of sixteen members, the whole being under the presidency of Sir W. H. Preece, K.C.B., F.R.S.

The New Shipbuilding Yard at Walker.—Messrs. Armstrong, Whitworth, and Co. have enclosed the immense area of land acquired by them at Walker-on-Tyne for the new naval shipbuilding yard. For the clearing away of the ballast hill to quay level two monster hoppers have been brought to the Tyne, and other preparations for the work are also in progress. The task of removing the hills will employ a large number of men.

Parade of Commercial Motor Vehicles.—The conditions to govern the fifth annual parade of commercial motor vehicles, organised by the Commercial Motor Users' Association, have been under careful consideration by the executive committee of that body. The object of these parades is to encourage the drivers of vans, wagons, and tractors, by means of money prizes and other awards, to take a personal interest in the driving and condition of their machines.

According to a recent Home Office return made under the Factories and Workshops Act the total number of persons employed in non-textile factories shows an increase of about 250,000, not counting the 856,686 persons employed in laundries This is an increase of about 8 per cent as compared with 1904. Large increases have also taken place in the following industries: Generation of electricity, 13,881 to 17,697; founding, etc., of metals from 266,967 to 293,412; food from 167,828 to 187,856; clothing and cloth accessories from 307,157 to 348,890; laundries from 71,633 to 85,686.

Reconstruction of Dundee Harbour.—Dundee Nine Trades, one of the bodies it is proposed by Dundee Town Council's Provisional Order should be deprived of representation on Dundee Harbour Board, compares very favourably with any section represented at the Board. The trust during the year has improved the buoying of the river and were going to deepen the channel. Once that was done and additional facilities provided in connection with the existing graving dock the needs of the shipbuilding industry would be met. At the present time there was no necessity for an additional graving dock, whatever might be the demands of the future.

PATENTEES' CHRONICLE

OF

Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

OCTOBER 31st, 1910.

25207 Speed gear. Taylor.
25208 Fishing tackle case. Girling.
25209 *Gas lamps. Thorp.
25210 Road rollers. Crosthwaite.
25211 Game. Coumbe.
25212 Game apparatus. Kaye.
25213 Device for tempering bobbins. Black.
25214 Device for tempering bobbins. Black.
25215 Curtain hooks. Harris.
25216 Cycle gear. Harris.
25217 Bleaching process. Reuss.
25218 Drawing compasses. Myers.
25219 Manf. of tubes. Moorcroft.
25220 Motor. Wilson.
25221 Motor. Wilson.
25222 Carriage. House.
25223 Metal bar, etc., cutters. Taylor.
25224 Electrical resistance. Summer.
25225 Water filter. Smith.
25226 Massage device. Lister.
25227 Aerial railways. Hamilton.
25228 *Line casting machine. Kennedy
25229 *Line casting machine. Kennedy.
25230 Engine piston. Brown.
25231 Spring tyres. Common.
25232 Hay baling process. Howe.
25233 Vice clamp. Costerton.
25234 Counter holder for card games, etc. Costerton.
25235 Wheels. Gibson.
25236 Decorative device. Pickstone.
25237 *Flushing cistern. Woodhouse.
25238 *Door locking device. Wilson.
25239 Cricket bat handle. Sargeant.
25240 Casting ingots, etc. Deer.
25241 Chemical manures. Radcliffe.
25242 Dry galvanic cells. Weatherill.
25243 *Automatic telephone system. Wanisch.
25244 Photo plate washing. Hazell.
25245 Frying pans. Lyon.
25246 Boilers. Simmons.
25247 *Corsets. Lecoutre.
25248 *Milling machine. Müller.
25249 *Motor car seat. Dietzel.
25250 Internal-combustion engine starter. Fuller
25251 Gramophone disc storing. Ried.
25252 *Cinematographs. Alexander.
25253 *Forming hollow bodies. Wayss.
25254 *Gas mantle. Ross.
25255 *Oxygen, etc., supply. Moewes.
25256 Rail joints. Zehe.
25257 *Diving apparatus.
25258 Wire strainers. Broadbent.
25259 *Game. King.
25260 Internal-combustion engine. Picardo.
25261 Plow. Boonzaier.
25262 *Coffin handle mounts. Handley.
25263 Spring hook manf. Halladay.
25264 Coupling. Gordon.
25265 *Boots. Saitzew.
25266 Carbazole manf. Bloxam.
25267 Wheels. Ogiline.
25268 *Friction clutch. Smith.
25269 *Looms. Block.
25270 *Looms. Block.
25271 Treatment of ores. Lockhart.
25272 *Threshing cereals. Weinfeld.
25273 Turning over music, etc., sheets. Zabski.
25274 Explosives. Piltins.
25275 *Device for automatic expansion. Lombard.
25276 *Propelling apparatus. Kaisen.
25277 Lifting jacks. Richardson.
25278 *Window cleaner. Eshins.
25279 Fastening for wearing apparel. Figueiredo.
25280 *Wireless telegraphy device. Goldthorpe.
25281 Lubricator. Willis.
25282 Boots, etc. Green.
25283 Flying machine. Hosmer.
25284 Relating to boots. Brihaye.
25285 Lamp. Harvey
25286 Draught excluder. Sommer.
25287 *Internal-combustion engine. Fornaca.
25288 *Producing rough plaster surfaces. Pohlmann.
25289 Target practice device. Thompson.
25290 Rendering cork, etc., non-porous. Lowman.
25291 Dye manf. Newton.
25292 *Dye manf. Bayer.
25293 Manf. of a substance like rubber Newton.
25294 Dye manf. Newton.
25295 *Lubricating oil pumps. Klinger.
25296 Knitting machine. Hawke.
25297 *Bottling machine. Pindstofte.
25298 *Wheels. Abeil.
25299 Bottle stoppering. Mills.
25300 *Railway crossing gates. Burleigh.
25301 Spraying nozzles. Johuson.
25302 *Tyres. Rodney.
25303 *Tramway point shifter. Cassisa.
25304 Wireless control of airships. Corry
25305 Piano tuning. Campbell.
25306 *Ticket holder. Stinson.
25307 *Treating rubber compounds.
25308 *Treating rubber compounds. Wittewrouge.
25309 Infants' chairs. Adams.
25310 *Ventilators. Allensby.
25311 *Pea sorter. Beale.
25312 *Air carburetting. Constantinescu.
25313 *Automatic train control. Harrington.
25314 *Motors. Weiss.
25315 *Galvanic batteries. Morrison.
25316 *Weighing apparatus. Goldschmidt.
25317 *Wheels. Rhoné.
25318 *Signalling device. Cassel.
25319 *Signalling device. Cassel.
25320 *Measuring device. Gehre.
25321 Water closet pans. Hassall.
25322 Mat holder. Mitchell.
25323 Picture frame adjuster. Mitchell
25324 Lamp. Lambert.
25325 *Cooking utensils. Schloss.
25326 *Picture postcards. Frerichs.

NOVEMBER 1st, 1910.

25327 Bullet catcher. Chittenden.
25328 Gunpowder manf. French.
25329 Furniture feet. Heath.
25330 Indoor golf. Chambers.
25331 Poultry house. Brown.
25332 *Turbine. Dyer.
25333 Screw joints. Ogden.
25334 Roller skates. Mote.
25335 Wind screen joints. Auster.
25336 Gas calorimeters. Smith.
25337 Spare wheel carrier. Hall.
25338 Fish hooks, etc. Wadham.
25339 Weaving apparatus. Barker.
25340 Braces. Travis.
25341 Valve. Gray.
25342 Measuring instrument. Slinger.
25343 Tramway rail sections. Davies.
25344 Flashlight lamp. Leonard.
25345 *Stuffing box packing. Hulm.
25346 *Treatment of ore. Quenner.
25347 Building material. Lynde.
25348 Secondary batteries. Naylor
25349 *Sprinkler. Moir.
25350 Ball-bearing cap. Sharp.
25351 *Ships, etc. Ravand.
25352 Lantern slide carrier. Hook.
25353 *Turbines. Blackstrom.
25354 Book protectors. Grimsley.
25355 Slippers, etc. Thacker.
25356 Internal-combustion engine. Still.
25357 Bath over-flow. Newsome.
25358 Locks, etc. Bauer.
25359 Leather, etc., stretching device Ränber.
25360 Combined belt punch and cutter Rowe.
25361 Collapsible boxes. Cole.
26362 Speedometers. Gardiner
25363 Switchboard. Hall.
25364 *Neck yokes. Norotny.
25365 *Typographical composer. Rogers
25366 Tea, etc., pots. Flack.
25367 Peat board manf. Pearson.
25368 *Electric apparatus. Alther.
25369 *Wire insulators. Mitchell.
25370 *Rock drilling. Smith.
25371 Electric light. Maddock.
25372 *Non-refillable bottle. Chartrand.
25373 Relating to combustion. Epstein.
25374 Latches. Theed.
25375 Carbonating apparatus. Pearmund.
25376 Internal-combustion engine. Calvert.
25377 *Vehicle castors. Norwood.
25378 Stamp delivering machine. Daniel.
25379 Postcards. Leggat.
25380 Wheels. Buik.
25381 *Printing press. Crump.
25382 *Steam engine. Stumff.
25383 *Recoverery of tin, etc. Levin.
25384 *Pump. Lack.
25385 *Electrical apparatus. Montgomery.
25386 Nitric acid manf. Hale.
25387 *Shearing apparatus. Johnson.
25388 *Bonbon stamping press. Rost.
25389 *Internal-combustion engine. Arzens
25390 Coin freed mecranism. Fawns.
25391 *Radial cylinder. Gnôme.
25392 *Rupture trusses. Loewy.
25393 Paper manf. Stocks.
25394 *Looms. Weissenborn.
25395 Jewellery. Woodhams.
25396 Dough moulder. Pointon.
25397 *Dynamo. Brown, Boveri, and Co.
25398 Potato planting. Debicki.
25399 Packing cases. Sindall.
25400 *Manf. of a plastic substance. Timpe
25401 *Treatment of ores. Johnson.
25402 Carburetters. Lovell.
25403 Fire extinguisher. Zwicky.
25404 Electric lamps. O Brien.
25405 Pouch fastener. Saenger.
25406 Milk delivering device. Jones.
25407 *Stringed instruments. Kurth.
25408 Hat conformanten. Richard.
25409 *Nut lock. Wolfe.
25410 *Fastener. Meuse.
25411 *Manf. of tungsten wires. Gray.
25412 Valves. Brook.
25413 *Corset fastener. Hahn.
25414 *Moulds. McNabb.

NOVEMBER 2nd, 1910.

25415 Boilers. Carrington.
25416 *Motor cycle side cars. Fulford.
25417 Ink fillers. Dittmar.
25418 Cycle carrier. Holloway.
25419 Cycle free wheel, etc. Jones.
25420 Wheel barrow wheels. Whiting.
25421 Locking lever. Cameron.
25422 Lamps. Goodwin.
25423 Building construction. Ellison.
25424 Signalling lamps. Hendy.
25425 Looms. Farnworth.
25426 Coal cutter. Crossland.
25427 Fabric manf. Mack.
25428 Mirrors. McEwan
25429 Bullets. Martin.
25430 Engine. Richardson.
25431 Musical instrument. Kaudson.
25432 Motor cars. Crossley.
25433 Motor cars. Davies.
25434 Gear cutting. Llewellin.
25435 Car structures. Nelson.
25436 Card setting machine. Darnley.
25437 Spinning frames. Andrews.
25438 Internal-combustion engine. Bust.
25439 Speed gear. Slaughter.
25440 *Shoe fastening. Ellis.
25441 *Sheet filing machine. Brown.
25442 Trap. Thompson.
25443 Bags, etc. Murrle.
25444 Camera stand. Dawson.
25445 Typewriter. Simmins.
25446 Tyres. Kilburn.
25447 Lock. Davenport.
25448 Sporting coat. Millington.
25450 Thread fastener. Wimble.

25451 Walking stick ferrule. Moxhay.
25452 Speedometer dial. Pieper.
25453 *Garment hanger. Peskett.
25454 Target. Govaertz.
25455 Couplings. Heimann.
25456 Horse shoes. Herndorf.
25457 Cirgar, etc., holders. Harper.
25458 Umbrellas. Izbieki
25459 Music rolls. Maxfield.
25460 Fastening. Martin.
25461 Chemical production. Newton.
25462 Treatment of pressed eggs. Hansen.
25463 Camera shutters. Deutsch.
25464 Cycle brakes. Lamplough.
25465 Road manf. Lennard.
25466 Clocks. Bell.
25467 Coin counter. Burdick.
25468 Speed gear. Roots.
25469 *Air ships. Roenne.
25470 *Internal-combustion engine. Schmied
25471 Pocket knives. Weintraud.
25472 Tyre remover. Primrose.
25473 *Repulsion motor. Brown, Boveri, and Co.
25474 Valves. Pugh.
25475 Shock absorber. Stevens.
25476 Power transmission. King.
25477 Necktie holder. Teesdale.
25478 Ceiling roses. Parkes.
25479 Tyres. Paterson.
25480 Furnace. Thompson.
25481 *Ear mark for animals. Masberg.
25482 *Multiple double seamer. Krummel.
25483 *Sewing machine. Thompson.
25484 Brakes. Royce.
25485 *Transmission gear. Royce.
25486 *Liquid fuel. Thompson.
25487 *Snap hook. Zimmer.
25488 *Flying machine. Parasino.
25489 *Boiler attachment. Barrow.
25490 *Treatment of ores. Falker.
25491 *Spinning spindles. Zimmic.
25492 *Lubricator. Boult.
25493 Metal recovery from slag. Vautin.
25494 *Shaft coupling. Schlüter.
25495 Physical force. Lagesen.
25496 *Pneumatic tyres. Wynne.
25497 *Treating fibre plants. Romanoff.
25498 Printing surface. Saalburg.
25499 Bedstead rails. Brierley.
25500 Bedstead rails. Brierley.

NOVEMBER 3rd, 1910.

25501 Lace manf. Barker.
25502 *Telephone switchboard. Aitken.
25503 Metal moulding. Bishop.
25504 Separating device. Soddy.
25505 Check valve. Chamber.
25506 Ventilator. Brown.
25507 Air filter. Hale.
25508 Castors. Lingard.
25509 Agricultural digger. Lewis.
25510 Boiler. King.
25511 Valves. Critchley.
25512 Sole levelling. Feeney.
25513 Tobacco saver. Rees.
25514 Coal tipplers. Dodds.
25515 Surgical apparatus. Lawless.
25516 Storage batteries. Drake.
25517 Carburetter. Hardy.
25518 Rock, etc., drill. Lippiett.
25519 Glass bottle manf. Knowles.
25520 Motor cycle wheels. Torling.
25521 Fire lighter. Hulme.
25522 Cycle forks. Smith.
25523 Clutch. Smith.
25524 *Rubber balls. Smith.
25525 *Boring, etc., machine. Melloy.
25526 *Spectacle case. Payton.
25527 Trawl nets. Lancaster.
25528 Recording telephone messages. Lamkin.
25529 Small arms. Lankin.
25530 Knife cleaner. Lankin.
25531 Shears. Phillips.
25532 Hook strap. Smith.
25533 Lamp. Dyson.
25534 Calenders. Watts.
25535 *Valve. Cockburn.
25536 *Chain grate stoker. McLaren.
25537 *Turbine. Rateau.
25538 *Liquid controlling device. Binnie.
25539 *Sparking plug. Herz.
25540 Moustache guard. Steele.
25541 Manf. of materials. Earle.
25542 Internal-combustion engine. Olsen.
25543 Cotton presses. Shield.
25544 Aeroplanes. Linzell.
25545 Belt cutter. Kidd.
25546 Internal-combustion engine. Lamplough.
25547 Locks, etc. Parkes.
25548 Packing textile materials. Ellinger.
25549 Valve. Watkins.
25550 Valve. Cochrane.
25551 *Steam engine. Stumpf.
25552 Sewage filter. Hughes.
25553 Sewage filter. Hughes.
25554 Crossbows, etc. Friedricks.
25555 *Insulating tube. Höfle.
25556 *Medicine. Hijo.
25557 *Speed gear. Thornton.
25558 Gun loading. Dawson.
25559 Blotting device. Kalle.
25560 *Evaporating device. Scheinemann.
25561 *Lubricant container.
25562 Guns. Dawson.
25563 Electric telegraph. Muirhead.
25564 Electric device. Lucas.
25565 Electric device. Lucas.
25566 Electric ignition device. Lodge.
25567 Metal cutting, etc. Challen.
25568 *Water treatment. Paterson.
25569 *Cookers. Sokopf.
25570 *Couplings. Reimann.
25571 *Ploughs. Hofmann.
25572 Fish preserving. Sciot.
25573 Treatment of latex. Livinston.
26574 *Typewriters. Martin.
25575 Nitric acid manf. Hale.
25576 Recovery of acids. Hale.
25577 Tyres. Carmont.
25578 *Railway signals. Maslin.
25579 *Signaling device. Foster.
25580 *Paper bag manf. Baker.
25581 *Iron manf.
25582 Cinematographs. Percy.
25583 Reinforced ebonite. Sterckx.
25584 Piston rings. Huntley.
25585 *Gas lamps. Chandler.
25586 *Looms. Denning.
25587 *Belts. Doll.
25588 Dynamo. Vandervell.
25589 *Braking device.
25590 Pens. Knight.
25591 Buckets. Thomson.
25592 *Roller grinding. Kirner.
25593 Cinematograph. Day.
25594 Producing vibratory motion. Minton.
25595 Cycle gear case. Hall.
25596 Cornice poles. Hudson.
25597 Rain gauge. Arnold.
25598 Wheels. Reggel.
25599 *Wheel. Margetts.
25600 Device for moving in required direction. Richards.

NOVEMBER 4th, 1910

25601 *Stair climber. Readdy.
25602 Carburetter. Wilce.
25603 Musical instrument. Swinburne.
25604 Lamps. Swinburne.
25605 Motor van body. Knill.
25606 Testing instrument. Ettles.
25607 Electrical switch. Reid.
25608 Dividing fatty materials. Mackenzie.
25609 Looms. Veevers.
25610 Safety lid. Rigby.
25611 Spinning machines. Wood.
25612 Trousers' suspender. Fairless.
25613 Artificial horizon. Ree.
25614 Wind screen. Hall.
25615 Furnace. Macdonald.
25616 Oven shelf. Dixon.
25617 Aerial device. Cuming.
25618 Boot manf. Parkes.
25619 Withing casks in cellars. Greenway.
25620 Non-skid device for vehicles. Murdoch.
25621 Protecting device. Nicholson.
25622 *Telescope. Zeiss.
25623 Tobacco cartridge. Levy.
25624 Tyre inflating. Poulton.
25625 *Brick manf. West.
25626 Golf playing. Harrison.
25627 Photo camera. Wishart.
25628 Eyeglasses. Wilson.
25629 Bursting tool. Clarke.
25630 *Fire box stays. Hastead.
25631 Boot displaying. Carter.
25632 Locking hinges. Hord.
25633 Biscuit pan conveyor. Rees.
25634 Arc lamp. Schmidt.
25635 Pipe cleaner. Rogers.
25636 *Worm milling cutter. Melloy.
25637 *Stentering machine. Barker.
25638 Rim brake. Bates.
25639 Cycle frames. Bates.
25640 Wood screw. Houghton.
25641 *Boot rubber tips. Baucutt.
25642 Aerial bombs. Barton.
25643 Radiators. Lamplough.
25644 Internal-combustion engine. Bevir.
25645 Valves. Robinson.
25646 *Colour printing. Manners.
25647 Spring fork. Smith.
25648 Boot brushes. Geldart.
25649 *Wheels. Gilbert.
25650 Pencils, etc., clip. Pass.
25651 Lifting jack. Adair.
25652 Bandage. Large.
25653 Whistle. Spurgeon.
25654 Piano player. Taylor.
25655 *Carburetters. Clench.
25656 Boiler scale. Lelarge.
25657 *Carburetter. Binon.
25658 Pens. Shand.
25659 Hair curler. Summers.
25660 Tyre. Alkin.
25661 Artificial teeth. Wienand.
25662 Wind screen. Russell.
25663 *Barrels. Archer.
25664 Type composing. Gilbert-Stringer.
25665 T-squares. Bray.
25666 Postcards. McGuffie.
25667 *Spanners. Freeman.
25668 Treating organic liquids. Browne.
25669 *Obtaining oily, etc., substance. Wynberg.
25670 *Photo apparatus. Bigge.
25671 *Steam engine. Lymer.
25672 Feed water heater. Marks.
25673 Lamp. Brough.
25674 Boots. Branch.
25675 *Number indicator. Kiparski.
25676 *Speed indicator. Morrell.
25677 *Belt fasteners. Sannair.
25678 Dynamo. Fuller.
25679 Lamp. Fuller.
25680 Carburetter. Hamilton.
25681 Cash tray. Waterhouse.
25682 *Filter. Auerine.
25683 Electric motor. B. T.-H. Co.
25684 Propeller. Evans.
25685 Carburetter. Hale.
25686 *Singeing machine. Allsop.
25687 *Lubricator. Bellevile.
25688 *Metal bender. Fahnestock.
25689 Seat stick. Green.
25690 Air compressor. Bell.
25691 Inter-connecting wires. Harris.
25692 Tyres. Bonham.
25693 Coupling. Tyson.
25694 Tyres. Arnold.
25695 Armour plate manf. Newton.
25696 Compounds of calcium. Folmer.

NOVEMBER 5th, 1910.

25697 *Cargo vessels. Williamson.
25698 *Compound manf. Kaufmann.
25699 Aeroplanes. Moore.
25700 Telephone call. Williams.
25701 Game. Robertson.
25702 Memorandum. Branson.
25703 Camp chairs. Nosted.
25704 Capstan, etc., lathes. Smith.
25705 Tobacco pipe. Frame.
25706 Drill. Middleton.
25707 Horse shoe. Tozer.
25708 Motor car axles. Austin.
25709 Muffler. Stannard.
25710 Wire rope haulage. Auld.
25711 Box. Hutton.
25712 Aeroplanes. Hammond.
25713 Dressers. Wilding.
25714 *Necktie holder. Wills.
25715 Lamp holder. Townley.
25716 Distilling apparatus. Wyld.
25717 Garden syringes. Purser.
25718 Garden frames. Cutler.
25719 *Weighing machine. Richardson
25720 Picks. Wade.
25721 Bobbins. Graf.
25722 Conveyor. Wallwork.
25723 Stoves. Robb.
25724 Weighing apparatus. Hipkins.
25725 Telegraph cable. Bates.
25726 Telegraph cable. Bates.
25727 Injection apparatus. Baer.
25728 *Trucks. Archibald.
25729 Twist lace machine. Jardine.
25730 *Lace manf. Jardine.
25731 Cooker. Graham.
25732 Electric apparatus. Siemens.
25733 Screens. March.
25734 Sand distribution. Ames.
25735 Furnace. Schwalfenberg.
25736 Furnace. Schwalfenberg.
25737 Tyre support. Ellingham.
25738 Tyre. May.
25739 *Internal-combustion engine. Higgins.
25740 Earthenware plates. Rupp.
25741 Steel manf. Kohlhaas.
25742 Locking washer. Morley.
25743 Stick seat. Hudson.
25744 Table, etc. Clarke.
25745 Carburetter. Lamplough.
25746 Treating ores. Stanley.
25747 Treating ores. Stanley.
25748 Wearing apparel. Newton.
25749 *Flying machine. Mees.
25750 *Flying machine. Sommer.
25751 *Toning silver salt.
25752 *Tobacco pipe. MacLaughlin.
25753 *Spooling apparatus. Reiners.
25754 *Lavatory basins. Ellis.
25755 *Lubricating device. Scott.
25756 Electric switch. Scott.
25757 Concrete wall. Brown.
25758 Window fastener. Davis.
25759 *Lathing. White.
25760 *Rod moulding. Clarke.
25761 Projecting lantern. Rosander.
25762 *Dress protector. Meissner.
25763 Paper manf. Nuttall.
25764 *Heat regulator. Nielsen.
25765 Music box. Walker.
25766 Ships' side light. Gill.
25767 Coke cooling, etc. Eaglesham.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to December 12th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

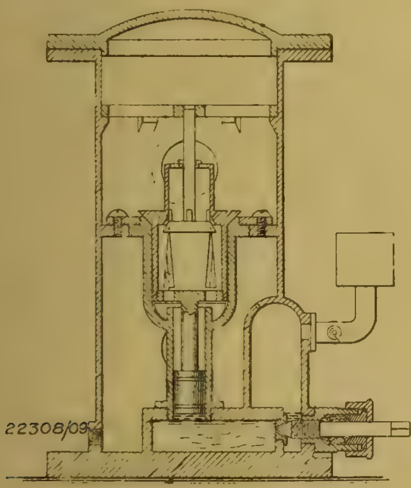
Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

15469 **Wolf**: Separation of metalliferous materials from their ores or other matter carrying same. 17939 **Denne**: Sole-levelling machines to be used in the manf. of boots and shoes. 18205 **Cowburn**: Aeroplanes and the means for propelling same. 20065 **Taylor**: Drill for boring inverted conical holes. [Post-dated March 2nd, 1910.] 20144 **Brezet**: Hydraulic power transmission apparatus. [Date applied for under International Convention, September 3rd, 1908.] 20309 **Glover and West**: Distillation of coal in vertical retorts. 20331 **Leslie**: Spindles of spinning and roving machines. 21059 **Garsed**: Aerial machines. [Post-dated April 15th, 1910.] 22107 **Walker**: Collapsible hat boxes or cases. [Post-dated March 29th, 1910.] 22182 **Braun**: Stoppering of bottles, jars, and the like. [Cognate Application. 22296, 1909.] 22267 **Chipperfield**: Gas-heated ironing apparatus. 22296. *See* 22182, 1909. 22307 **Hill**: Pneumatic tyres. [Cognate Aplication. 5333, 1910.]

22308 **Brown and Tilley**: Air or gas compressors.

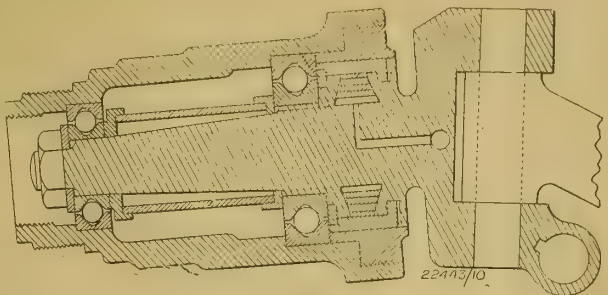
This invention relates to that class of air or gas compressors in which a pump or blower draws in air or gas and passes it to the apparatus or burners in a state of pressure, a valve connecting the inlet and the outlet so that should the pressure become excessive it will open the valve and relieve the pressure at the apparatus or the burners, some of the high-pressure gas passing back again to the pump or blower and continuing to do so until the pressure on the outlet side of the pump or blower is reduced and the valve thereby closed. The essential features of this invention consist in constructing the relief valve hollow and with slots or holes in the wall below the seating bead or ring, positioning an auxiliary drop valve inside the relief valve for having a seating therein when lifted by the pressure of gas in the bottom chamber, and connecting the relief valve to a piston movable in a cylinder connected by a valve-controlled pipe with a chamber.



22313 **Thomas Elsley Ltd., and Elsley**: Louvre casement ventilators. 22320 **Attwood**: Automatic apparatus in connection with lighthouses, lightships, buoys, beacons, or any other sea or land marks. 22352 **Smallwood**: Cleaning and polishing composition for metal, glass, or the like. 22411 **Gray**: Driving belts.

22443 **Miles**: Friction clutches and brakes.

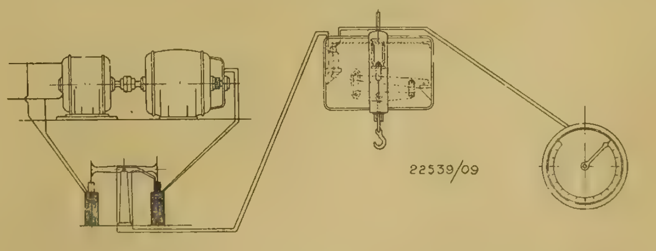
This invention relates to improvements in friction clutches and brakes operated by fluid pressure which expands the inner member of the clutch circumferentially to grip the outer member. According to this invention one of the frictional surfaces is of the expanding type, and the object of the invention is to provide efficient means for effecting its expansion and control; this is carried out by fluid pressure or any expansive gas. Beneath the expanding members is arranged an insertion of leather or such like material composed of several consecutive rings. The invention enables a friction clutch or brake of very small dimensions, but great power, to be provided which renders the invention suitable for application to variable gears of the type in which the wheels are always in mesh. Essentially the invention consists in the provision in a friction clutch in which the inner member is caused by fluid pressure to expand circumferentially so that it shall bind against the outer member providing the inner member with rings of leather which lie in an undercut groove and beneath which the fluid can be admitted.



22446 **Bradley**: Carding engines. 22463 **Searle and Condit**: Automatic small arms. 22475 **Potter**: Propelling mechanism of vessels or machines for aerial navigation. 22497 **Greville**: Clutches. 22514 **Wyld and Green**: Method of revivifying sulphuretted oxide from gas works. 22518 **Taylor**: Methods of charging and discharging electric accumulators or secondary batteries. 22526 **Thomson**: Double-arch letter or document files or cases.

22539 **Dobson, and Henry Pooley and Son Ltd.**: Electrical indicating means for weighing machines.

This invention has reference to electric weighing machines in which the weighing is partly effected by solenoids operated by the weighing levers of the mechanical parts of the machine, so as to cause the electric indicating apparatus to show various readings according to the greater or less movement of the levers of the weighing machine, due to the greater or less load upon them. In this invention there is provided in connection with a weighing machine, whether it be of the suspended, stationary, or platform type, and in which the weighing is effected by induced electrical currents produced by the movement of the weighing mechanism of the machine, an electrical motor in combination with an alternating-current generator driven thereby, and an electrical governing device interposed between the generator and the electrical means of the weighing mechanism for producing induced currents. The continuous-current motor is connected up with the means for producing the alternating current and the continuous-current mains with one of the solenoids of the governor device which it energises, and the continuous

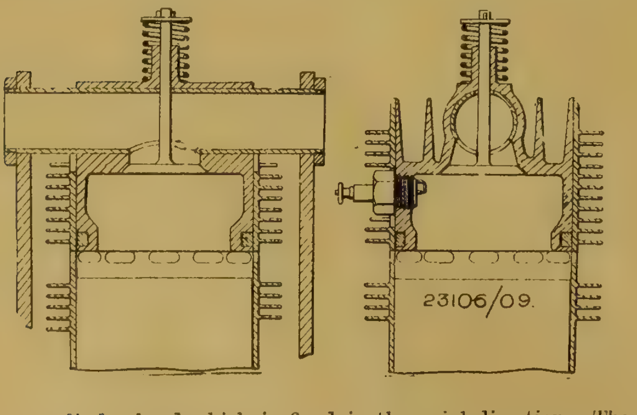


current according to the fluctuations in it causes the governor device to move so as to control or regulate the alternating current in the other solenoid of the governor device and produced in the alternating-current generator. By means of this governor device and by generating the alternating current from the continuous current the alternating current supplied from the alternating-current solenoid of the governor device and to a solenoid apparatus fitted to the weighing machine will be constant, and by this means the current transmitted to the volt indicator through the solenoid appliances or part thereof moved by the weighing mechanism of the machine will correspond truly with the load and with the amount of movement of the parts of the weighing machine by which this movement is accomplished.

22546 Gander: Scale or index for use on type-composing machines. 22555 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of dyes. [Samples furnished under Section 2 of the Act.] 22579 Gewerkschaft Deutscher Kaiser Walzwerk Dinslaken: Rolling mills. [Date applied for under International Convention, November 2nd, 1908.] 22592 Coleman and McClelland: Means for heating liquids. 22608 Buch: Sand-moulding machine. 22614 Thomae: Double-acting ratchet braces. 22660 Denison and Denison: Method of and machinery for the manf. of crimped or pleated capsules of paper or analogous material to serve as caps for bottles, cups for confections, and the like. 22697 Pearse: Skating and like apparatus. [Cognate Application. 27886, 1909.] 22725 Bouchard-Praceiq: Method and apparatus for collecting mechanical energy in the disturbed waters of seas and lakes by directly obtaining a continuous rapid rotary motion easily convertible into electric energy. [Date applied for under International Convention, April 9th, 1909.] 22731 Skilton: Apparatus for facilitating the coding, decoding, and checking of condensed telegrams, and for correcting errors made in the transmission of same. 22764 Armour: Indicating and recording apparatus for electric pyrometers and the like. 22766 Watson: Straps and belts. 22772 Bowden and Raven: Wheel hubs for perambulators and like vehicles. 22798 Macculloch and Bernard: Horse race or like recreative apparatus. 22818 Newland: Flushing cisterns. [Cognate Application. 25465, 1909.] 22823 Damey: Electric incandescent lamps and their holders. 22853 John Lysaght Ltd., and Whitmore: Heating and annealing furnaces for use in connection with rolling mills. 22856 Longsdon and Bottomley: Machines for starching linen and like articles. 22867 Facon: Gulleys. 22920 Lake (Asbest- und Gummiwerke Alfred Calmon Akt.-Ges.): Packing for stuffing boxes and the like. 22930 British Radio Telegraph and Telephone Co., and Balsillie: Means applicable for use in transmitting and receiving signals by wireless telegraphy or telephony. 22979 Slack: Gas-heated washing boilers. [Post-dated April 1st, 1910.] 22981 Jackson: Mashing of tea for schools, factories, and the like, and apparatus therefor. 23002 Nicholas and Bateman: Furnaces for the melting of metal or scrap or like material. 23010 Newton (Farbenfabriken vorm. F. Bayer and Co.): Preserving preparations. [Application for Patent of Addition to 10073, 1909.] 23039 Boult (Electric Meat Curing Co.): Processes of preserving. 23064 Patterson (Urquhart): Rotary engines. 23073 Hardy: Playing cards.

23106 Lanchester: Internal-combustion engines.

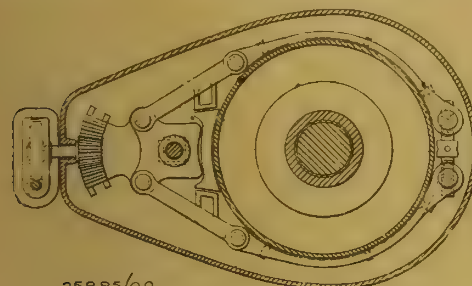
This invention relates to internal-combustion engines, and consists essentially in the provision of a sleeve surrounding the engine piston and a member analogous to a cylinder head which is fixed in the axial direction. The piston is connected to a connecting rod and a crankshaft of the usual type and reciprocates within the sleeve. The sleeve also is caused to reciprocate, being connected to an eccentric or similar means driven from the crankshaft and thereby opens and closes a port or ports formed in the wall of the sleeve by causing these ports to move clear of or overrun the fixed head. The above ports serve as exhaust ports, the burnt gases passing directly into the atmosphere, as no exhaust pipe is provided. The admission of the charge to the engine may be made through an ordinary spring mushroom valve, and this valve may either be mounted in the fixed head or in the piston itself. In the former case an induction pipe connects the head to the fuel supply and in the latter the fuel mixture is supplied primarily to the crank case of the engine.



23157 Nirascou: Scale scraper for boiler tubes. 23210 Dussich: Lubrication of machinery. 23271 Spratt and Houghtons Ltd.: Talking machines, phonographs, or the like. 23273 Evans: Device for facilitating object drawing. 23288 Hoyle and Strange: Percussion fuses for projectiles. 23293 Cliburn and Cliburn: Clip fastenings. 23307 Callender's Cable and Construction Co., and Petersen: Combination of an electric cable jointers' hand cart and an electric cable drum. 23319 Chapman: Arrangement of a combined collector ring, commutator, and switches for use with a small battery to start petroleum engines fitted with magneto igniting apparatus. 23320 Frishmuth: Packless valves. 23327 Smith: Machines for the splitting or other working of stones and the like. [Date applied for under International Convention, October 19th, 1908.] 23333 Saunders: Construction of cylindrical or other hollow bodies of veneers. 23396 Wanklin: Roller skates. 23415 British Thomson-Houston Co. (General Electrical Co.): Voltage regulation of alternating electric current distribution systems. 23439 Johnson (Chemische Fabrik Griesheim-Elektron): Purification of magnesium and magnesium alloys. 23489 Powell: Sheet-metal clips for rigidly joining light framework. 23510 Weller: Anæsthetic nasal-inhaling apparatus. 23512 Whiffin: Method of inlaying or ornamenting wooden or other surfaces. 23573 Southall, Wynn, and Harris: Miners' lamp for actual use in mines and for use as a model. 23824 Tussaud and Tussaud: Composition or material for reproducing works of art, such as models, sculptures, and the like. 23886 Keighley: Apparatus for indicating and recording scores and for similar purposes. 23958 Newman: Perforating machines. 23964 La Force: Apparatus for indicating the liquid level in a tank and for totalising the quantities of liquid poured into the tank. 23972 Ponder: Cake tins and the like. 24043 Henderson and Russell: Paper-cutting machines. 24080 Barnes: Smoke consumer for inverted incandescent gas lights. 24233 Baker: Folding perambulators, push cars, and the like. [Application for Patent of Addition to 18555, 1908.] 24272 De Urruela: Detachable treads for pneumatic and other tyres. 24278 Jones: Treatment of flour and meal. 24333 Jones: Safety guards or barriers for mine and like cages. 24366 Fox: Adjustable spanners. 24437 Ruhstrat: Process of manufacturing materials for metallic filaments of electric incandescent lamps. 24566 Hirst and Angold: Electric arc lamps. 24573 Bunn: Fastening for the cantrails of landaulettes and for other like uses. 24575 Watson: Device or apparatus forming a fire basket and a water heater combined. 24603 Dreyfus: Candle holder. 24691 Lord: Pulleys employed in connection with the gallows of steam trawlers and in other situations. 24761 Littlewood: Device for holding safety razor blades for stropping or like purposes. 24854 Hall: Crushing, pulverising, and amalgamating machines. 24886 Taylor: Horse clippers and the like. 24898 Adkins: Nail-feeding apparatus. 25280 Metropolitan Amalgamated Railway Carriage and Wagon Co., and Wheeler: Railway hopper wagons. 25287 Best: Construction of means for regulating the gas supply to burners and the like. 25350 Rowan and Lloyd: Disinfecting and fumigating block. 25439 Borsch: Devices for automatically raising trousers when sitting down. 25465. *See* 22818, 1909. 25606 Hollingworth (Crompton and Knowles Loom Works): Pneumatic or air-pressurre actuated filling detector mechanism for automatic weft-replenishing looms. 25620 Warne: Umbrella stands. 25625 Prudent: Resilient wheels for road vehicles. 25645 Vernon: Instruments for determining, measuring, and recording the position and movements of object in space. 25705 Marshall: Valve gear of internal-combustion engines. [Application for Patent of Addition to 22849, 1909.] 25730 Dalby and Hill: Brake for roller skates. 25833 Crane: Binding or attachment to each other of loose-book catalogue sections or similar parts. 25853 Berenger and Huessener: Belt pliers.

25885 Harfield: Brake mechanism for cable lifters and the like.

This invention relates to improvements in brake mechanism for cable lifters. The improved construction provides a powerful frictional differential action when pressure is applied to the brake drum or sheave by the brake block through the medium of the double-nose lever, one or the other of the brake straps is tightened by the lever which is moved in the same direction as the cable lifter is revolving, and by its differential action tightens the one strap to a greater extent than that to which the opposite strap is yielding. To release the brake the hand wheel is turned so as to bring the double-nose lever into the central or inoperative position.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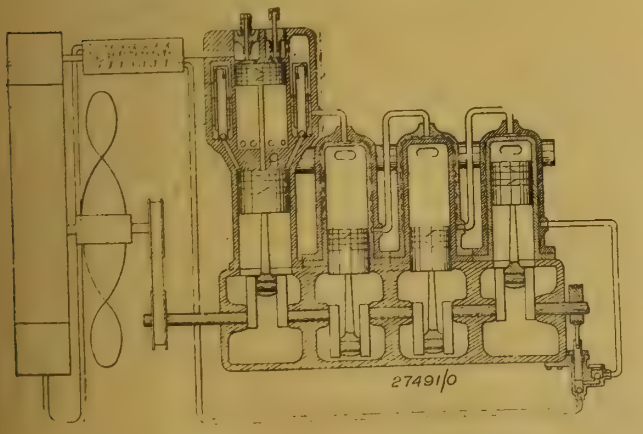
25910 Gibson: Train-controlling mechanism. [Date applied for under International Convention, April 5th, 1909.] 25913 Stern: Draught excluders for doors. 25951 Hollingworth (Crompton and Knowles Loom Works): Magazines for weft-replenishing drop-box looms and means for selecting and releasing the bobbins or filling carriers. 26130 Wilkes, Coombs, Hatcher, Burt, and Moores: Carburetters. 26142 Ruggles: Washer for screw-down taps. 26217 Schnorrenberg: Means for operating gas valves operated from a distance. 26317 British Cotton and Wool Dyers' Association, and Robson: Machine for the mercerising, dyeing, bleaching, or like treatment of cotton or other vegetable fibre in the roving, sliver, or loose state or woven into fabrics. 26568 Christmas: Flying machines. 26583 Bruaas: Combined cultivators and harrows. 26641 Leadbeater: Heels for boots and shoes. [Cognate Application. 11384, 1910.] 26685 Taylor: Wind and dust screens for side cars, tri-cars, trailers, bath chairs, and the like. 26911 Krayn: Device for production of three colour screens for colour photography. [Date applied for under International Convention, November 20th, 1908.] 27032 Rosenthal: Dental instruments, particularly adapted for stopping teeth. [Date applied for under International Convention, December 2nd, 1908.] 27080 Cole: Photographic washing tanks. 27150 Norman: Spring suspension arrangements of motor cars and other vehicles. 27214 Douglas: Devices for securing or fastening collars and like apparel. 27483 Hammond: Supply of heated air to boiler furnaces. [Application for Patent of Addition to 26953, 1906.]

27491 Stocks: Combined internal-combustion and fluid-pressure engine.

This invention has for its object the utilisation of the waste heat of internal-combustion engines for the purpose of raising pressure by evaporation of water or other suitable fluid. The invention is applicable to an internal-combustion engine with one or more cylinders, and comprises a receiver to contain the exhaust gases, a steam cylinder surrounded by a steam generator, means to circulate water around the internal-combustion engine cylinders to the steam generator, and from thence to a condenser, then through a feed-water heater, and again to the internal-combustion engine cylinders, a compressor to receive the pressure of the exhaust gases and force same to the generator to raise the water to steam, and means for utilising the steam in the steam cylinder.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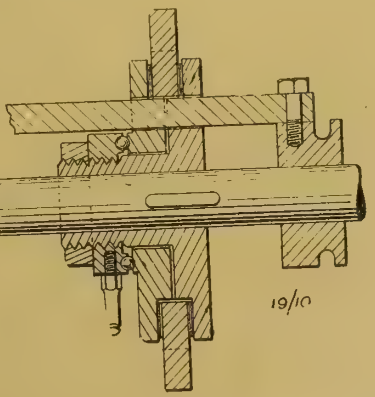
27556 Merritt: Coin-controlled locks. 27586 Cantono: Starting devices for explosion motors or other rotating mechanisms. 27597 McNaught: Wool-washing and squeezing machines. 27744 Gratieux: Flexible gas tubes. 27773 Newton (Farbenfabriken vorm. Friedrich Bayer and Co.): Manf. and production of vat dyestuffs. [Application for Patent of Addition to 7819, 1909. Samples furnished under Section 2 of the Act.] 27826 Hausser: Manf. of nitrogen oxides. 27831 Kuhn: Manf. of beverages from grapes and raisins. [Date applied for under International Convention, December 2nd, 1908.] 27886. *See* 22697, 1909. 27953 Moss and Moss: Pumps and motors. 27997 Balaban: Copy holders for typewriting machines. 28010 Woods, Casartelli, and Casartelli: Thermometers for taking the internal temperature of meat, carcases, or the like. 28042 Johnson (Badische Anilin and Soda Fabrik): Manf. of chlorine derivatives of indigo. 28050 Bruns: Methods of and means for reversing two-cycle internal-combustion engines. [Date applied for under International Convention, February 8th, 1909.] 28147 Riebel: Machine for affixing hinges having fastening points. [Rights under Section 91 of the Act not granted. Application for Patent of Addition to 24900, 1909.] 28177 Bell and Graham: Construction of mechanism for adjusting brakes of winding engines and the like. 28322 Harling: Slasher sizing, beaming, and like machines. 28390 Valentine: Gas fires. 28513 Ritchie: Method of delivering coal or other minerals from the working face in mines, or elsewhere, into tubs, hutches, or wagons and means for effecting same. 28523 Mason: Advertisement cabinet. 28525 Speight: Striking plates for the locks of carriage doors or the like. 28552 Hartmann: Purification of liquids by electricity. 28826 Wise: Acetylene generators. 28828 Mitchell: Manf. of printed felts. 28850 Hansen: Recoil loading pistols. 29011 Stern: Saucepans. 29199 John Ruscoe and Co., and Kenyon: Means for connecting branch service pipes with mains. 29270 Bull: Means for operating fanlights and the like. 29459 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of a new azo dyestuff. 29588 Robertson: Jars, bottles, and the like. 29614 Bell: Wheels for motor cars, bicycles, and the like.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29650 Sussmann: Burner for incandescent gas light. [Application for Patent of Addition to 2789, 1909.] 29693 Burbach: Process for the manf. of water-tight reservoirs and chambers of a like nature from ferro concrete. [Date applied for under International Convention, December 18th, 1908.] 29884 Lake (Pierce, Alden, and Parmenter): Skiving machines. 30031 Shrimpton and Weir: Distributing valve mechanism for direct-acting pumps. 30180 Schroeder and Macalister: Dress fasteners or the like. 30192 Lanchester: Construction of bridges. 30242 Harrison: Fire extinguishers. 30287 De Colombier: Construction of cylinders for internal-combustion, steam, and air engines, and the like. [Date applied for under International Convention, December 28th, 1908.] 30352 Clarke: Telephone mouthpieces. 30527 Kelham and Marshall: Washers.

1910.

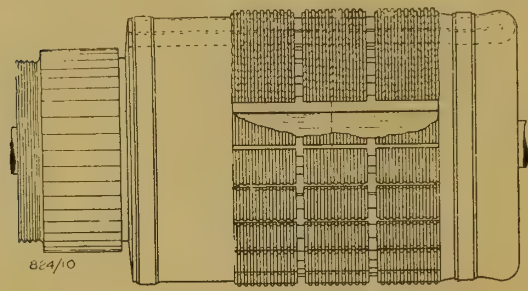
19 Wetherell: Clutches for conveying rotary motion.

This invention relates to clutches of the kind in which one clutch member is gripped between two outer clutch members, one of which rotates relatively to the other when the driving shaft rotates, and are thereby caused to approach and grip the first clutch member. The invention consists essentially in a clutch comprising an annular clutch member rotating between two gripping plates, one of which is adapted to rotate to a limited extent relatively to the other, and has wedge surfaces on its outer surface and the wedge ring fixed relatively to the fixed plate and acting to force the loose plate towards the fixed plate.

92 Holt: Making the soldered joints on lead or other metal pipes. 166 Jones: Flower holder. 169 Shelley: Spring wheel. 277 Roberts: Egg cups. 362 Chavasse: Combined broom and scraper. 503 Carryer, Malkin, and Malkin Patent Pedal Co.: Pianos. 526 Wolf, Bambury, and Bernardy: Incandescent gas lamps of the inverted type. 566 Strassberger: Cards for use in raising textile fabrics. 685 Young: Ladies' hat containers. [Date applied for under International Convention, January 26th, 1909.] 695 Hibbert: Mule carriages. 711 Reith: Combined turf weeder and repairer. 764 Robinson: Turbine engines. 820 Maconochie: Handles of forks, spoons, and knives.

824 Crompton and Co., Macfarlane and Burge: Dynamos and motors.

This invention refers to improvements in dynamos and motors, and more particularly to the armatures thereof. It is a well-known fact that armature cores tend to overheat in a manner detrimental to the efficiency of the machine, either owing to the eddy currents induced in the armature core, to the heat derived from the copper conductors, or to hysteresis. According to this invention the radiating surface of the armature exposed to the atmosphere is increased by building up the armature with core discs of two different diameters, one slightly greater than the other. Such larger and smaller core discs are threaded on alternately, so permitting radiation from the sides of the peripheries of the larger core discs as well as from their edges.

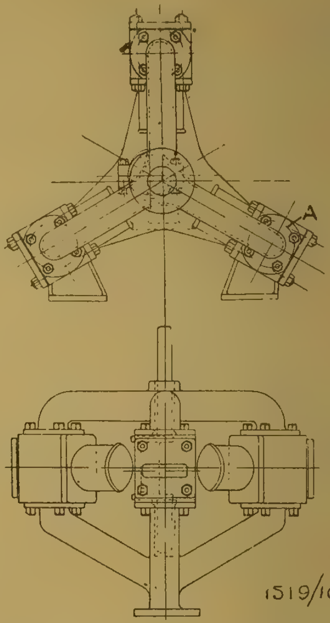


848 Burn: Machines for moulding concrete building blocks and the like. 851 Burch: Means for lighting gas lamps or lanterns. 871 Angerstein and Burgerhausen: Device for unfastening and operating doors by means of suction. 898 Riley, Whitham, Foden, and Steele: Friction clutch devices for warping, beaming, and other textile machinery. [Post-dated April 16th, 1910.] 941 Hiscock: Variable-speed driving gears. 1061 Ireland: Propellers. 1224 Aumann: Production of circulation in a liquid by means of gases. 1265 Hipkins and Ker-Ramsey: Automatic weighing apparatus. 1427 Porter: Apparatus for conveying bottles. 1467 Whitington and Whitington: Plant labels and the like.

1519 Merryweather: Pumps.

This invention relates to improvements in pumps in which the pump body consists essentially of three barrels arranged radially around a common centre together with the valve chambers and the suction and delivery passages necessary to lead the water to and from the valve chambers. The present improvement consists essentially, when three plungers are arranged radially round a common crankshaft, in a method of construction comprising two trifurcated members constituting the suction and delivery water passages respectively and three separate valve boxes adapted to be secured between members.

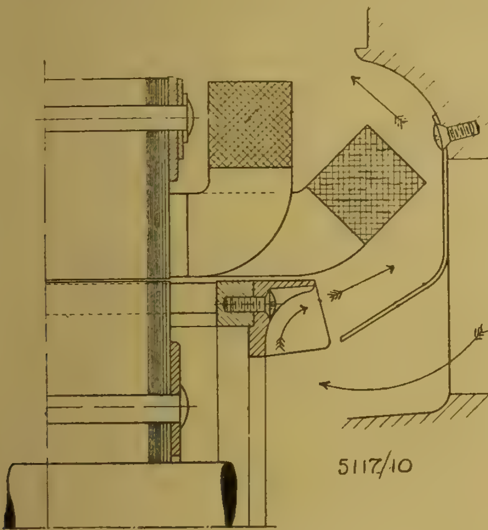
1675 Smith: Syphon cisterns. 1832 Everitt: Trouser and like stretching arrangements. 1833 Everitt: Hanger or suspender for a coat or like garment. 1851 Willcox: Carrying of spare rims or wheels upon motor vehicles. 1877 Dalen: Light signal lanterns. 1910 Deprez and Richir: Carburetted air stoves and lamps. 1958 Hall, Simpson, and Co., and Simpson: Combined stopper and regulator of the flow of liquids from vessels fitted with screwed spouts or necks. 2098 Schmidt: Combined water-tube boiler and superheater arrangements. [Date applied for under International Convention, February 18th, 1909.] 2469 Watkins: Hand-driving gear for washing machines. 2550 Altmann: Valves and valve gear for steam engines. 2617 Weber: Combined aiming devices and searchlights. 2675 Wills: Ovens, stoves, and ranges heated by gas. 2888 Newton (Farbenfabriken vorm. F. Bayer Co.): Manf. and production of a new pharmaceutical product. 2983 Westinghouse Metallfaden-Gluhlampenfabrik Ges.: Process for decarbonising metallic filaments for incandescent electric lamps. [Date applied for under International Convention, February 19th, 1909.] 3169 James: Suspension of pictures and other articles. 3222 Lake (Maloney): Traveller rings for ring and traveller spinning and twisting machines. 3252 Barlow and Warburton: Manf. of terry fabrics. 3325 Dacheux: Type-distributing apparatus. [Date applied for under International Convention, May 4th, 1909. Application for Patent of Addition to 14723, 1909.] 3543 Turnbull: Emergency tyres, rims, or annular wheels and the means of fixing same. 3610 Westinghouse Metallfaden Gluhlampenfabrik Ges.: Manf. of tungsten filaments for incandescent electric lamps. [Date applied for under International Convention, February 15th, 1909.] 3731 Trussell: Temporary binders. 3813 Willkomm: Speed-controlling devices for motor engines. 4086 Akt.-Ges. Metzeler and Co., Metzeler and Vossen: Method of manufacturing waterproof, lustrous fabric, for balloon envelopes and aeroplanes. 4098 Urbain, Feige, and Scal: Electric lamp. 4191 Becker: Manf. of vice jaws, hammers, and like tools. 4478 Draper and Tabberer: Lubrication of loose pulleys, wheels, rollers, and the like. 4562 Warner: Wrenches. 4566 Siner: Means for detachably securing tyres to vehicle wheels. 4688 Thompson (Excelsior Needle Co.): Apparatus for use in the manf. of spring beard needles. 4698 Pergolizzi: Gramophones. [Application for Patent of Addition to 24588, 1909.] 5022 Revere Rubber Co., and Cobb: Braided hose.



5117 Siemens Bros. Dynamo Works, Kieffer, and Schaeffer: Ventilation of dyanmo electric machines.

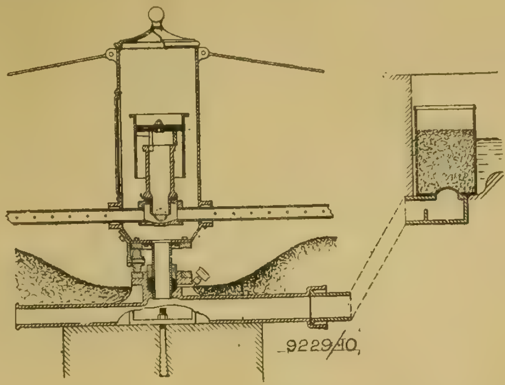
This invention relates to improved arrangements for ventilating dynamo electric machines whereby eddy currents in the air streams which come into contact with the windings of the dynamo are prevented and a greater supply of cool air is thus obtained. It refers particularly to squirrel cage induction motors of the kind in which the fan vanes project from the rotor core a considerably shorter distance than the stator winding projects frm the stator core. It consists in a special form of fan in combination with an improved arrangement of air baffling or guiding plates. The fan vanes suck in a current of air in a substantially radial direction and deliver it in a more or less axial direction—that is to say, in a direction which is more or less parallel to the shaft of the dynamo. The vanes are mounted on a curved rim of such a shape that the delivered air, instead of travelling radially outwards and coming into direct contact with the horizontal parts of the end windings or "hang out" of the stator whereby air eddy currents are formed, is directed into a more or less axial direction and sweeps over the end windings in a manner which to a large extent prevents the setting up of eddy currents. If desired the rim and the vanes can be combined together into one self-contained fan wheel mounted on the rotor.

5127 Bumiller: Means for lighting Christmas trees. 5128 Bain: Sliding legs for trunks. 5281 Sefton-Jones (Empire Machine Co.): Drawing glass cylinders. 5333. *See* 22307, 1909. 5335 Dart: Match composition. 5391 Lake (Bour): Apparatus for preventing side slip in motor cars and like vehicles. 5487 Huguenin: Devices for relieving axial thrusts in steam turbines, pumps, and like machines. 5557 Golby (Peerless Crown Cork Feeder Co.): Mechanism for feeding caps to bottles. 5561 Carbone: Arc lamps. 5592 Pushee: Apparatus for making brushes and the like. [Date applied for under International Convention, July 12th, 1909.] 6405 Eckert: Tips for boots and shoes. 6421 Summerley: Tobacco cartridges. 6617 Dacheux: Type-distributing and composing machines. 6622 Diehl and Faber: Manf. of coke. 6706 Marshall: Machines for the manf. of flexible metallic tubes or for armouring insulated electric and other cables. 6872 Rose: Gripping apparatus applicable for removing the skin or hide off the tails of bullocks' carcases and for other purposes. 6895 Petersen and Sem: System for use in long distance telephony. [Date applied for under International Convention, March 25th, 1909.] 6956 Calzada: Machine for spreading mineral manures and the like materials upon fields. 7061 Firma Edouard Dunkelberg and Jannert: Razors. 7305 Soc. L'Air Liquide: Separation of oxygen and nitrogen from the air. [Date applied for under International Convention, March 24th, 1909.] 7446 Breil: Manf. of shafts and the like. [Date applied for under International Convention, March 27th, 1909.] 7631 Johnson (Badische Anilin and Soda Fabrik): Manf. and production of compounds of the anthracene series. 7644 Desmond: Fishing tackle. 7747 Mead: Mufflers for personal wear. [Date applied for under International Convention, August 9th, 1909.] 7766 Fabry: Purifying coal gas after the extraction of ammonia. 7933 Harle et Cie.: Apparatus for connecting to a rope or chain articles to be transported thereby. [Date applied for under International Convention, April 19th, 1909.] 8046 Patterson: Safety envelope. [Cognate Application. 10640, 1910.] 8062 Tacchi and Kirschbaum: Gearing for motor vehicles and cases therefor. 8073 Skremka: Fastenings for garments. 8094 Dittmar: Manf. of phosphoric acid. [Date applied for under International Convention, November 6th, 1909.] 8099 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of tetramethylene-diamine. 8227 Smith: Printing or numbering machines, or combined printing and numbering machines. [Date applied for under International Convention, April 13th, 1909.] 8443 Berger: Drying apparatus. [Date applied for under International Convention, December 14th, 1909.] 8707 Millerd: Hatpin point protector. 8823 Hunt: Adjustable shaft and coupling. 8898 Gray: Chimney tops. 8963 Lush: Centrifugal pumps for pumping sands, ballast, minerals, sludges, and the like. 9036 Lovekin: Fluid-pressure power plants. 9174 Robinson and Edwards: Moustache and lip guards for spoons. 9185 Jenkins and Jenkins: Hand tools for inserting or withdrawing tubular screwed ferrules from tube plates and the like.



9229 Dixon and Blakeborough: Automatic revolving and intermittently operating sprinklers or sewage distributors.

This invention relates to automatic revolving sprinklers of the reaction type for distributing sewage or other liquids on to bacteria beds or filters. In this invention the central fixed pillar or column commonly employed in revolving sprinklers of the reaction type is dispensed with, and in place thereof a tubular receptacle revolubly supported at the centre of the bed and connected at its lower end with the supply chamber is provided. The distributing arms pass through the wall of this chamber and are connected together by a hollow junction box on which rests a vertical pipe forming the long leg of a syphon. Surrounding this pipe is an outer pipe forming the short leg of a syphon and constructed of sufficiently increased diameter to allow of free passage of liquid between the two pipes. The outer or larger pipe is obstructed across its whole inside diameter by an adjustable disc or stopper provided on its underside with feet or legs which in one position are adapted to rest upon projections upon the outside of the top of the inner pipe, thus lifting the disc or stopper above the top of the centre pipe and allowing for free passage of liquid. If the disc or stopper is partly revolved, the feet or lugs thereon do not come opposite to the projections in the centre pipe and the stopper can therefore be dropped down on to the top of the centre pipe, thus blocking same and acting when desired as a valve to stop the flow of liquid and put the sprinkler and filter bed out of action. The inlet end of the feed pipe connecting the tubular receptacle with the feed chamber is provided with a cylindrical clinker basket or screen, or alternatively the cylindrical basket or screen may be placed in the tubular receptacle in the sprinkler and the parts mentioned forming the syphon be placed in the supply chamber at the inlet to the feed pipe.



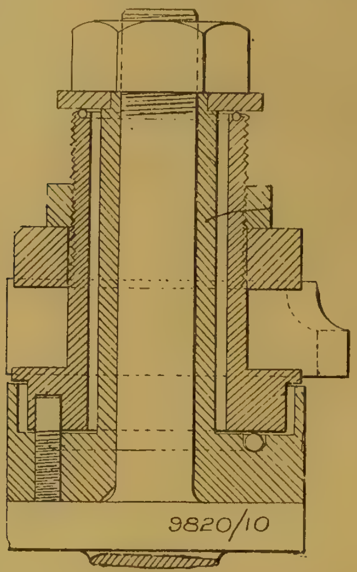
9488 Thompson (Ernst Eisemann and Co. Ges.): Devices for automatically controlling the ignition period in magneto electric ignition apparatus. 9576 Thorel: Machine for making seamless goloshes and uppers for boots and shoes. 9715 Wittgenstein: Fastener on albums for pinning the single sheets thereto.

9820 John Elsworth and Sons Ltd., and Fenton: Cutter holders for wood-working machinery.

The invention has for its object to provide for wood-working machinery, such as planing and irregular moulding machines, a simple and effective cutter holder of the type in which reversal of the direction of rotation of the cutter spindle automatically adapts the cutting tool to perform work in that direction, thus dispensing with the necessity for readjustment of the cutter when reversal is to be made. The invention consists essentially in the provision of a flanged sleeve embracing the cutter spindle and pivoted to one side thereof, the cutting tools being held between the flange and a collar thereon, and of a second flanged sleeve embracing that sleeve, a pin in the flange of one sleeve engaging an aperture in the flange of the other sleeve, and cutting tools held upon the second sleeve.

9861 Rowley and Champness: Disinfecting apparatus for use with flushing tanks. 9878 Descales: Permutation locks. [Date applied for under International Convention, June 21st, 1909.] 9905 Shea: Shaving soap stick case. 9909 Moritz: Lids for closing vessels. 9983 Hoffmann: Device for use in counting money, tokens, or the like. [Date applied for under International Convention, October 30th, 1909.] 10022 Kempshall: Tyres. 10323 Carter: Toy flying machines. 10473 Reynolds: Wads for shot cartridges. [Date applied for under International Convention, December 20th, 1909.] 10474 Hirsch: Electric switches. 10575 Esnault-Pelterie: Flying machines.

[Date applied for under International Convention, May 6th, 1909. Application for Patent of Addition to 15637, 1909.] 10640. *See* 8046, 1910. 10671 Girardin: New paper for drafting designs for fabrics. [Date applied for under International Convention, April 30th, 1909.] 10781 Treitschke: Locking devices for cycles. 10800 Chandler: Apparatus for sampling liquids automatically. 10860 Williams, Williams, and Hawken: Dies and punches for sash bars. 10995 Sutton: Apparatus for the display of textile fabrics and articles. 11377 Streich: Automatic musical instruments. [Date applied for under Rule 13, October 6th, 1909..] 11384. *See* 26641, 1909. 11452 Nielsen: Milking machines.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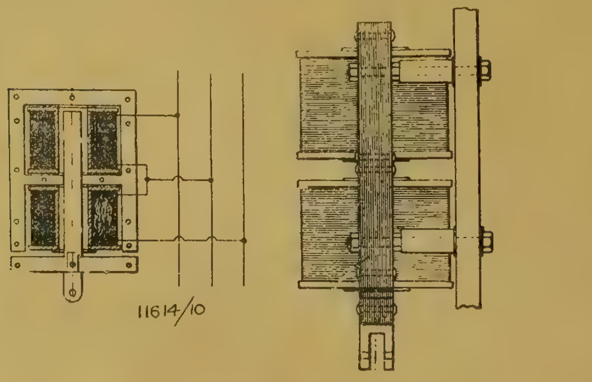
11614 Adams Manufacturing Co. (Cutler Hammer Manufacturing Co.): Alternating-current magnets.

This invention relates to improvements in alternating-current magnets, and has for its object to produce an improved alternating-current magnet of the kind exerting a sufficient minimum pull to keep its armature firmly seated and in which the centre of pull upon the armature will remain substantially stationary. According to this invention in a magnet wherein the circuits or paths for the magnetic fluxes, and the air gaps in the paths are symmetrically arranged about a common axis, the axes of the exciting coils are also arranged on the axis about which the circuits are symmetrically arranged, whereby the magnetic fluxes are concentrated about this common axis. In an alternative arrangement each exciting coil is divided into two parts which are respectively arranged on different limbs of the magnet, each pair of limbs carrying the parts of one coil being arranged symmetrically about the central axis of the magnet and each limb carrying only one coil.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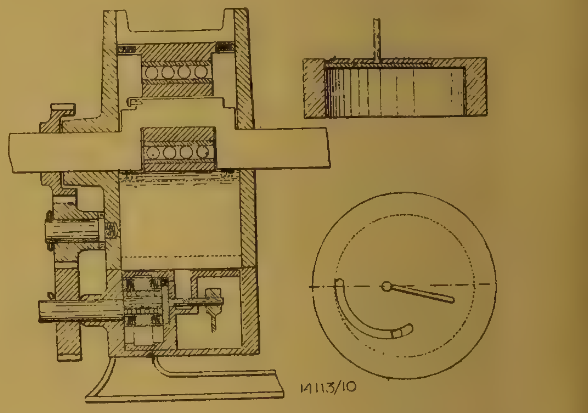
11622 Hitt: Rockets. 11805 Schimmel: Band apparatus for sand-papering, smoothing, and polishing flat surfaces. 12083 Randell: Means of attaching and releasing the lock plates of guns. 12515 Fischer: Apparatus for indicating the escape of gas from pipes or conduits. 12529 Furreg: Process and apparatus for coating sweetmeats with sugar crystals and the like. 12629 Bloxam (Maschinenfabrik W. T. Odhner): Carriages for range finders. 12766 Wheway: Horse collars. 12900 Szandtner: Device for connecting stationary with vertically movable tracks. 13118 Dupont and De Tizac: Device for enabling the carburetter to be dispensed with in explosion motors. [Date applied for under International Convention, December 14th, 1909.] 13133 Kron: Tanning or production of leather. 13134 Leitch: Method of constructing terracing of football and other grounds. 13137 Samoje: Gas turbines. 13153 Bell: Means for supporting and turning fanlights, windows, and the like. [Date applied for under International Convention, October 19th, 1909.] 13223 Lake (Winchester Repeating Arms Co.): Small arms. 13318 Putz: Vehicle and the like wheels. [Date applied for under International Convention, June 12th, 1909.] 13357 Slater and Slater: Surgical trusses. 13521 British Thomson-Houston Co. (General Electric Co.): Electric motor control systems. 13678 Barrett: Lock nuts. 13685 Non-Explosive Gas Co.: Apparatus for the manf. of air gas. [Date applied for under International Convention, August 10th, 1909.] 13773 Jordan: Detachable rims for vehicle wheels. 13981 Lamson Paragon Supply Co., and Pinney: Tabs or thumb-and-finger pieces for carbon or like sheets or other fabrics. 13991 Widegren and Widegren: Method of and means for controlling from a distance electric apparatus, and especially telegraph apparatus and the like. [Date applied for under International Convention, June 18th, 1909.]

14113 Beck: Rotary motors. [Date applied for under International Convention, May 6th, 1910.]

This invention consists in improvements in rotary motors of the type comprising a disc loose on a driving crank which it drives by its rotation around the internal circumference of a casing, the disc carrying an abutment that reciprocates in the peripheral wall of the casing. The invention consists essentially in the provision of an obturating disc adapted to rotate in the eccentric circular recess having an aperture which, when in coincidence with the aforesaid slot, allows the motive fluid to enter the aforesaid casing, a circular slide valve adapted to roll round against the internal periphery of the casing, and means for actuating the obturating disc automatically from the governor or other part of the motor, or by hand, whereby the circular valve is caused to uncover the steam admission orifice constituted by the coincident aperture and slot aforesaid during a period of time varying with the position of the obturating disc as determined by the governor or other operating means.

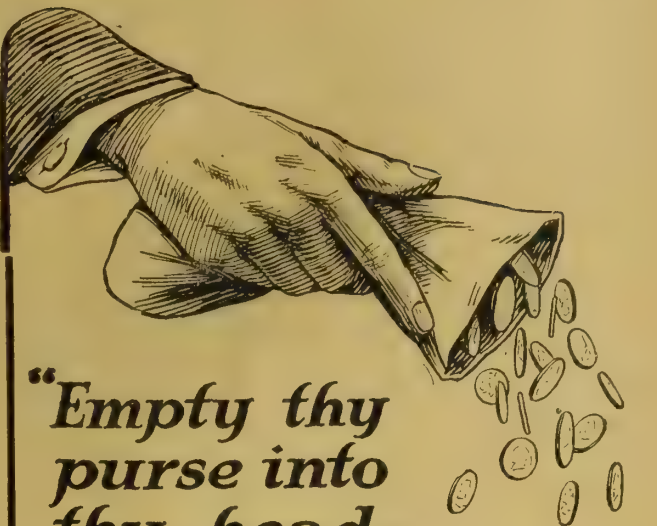

14113/10

14410 Bruder and Bruder: Ventilating devices for water closets. 14501 Armstrong: Exercising devices. [Date applied for under International Convention, June 30th, 1909.] 14817 Liebenguth: Devices for cutting out dough figures or patterns. 14861 Justice (Nitritfabrik Akt.-Ges.): Process for the preparation of tannic extracts and tannic acid. [Request under Section 19 of the Act not granted.] 15024 De Kempeneer: Match holders. 15217 Fried. Krupp Akt.-Ges.: Transition couplings for railway vehicles. [Date applied for under International Convention, March 1st, 1910.] 15400 Bofinger and Ziegler: Boxes for stamp inking pads. [Date applied for under International Convention, July 2nd, 1909.] 15803 Pollin: Driving belts particularly for use on motor cycles. 15812 Goodhart: Self-starting devices for internal-combustion engines 16340 Honold: Device for fixing a coupling in correct position on a shaft. 17044 Lukasiewicz: Apparatus for stretching leather for saddlery purposes. 17179 Macaulay: Holding, lowering, and disengaging gear for ships' boats. 17342 Williams: Hen and like coops. 17465 Wilson: Vehicle tyres. 17749 Goettel: Apparatus for airing or ventilating grain, seeds, and other materials. [Date applied for under International Convention, July 26th, 1909.] 18147 Dauber: Lavatory basins. 18372 Wenk: Means for the mechanical discharge of containing vessels used in the treatment of superphosphate. 18561 Felten and Guilleaume Lahmeyerwerke Akt.-Ges.: Loom heddles. [Date applied for under International Convention, August 7th, 1909.] 19099 Searle and Condit: Automatic small arms. [Date applied applied for under Rule 13, October 2nd, 1909.] 19164 Siemens Bros. Dynamo Works, and Kieffer: Ventilation of dynamo electric machines. 19265 Unverricht: Automatic safety devices for railways. [Date applied for under International Convention, August 17th, 1909. Application for Patent of Addition to 24244, 1909.] 19777 Cohn: Fastening device for ladies' hats. 20606 Evans: Aeronautical apparatus. [Date applied for under Rule 13, September 3rd, 1909.] 20607 Evans: Aeronautical apparatus. [Date applied for under Rule 13, September 3rd, 1909.]

COMPLETE SPECIFICATIONS OPEN TO PUBLIC INSPECTION BEFORE ACCEPTANCE, UNDER THE PATENTS ACT, 1907.

1910.

2898 Hess: Typewriting machines. 3105 Soc. Anon. Banque du Radium: Fibres impregnated with actinium or other radioactive substances and the process of manufacturing them. 4530 King: Marine boilers. 7720 Dieffenbach and Moldenhauer: Manf. of hydrogen. 8314 Rheinische Metallwaaren und Maschinenfabrik: Guns adapted to fire at high elevations. 8697 F. Krupp Akt.-Ges: Sighting apparatus for ordnance. 15343 Smith and Larsen: Electric controllers. 18099 Anilinfarben und Extract Fabriken vorm. J. R. Geigy: Manf. and production of monoazo colouring matters. 19267 Bichel: Submarine offensive mines. 19353 Whitehead and Co.: Torpedoes. 19942 Stock: Gear casing for the wheels of self-propelled vehicles, ploughs, or the like. 20046 Emanuel: Processes of treating ores. 20047 Emanuel: Processes of treating ores. 20048 Emanuel: Processes of making sodium aluminate. 20144 Koppers: Apparatus for levelling the charge in ovens for manufacturing gas and coke. 20739 Knapp: Window curtain screen and the like. 20970 Farbwerke vorm Meister, Lucius, and Bruning: Manf. of vat dyestuffs. 21009 Gluck: Time-indicating apparatus, particularly applicable as a workmen's time indicator. 21170 Quentell: Computing machines. 21406 Soc. Ribayron and Victor: Wood-working machines. 21558 Westinghouse: Fluid-pressure devices and sliding joints therefor. 21572 Desmolieres: Multiple-band belts. 21729 Perkins: Presses. 21789 Stettiner Chamotte-Fabrik Akt.-Ges.: Method of constructing retort furnaces and the like. 22030 Himalaya: Manf. of safety explosives. 22109 Mennig and Recke: Steam engine cylinders and valves. 22129 Roth: Covering for floors, walls, ceilings, and analogous purposes. 22199 Pfabe and Firm Heinr Otto Muller: Device for shuffling cards. 22204 Langbein-Pfanhauser-Werke Akt.-Ges.: Process for the manf. of sheets, bands, wire, and the like of electrolytic iron. 22225 Wagener: Regenerative coke ovens. 22288 Farbwerke vorm. Meister, Lucius, and Bruning: Isolated alkali salts of indoxyl and a process for the manf. thereof. 22335 Burkheiser: Process for separating sulphuretted hydrogen from gases. 22384 Michl: Burner headpiece for gaseous or vaporous combustibles. 22394 Forsberg: Electro-magnetic device. 22407 Rich: Eye piece for optical instruments. 22408 Smith: Internal-combustion engines. 22419 Michelin et Cie.: Bottles and like containers for compressed gas. 22425 Dropiowski: Focussing device for roll films. 22478 Anderl: Process for the manf. of siphon heads of aluminium. 22517 Riese: Electrical



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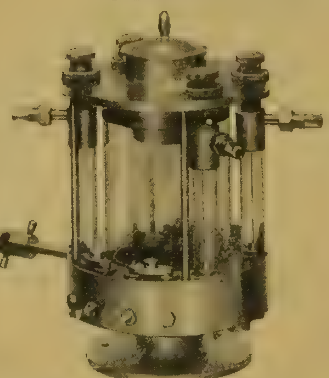

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VOL. 42. FRIDAY, NOVEMBER 18, 1910. No. 1,238.

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OUR COAL WASTAGE—A SOLUTION.

THE opening meeting of the Institution of Electrical Engineers, which took place on the 10th inst., was an event of historic interest. It marked a new era in the life of the Institute, the occasion being the first meeting of members in their own building. It is not necessary to dwell further upon this matter than to say that the new premises are a credit to this august body, and that the Institution is well worthy of its new building.

The great interest, however, was centred in the new President, Mr. S. Z. de Ferranti, who opened up by his address a subject of great importance and of universal interest to the British community. Briefly, the subject concerned the conservation of our coal supplies, and the means by which this may be accomplished. Other issues of secondary importance, and which would naturally follow from the fulfilment of the first, included the means of supplying our own food requirements and the better utilisation of our labour.

As one might naturally imagine, the solution suggested by Mr. Ferranti depended upon the erections of highly economical electric power stations, and the employment of the energy thus produced for heating, lighting, and practically all domestic and industrial purposes for which coal is now consumed. With the present methods now in vogue for the production of energy in various forms in this country the annual coal consumption is estimated at 167,000,000 tons, but owing to the inefficient means adopted, useful work to less than 10 per cent is produced. We cannot, of course, ever expect to obtain anything like full value out of the energy contained in coal, but by means of large power units, producing electric energy at, say, 100 stations distributed throughout the country, and by using steam turbines of, say, 25,000 kilowatts each, it would be possible to distribute the transformed energy in whatever form required by a consumption of coal not exceeding 150,000,000 tons annually, and this figure is estimated on a load factor of 60 per cent, which is anticipated, when all industries and domestic requirements are taken together, and without assuming efficiencies of plant exceeding what might reasonably be expected.

Mr. Ferranti was undoubtedly indulging to some extent in a flight of the imagination, but there was so much sound reasoning in his arguments that the possibilities of the scheme were converted into probabilities, and the assemblage appeared to acknowledge the feasibility of such a project in the not very distant future. Twenty years ago who would have believed that within this short period wireless telegraphy and aerial flight would be accomplished facts, yet the realisation of the wholesale distribution of electrical energy throughout the country appears more within the bounds of possibility now than did the two matters above referred to a couple of decades ago.

Mr. Ferranti has long been known by the electrical fraternity for his originality and determination to depart from trodden paths, and there is no reason to assume that he has overstepped the limits of sound prophecy after the lucid manner in which he expounded his scheme. While dealing in quantities that are almost beyond conception, no engineer would wish to criticise the efficiency of the various members of the generating plant which were assumed, in view of the large units proposed. Taking the question of capital costs, we are quite in agreement that the figures stated for first outlay and running costs could be commercially realised. The generating stations Mr. Ferranti fixed at £7 per kilowatt installed, and with distribution costs the total capital outlay should not exceed £500,000,000 sterling. Further, the estimated works costs would be ·036 penny per unit, and with capital charges at ·0776 penny, the total cost would not exceed ·1145 penny per unit, a figure at which it was stated that energy could be sold for a sum not exceeding one-eighth penny per unit. There would, naturally, be varying rates for different purposes, but it would be possible to encourage new industries, such as can only at the present time be successfully operated on a large scale by means of water power.

The production of this cheap power would open up immense possibilities yet unthought of. The wholesale manufacture of bye-products, such as sulphate of ammonia, was one point mentioned as enabling intensive cultivation of crops to be carried out, and a development in this direction would, even with our limited acreage, provide sufficient cereal growths to satisfy the demand of the country, thus dispensing with foreign supplies.

The great factor, however, which we fancy will stand in the way of the practical development of the scheme put forward by Mr. Ferranti will be British apathy or inertia combined with vested interests. The enormous sum needed is such as will make the most venturesome hesitate, and without universal combination the scheme would be doomed to failure.

Kingston Bridge Widening.—According to the *Times*, the Surrey County Council had before it on the 8th November the question of the proposed widening of Kingston Bridge, and the complete estimates were now for the first time available. The widening is to be effected by the extension of the piers, abutments, and wing walls on the south or up-stream side of the existing bridge. The total estimated cost of the work is £109,550, of which Middlesex will have to find £44,650 and Surrey £64,900. The heavier cost to Surrey is due to the Council's having to acquire valuable shop property, the item allowed for this being £25,250, as compared with an estimate of £5,000 for the purchase of property on the Middlesex side of the river. Mr. Basil Mott is to be the engineer, and his fee has been fixed at an inclusive sum of £5,000. The Council agree to the promotion of a Bill in the ensuing Session of Parliament to enable the widening to be carried out. Considerable dissatisfaction has been expressed in Kingston at the fact that the plans, which have been on view at the County Hall, show that it is only proposed to acquire the shop at the corner of Thames Street which abuts on the approach to the bridge, leaving on the opposite side of the street a building which will project 9 ft. across the approach road. The Corporation has made strong representations to the joint committee of the two County Councils on this question, and the action of the committee was sharply criticised.

Electric Power at Hartlepool.—An installation of electric power has recently been made at the Warren Cement Works of Otto Trechmann and Company, at Hartlepool, which contain some 500 H.P. of electric motors (from 10 H.P. to 25 H.P.) running at 890 revolutions per minute controlled by Reyrolle type drum starters. The power is supplied from the mains of the Cleveland and Durham Electric Power Co. Ltd. The wiring, etc., has been carried out by Messrs. Kirtly and Dunford. It is proposed to make further large extensions, but this will not be with direct current as at present, but, in all probability, with three-phase current.

Argentine Republic.—The *Boletin Oficial* publishes a decree granting to the Buenos Aires Western Railway ("Ferro-carril Oeste de Buenos Aires") a concession for the construction of a section of line 45½ miles long from La Zanja to Meridiano V. The *Boletin* publishes a decree empowering the Buenos Aires Great Southern Railway Ltd. ("Gran Ferro-carril del Sud de Buenos Aires") to construct and work a line of either single or double track to connect its system with the Buenos Aires harbour lines. Work must be commenced within six months after the approval of the plans, and completed within two years thereafter. Under the terms of another decree a concession is granted to Señor Damián M. Torino for the construction and working of a railway from Rufino, in the Province of Santa Fé, *viâ* Pegasano and Nacuñán, to San Rafael, in the Province of Mendoza.

Construction of a Pier at Marola.—The Commercial Intelligence Branch of the Board of Trade learn from a reliable source that great difficulty is being experienced in the construction of a pier at the Government coal depôt at Marola (Cadimare) in Spezia gulf. This work has been attempted several times, but has always proved impossible of accomplishment, to the loss of any firm contracting for the work. There would appear to be fresh-water springs rising at the bottom of the sea at this point, causing a continual subsidence and shifting of any foundation laid. The Marine Engineers have just recently made another attempt to construct this pier, but after they had built about 75 to 100 yards of the outer wall, it fell to pieces again, the stones being tilted end-up or lying all irregularly. Even piles are said to be unavailing in this case, being swallowed up also.—*Board of Trade Journal.*

Straits Settlements.—The *Straits Budget* publishes the annual address by the Governor of the Straits Settlements on the financial, etc., position of the colony, in the course of which he stated that among the more important services which it is proposed to undertake in 1911 are the following:—Building of a new district court; construction of a sea wall across the gap at Johnston's Pier; raising of low-lying land adjoining Penang Road, and draining of the swamp at Balestier Road; erection of a lighthouse on Kuruman Island, off Labuan; and construction of a hill railway.—*Board of Trade Journal.*

Internal Combustion Locomotives.—The Montania Engineering Company Ltd. have issued a publication giving particulars of internal-combustion locomotive engines and as to their use in mines above and below the surface, also in rural industries and in quarries. The frames of these locomotives are of the box pattern, built up of angle irons, and are suspended on the axles by means of laminated springs. The motor, which is mounted on this frame, is adapted to work with benzine, benzoline, crude benzol, or petroleum. The usual speed attained by these locomotives is 3¾ miles an hour. The main advantages claimed for these engines as against steam and electric locomotives are absence of delay occasioned by steam raising, saving of fuel during stoppages, and low cost of maintenance; further, there are no noxious vapours or smoke, as the waste gases are cooled by means of a sprinkler and a dash pot, and there is no excess of weight on account of electric accumulators nor loss of time while charging them.

Moulding Machine for Castings.—The "Adaptable" Moulding Machine Company of Birmingham are placing on the market an apparatus which is designed to diminish the cost of casting by ordinary methods, and also to reduce the expenditure of labour. The machine is constructed to accommodate any size of pattern plate from 12 in. to 20 in. wide, and from 3 ft. to 4 ft. long, with a maximum draw of 6 in. The pattern is withdrawn by the operation of a lever, and it is stated that the withdrawal can be accomplished with an accuracy of one-hundredth of an inch in a 6 in. draw, while the adaptability of the apparatus to varying widths and lengths of patterns allows the machine to be kept constantly employed.

Ferro-Concrete Bridge.—A new ferro-concrete bridge has been constructed over the River Nore at Kilkenny, and the results of tests made have given satisfactory results. The bridge has the largest span of ferro-concrete in the United Kingdom. The total length of the bridge is 196 ft.; total width, 36 ft. 4 in.; span of arch, 140 ft.; rise of arch, 11 ft. 6 in.; width of roadway, 22 ft.; width of each footpath, 6 ft.; width between parapets, 34 ft. The arch crosses the River Nore in a single span. It consists of three parallel ribs spaced 12 ft. apart, centre to centre, each rib 2 ft. 6 in. thick at the springings and 2 ft. thick at the crown, all the ribs being 2 ft. wide. From the end portion of each rib rise 14 vertical spandril columns, 12 in. by 14 in., supporting the main longitudinal beams, 14 in. by 24 in. deep, of the road platform above; the middle portions of the ribs and longitudinal beams merge into one another at the crown, where the total thickness of the arch is 2 ft. 6 in. wide. To insure absolute lateral rigidity of the great arch, the three ribs are braced together by transverse walls 6 in. thick between each of the fourteen groups of spandril columns, these walls extending up to the underside of the platform. The lateral rigidity of the structure is further assured by the transverse secondary beams, which connect the three main beams at intervals of 4 ft. 2 in. apart, centre to centre, and still more by the 6 in. continuous slab connecting all the beams of the platform. As the arch construction proper is only 26 ft. wide, support for the two footpaths and parapets is provided by extending the transverse beams of the road platform so that they project as cantilevers 5 ft. beyond the outside face of the main longitudinal beams. The platform slab continues over, and piling connects these projecting beams, and upon it are built the two parapets. In the tests the bridge was subjected to a total pressure, moving and stationary, of upwards of 300 tons. The total deflection registered at the height of the tests was one-fifth of an inch, and this almost inappreciable yield was at once recovered on the removal of the test load. A deflection of 2½ in. was, in the opinion of the superintending engineers, quite allowable without any risk of fracture.

THE PRINCIPLES OF IRONFOUNDING.

By Prof. A. Humboldt Sexton, F.C.S., F.I.C.

(Continued from page 574).

The Sand.

The properties of the sand have already been discussed. Fresh facing sand will always be used for the part of the mould which comes in contact with the metal. The sand must be sufficiently moist to cohese, and yet not wet, as excess of moisture will tend to cool the metal, to lead to the production of a large quantity of steam and to reduce porosity. The sand, therefore, should be as dry as is consistent with its binding property.

The ramming of the sand is of very great importance and depends on the judgment of the moulder. The wetter the sand the harder it can be rammed, and the harder it is rammed the denser and the less porous will it be; but in the moist condition it is stronger. An over-wet or too hard-rammed mould is likely to lead to scabbing, owing to the difficulty the gases have in escaping. It is very important that the ramming should be even, that is, that the sand should be of the same hardness all over the mould. It is much easier to secure uniformity when the sand is pressed and rammed on to the pattern than when the pattern is pressed into the sand, and therefore for good work turn-over moulding is always preferable to bedding-in, and is almost invariably used. The ramming of surfaces parallel to the surface of the flask, *i.e.*, which will be horizontal when the mould is in position, is comparatively easy, but the moulding of surfaces which will be vertical requires much more care. The sand is not a liquid, so that vertical ramming will not produce corresponding horizontal stress. Very many failures and defects in casting are due to bad ramming.

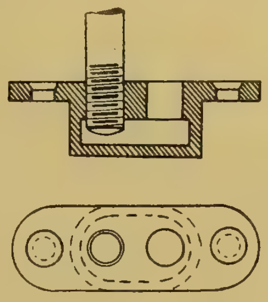

Fig. 95.—Solid Bottom Rapping Plate.

Venting.

When the mould is finished it is, of course, full of air, which must be displaced by the metal As the air is heated by contact with the hot metal, its volume enormously increases, so that the volume of air, for which escape must be provided, is much greater than the volume of the casting. Then as the hot metal comes in contact with the moist sand, the water is converted into steam; any coal dust used is decomposed and the gases evolved have to escape. The facing sand must be porous enough to allow of this escape, for it is quite obvious that no holes can be allowed in the facing, as they would certainly produce irregularities in the face of the casting. But there is no reason why the permeability of the backing sand should not be increased by means of holes, which will form passages by which the gases can escape. This is done by venting. By means of a wire, about ⅛ in. in diameter, a large number of holes are made through the sand, and these may reach to within ¼ in. of the surface of the mould, but obviously must not go too near. Good venting requires great skill and care. In small work the vent holes come to the surface direct, but in very large and heavy work they are often arranged so as to form a series of small passages uniting into larger passages. The venting does not need to be arranged uniformly all over the surface of the casting; in a large flat casting it may well be so, but in many castings there will be places towards which the gas will be forced by the inflowing metal, cavities, as it were, in which it may be trapped, and these especially need copious venting. In the case of small castings, and in the cope of large ones, the vent holes communicate with the air, but in the case of the lower portion of large bedded-in castings this is not always possible. Where such casting are made, the floor sand should rest on a layer of coarser material, to which the vent holes may be carried. If a little thought be given to the matter instead of merely making random jabs with the venting wire, there will usually be little difficulty in securing good venting. To facilitate the escape of gases, a "riser,' which is an extra "gate," left open to the air, is sometimes used.

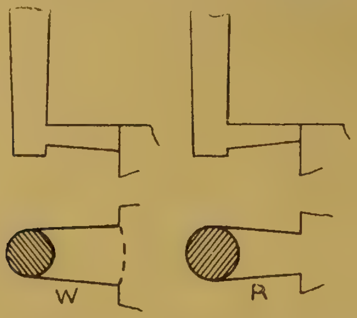

Fig. 96.—Right and Wrong Shape of Runner.

Runners and Gates.

The molten metal is poured down a vertical tube or gate left in the upper portion of the sand. This may lead directly to the mould, but, more usually, it is connected by means of a runner.

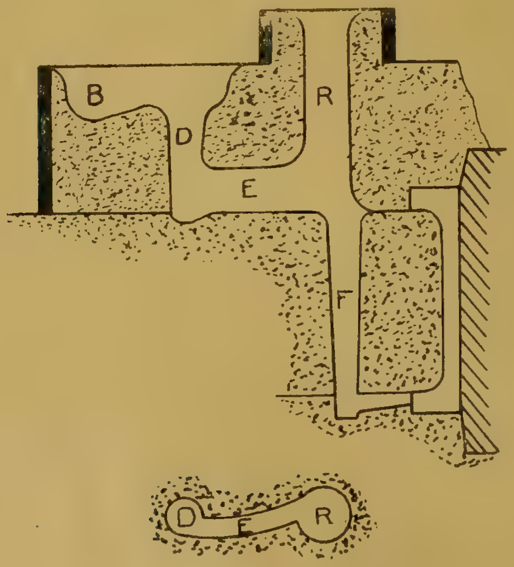

Fig. 97.—Simple Skimming Gate.

The part of the mould to which the metal will be led varies with circumstances; it may be the top, the side, or the bottom, and there may be one or more gates, and one or more runners, according to circumstances. The object is to allow a ready flow of metal to all parts of the mould in a continuous stream, and in such a way that there will be as little danger as possible of breaking away any part of the mould, for it must always be remembered that the mould is friable, and projecting portions might easily be broken off by a rush of the heavy liquid metal.

The runners must be of sufficient area to allow of the flow of metal, but individually they must not be large, for it must be remembered that they will solidify full of metal and then will leave a projecting piece of metal which will have to be broken off. They must be so arranged that this bar will be weakest where it joins the casting, otherwise it will be difficult to break it off close, or it may carry away with it a part of the casting itself. The runners may be uniform in size, but they are better made taper with the narrowest part joined to the casting, as shown in fig. 96 at R; not with the widest part next the casting as at W, which would make it very difficult to break off evenly.

When a casting is of large area, a number of runners may be taken from the bottom of the gate, forming a spray; the arrangement of the runners needs thought and care.

When the gate pin is removed, there is a vertical passage or gate slightly tapering towards the bottom, and communicating either directly with the mould or indirectly by means of runners. Into this the metal is poured, and for convenience of pouring it is usually widened out at the top into a pouring basin. This basin may be either circular, with the gate in the centre, so that the metal is poured down the gate, but it is much better made elongated, so that the metal is poured into a sort of side basin, and flows gently down the gate as represented at W, fig. 93. The metal is poured into the basin at F, which being kept full, allows a steady flow of metal at a uniform pressure. For the small castings, the "basin" is made in the sand at the top of the cope, but where greater pressure is required a small box is placed over the gate, the gate is continued through this, and the pouring basin is made at the top of it. The additional box is usually 3 in. or 4 in. high, so as to give an additional pressure equal to that depth of metal. As the metal is poured it often breaks away some of the sand of the basin, and the metal may bring over with it some scum from the ladle. These are lighter than the iron, but if the current is rapid they are apt to be carried forward into the casting, and if they cannot rise before the metal solidifies they produce defects in the casting. To overcome this difficulty, skimming gates, in which opportunity is given for the rise of any scum, are often used. One form is shown in fig. 97. The metal is poured out into the basin B, and flows by the passages D and E to the gate F. Over the gate F is a vertical passage R, up which any light material can float. Much more complicated forms of skimming gates are occasionally used. The simplest arrangement is probably that shown in fig. 98, where C is a box of firebrick, called a skimming core, placed across a long pouring basin, so that the metal, on its way to the gate D, has to flow beneath it through the passage S and any scum is retained at *d*. More complicated arrangements, in which skimming basins, made of separating material, are some-

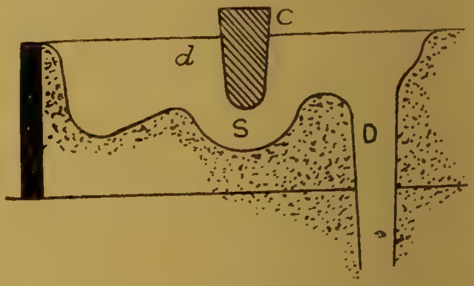

Fig. 98.—Skimming Gate with Core.

times used. One of these is shown in fig. 99, and needs no explanation..

Sometimes a flow-off gate is used, an opening passing through the cope, so that when the mould is full the metal will rise with it and flow away by a channel cut for this purpose. The flow-off gate is placed at the highest part of the casting, where light dirt or scum would tend to accumulate, and which is thus carried away.

Feeding Head.

The casting will solidify first at the outside, and if it it still contains a large mass of liquid metal, this, as it solidifies, will contract and leave a cavity, and to avoid this a supply of liquid metal must be kept up to the centre of the mass. As a rule, the runner being small, the metal in it will solidify before the mass of the casting, so that the supply of metal to the still liquid interior will be cut off. This is overcome by the process of "feeding." Over the heaviest part of the casting where "feeding" is necessary, a riser of large size is made with a casting basin at the top. When the metal is cast in the usual way, the metal rises into this riser; by means of a feeding rod which is moved up and down, the closing of the passage is prevented, and the basin is kept full of molten metal which can flow in as there is room for it.

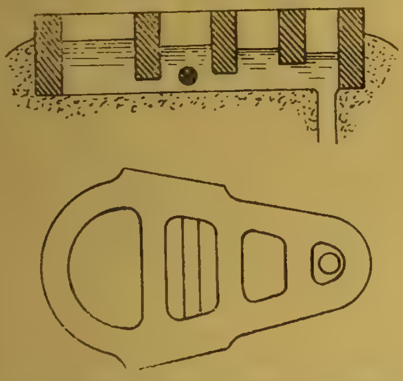

Fig. 99.—Skimming Basin of Refractory Material.

(To be continued.)

COAL CONSERVATION, THE FOOD, AND LABOUR PROBLEMS.*

The problems of coal conservation, home-grown food, and the better utilisation of labour are closely connected with, and are all capable in great measure of being solved by, electrical treatment. Taking all the uses for coal into consideration, I believe that we are getting back an amount represented by useful work of one kind or another of much less than 10 per cent of the energy in the coal.

With regard to food supply, our only chance of supplying our food requirements lies in a successful system of intensive cultivation throughout the country. Besides money this requires a liberal supply of chemical fertiliser for the land, principally in the form of fixed nitrogen. This commodity, on account of the wasteful system of using our coal, is, I believe, at too high a price to make intensive cultivation attractive to the farmer. The third subject is that of our wasted labour. We can first consider the labour spent in and about raising and distributing the coal which we now use, and which we would save under more economical conditions. If you consider what goes on in every household you will see how large a proportion of domestic labour is devoted to this. There are also all the people who are now employed in the process of burning coal for all the various uses to which it is put, and who represent an enormous amount of labour which, under a more efficient system, could be turned to better account in the interests of the country. The efficient working of the country to a large extent depends upon the proper use of its natural resources in the form of material and labour, and the saving of all the waste in both of these which can possibly be brought about.

We are forced to the conclusion that the only complete and final solution of the question is to be obtained by the conversion of the whole of the coal which we use for heat and power into electricity, and the recovery of its bye-products at a comparatively small number of great electricity producing stations. All our wants in the way of light, power, heat and chemical action would then be met by a supply of electricity distributed all over the country. It must, however, be remembered that the distribution of energy in the form of electricity instead of coal can only be effectively carried out when it can be done in such a way that it is available for all the purposes for which coal is now used, and this can only be the case when the conversion is effected at such an efficiency as will cause the electric energy delivered to represent a high percentage of the energy in the coal. Another controlling factor is that both the conversion of the coal into electricity and the distribution of the current must be effected at a low capital cost so as not to overburden the undertaking with capital charges.

The author has reached the conclusion that a heat conversion efficiency of at least 25 per cent must be obtained if this scheme was to be a success. This predicated the use of large gas engines fed from producers. In the conversion of coal into electricity, one of the most important considerations is the load factor. Electricity for lighting, cooking, power and traction must be available when required. Domestic heating, on the other hand, will be largely effected by heat storage, thus giving a controllable form of demand. Metallurgical and chemical processes, which depend for their success upon a very cheap supply of current, will have to be so adapted and modified that they can take current intermittently and so fill up the load curve, thus enabling the current which they require to be produced with the least capital expenditure, and at the same time greatly assisting the good conversion efficiency of the whole supply. I believe that under the circumstances a load factor of 60 per cent would be obtained. Considering now the means to be adopted for converting the coal into electricity, and the efficiency at which this can be done, we find that in gas-engine driven alternators we have a system theoretically capable of returning 25 per cent of the energy in the coal in the form of electricity, and from this point of view they would meet our requirements.

Estimating on the basis of the typical generating station, considered and multiplying by the number of stations, I have put down the capital cost of generating works at £7 per kilowatt, which, for the total kilowatts required, gives an expenditure of £175,000,000 sterling. The cost involved in the distribution system on such a scale is difficult to estimate. The condition of demand in relation to the position of the supply stations would, however, be favourable, as a great deal of the energy required would be transmitted only short distances, and units of demand would be large. Under the circumstances, I believe that £13 per kilowatt would be amply sufficient, and a sum of £325,000,000 sterling would thus cover the cost of the distribution system. The total cost of the scheme, including all expenses up to the point of delivering the electric supply to the consumer, would thus be £500,000,000 sterling.

The cost of producing the electricity required under the scheme may now be considered. Capital costs taken at 8½ per cent upon the money invested form by far the most serious item, and amount to 0·0776d. per unit, or a total of £42,500,000 per annum. The works costs would, I believe, not exceed 0·036d., bringing up the total costs, including interest and all other charges, to 0·1145d. per unit, or £62,000,000 sterling per annum. In arriving at the above figures for the costs of generation 60,000,000 tons has been taken as the annual coal consumption, and this has been charged at an average price of 10s. per ton, thus amounting to £30,000,000 sterling. On the other hand, it has been assumed that with improved processes of conversion, one ton of coal will yield fixed nitrogen equivalent to one cwt. of sulphate of ammonia. The present price of this commodity is well over £12 a ton, but considering the large scale of production and the necessity of supplying it at a low price to make its use general for agricultural purposes, I have reckoned the fixed nitrogen as of a value of only £8 per ton of sulphate of ammonia, or, on the 3,000,000 tons to be produced, of £24,000,000 sterling. This reduces the cost of the coal to £6,000,000 sterling, which largely accounts for the low works costs.

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*Abstract of address delivered by Mr. S Z. de Ferranti to the Institution of Electrical Engineers.

Following up the costs of electric generation already discussed, I have assumed, for the purposes of comparison, that the average price at which current would be supplied throughout the country would be ⅛d. per Board of Trade unit.

Regarding the supply of power, electricity is now admittedly the most convenient form of power for all purposes, and this, again, notwithstanding the costs involved on the comparatively small scale on which we now produce.

The case with regard to electric tramways and light railways is well known, and any reduction in the costs of running due to cheaper current would, of course, act greatly in favour of these undertakings, and would help to extend their usefulness. The electrification of main-line railways has not yet progressed very far, and it is hard to make out a sufficiently strong case to warrant the large expenditure necessary for electrification; but there is little doubt that growing traffic, which necessitates additional works, will be best met by electrification, which will enable a greater return to be obtained from existing lines and works.

The manufacture of pig iron is, no doubt, quite the most economical use of coal that we now have, but recent work with electric smelting furnaces has shown that it is only necessary to have electric current at a low enough price and for sufficient experience to be obtained to make it more economical to smelt iron electrically than by present methods, and using only sufficient coke to provide the carbon for the purpose of reduction. It may be taken, from the experiments already made, that when worked on a sufficient scale a quarter of a ton of coke would be required per ton of iron produced, and that four tons of iron would be obtained per kilowatt-year. This would mean that about 0·42 ton of coal would have to be converted into coke and used per ton of iron, together with about 2,200 Board of Trade units, which, at $^{1}/_{12}$d., would come to 15s. 3d. per ton of iron. As the electric furnaces would no doubt closely adjoin the generating station, the price named for current would be a good one.

The manufacture of aluminium is another of the processes which will be greatly facilitated by a cheap supply of electricity. In fact, it may be said that aluminium can only be produced economically at present in water-power countries, but as an intermittent supply of electricity could be given under the proposed scheme at a lower price than it is being obtained from water-power, we should be in a better position than the water-power countries to manufacture this metal.

There is a further application of the electric current which, so soon as the price was low enough, would, no doubt, largely come into use, namely, the intensive growing of fruit and vegetables under glass. It is known that considerably more forcing in the way of heat can be advantageously applied where light is also furnished artificially, and it is therefore probable that, with electricity everywhere available at a low price, an immense amount of intensive cultivation under glass with the heat supplied by means of the electric arc would be undertaken. Summarising the whole position, it may safely be said that, wherever coal, gas or power are now used, everything for which they are used will be better done when electricity is the medium of application.

Hardly less in importance in the all-electric scheme is the question of the bye-products which become available by the proper use of our coal. These consist principally of fixed nitrogen, together with tar and oils. Fixed nitrogen in the forms of sulphate of ammonia, nitrate of soda, and nitrate of lime is a most valuable fertiliser, and enables land continually to produce the same crops with a greatly increased yield per acre. According to last year's Board of Trade returns we now grow about 23 per cent of the total wheat that we use, and import 77 per cent. Of the barley used we grow 59 per cent and import 41 per cent, and of the oats used 78 per cent is home grown and 22 per cent imported. Last year we devoted 7,750,000 acres to the cultivation of these crops. With scientific treatment in the production of the seed, in the sterilisation of the ground, and in the application of fertiliser, we may look at no distant date to an increased yield of 50 per cent in these crops upon what is now being produced per acre. With this increased yield we could produce corn crops sufficient to supply the whole of our requirements upon 11,000,000 acres. This would represent 23½ per cent of our present cultivated area, and would only be an addition of 3⅓ million acres to the land now used for the purpose of growing these same crops.

In order to fertilise the land, we should have available, under the all-electric scheme, 3,000,000 tons, or its nitrogen equivalent, of sulphate of ammonia. This, if used over the whole of the 46,750,000 acres now under cultivation, would average 143 lbs. per acre. The availability of large quantities of this fertiliser at a very much lower price than at present prevails would also enable us to produce the whole of our sugar at home.

Mr. Ferranti went into considerable further detail upon the subject of intensive cultivation, but sufficient has been quoted to enable readers to gain an insight into the scheme proposed for the solution of the problem he started out to deal with.

THE INTERNAL COMBUSTION ENGINE.*

THE subject was introduced by a resumé of the early history of the internal-combustion engine, bringing the matter by stages up to the adoption of this source of power for marine work. Beginning with the early attempts to employ gunpowder as a means of producing the required pressure, the author proceeds to deal with the Lenoir engine, the improvements of Messrs. Otto and Langen in 1866, and the improvements made by Mr. Beau de Rochas who originally introduced the idea of compressing the explosive mixture before ignition, which was afterwards developed by Dr. Otto. Of the numerous attempts that have been made to design internal-combustion engines working on a different cycle, that patented here in 1880 was one of the most successful. In this arrangement the charge of air and gas was forced into the cylinder by means of a separate pump at the end of the expansion of the power stroke, and the charge so forced in was compressed by the in-stroke, and the ignition effected in the usual manner. In this manner a power stroke was obtained once in every revolution of the crank shaft.

Proceeding, the author next deals with the two-cycle principle, the four essential operations of which are—charging, compressing, firing, and exhaust, all performed during one revolution of the flywheel instead of in two revolutions as in the previous cycle.

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* Abridgment of paper read by Mr. W. P. Durtnall at the Naval, Mercantile, Marine, and General Engineering Exhibition, September 17th, 1910. Institute of Marine Engineers.

Fig. 1 shows this engine in diagram, showing the instroke of the piston. It will be seen that a mixture of gas and air is drawn in at A, from the carburetter or mixer, to the crank case B. A previous charge is being compressed in the combustion chamber D. Just as the crank is turning the top centre it will be observed that the electric spark is igniting the charge. The pressure so raised will push the piston forward, and expansion thus takes place, until the exhaust port F is uncovered by the piston (which forms its own valve). The exhaust gases escape under the remaining pressure into the exhaust pipe or box, the pressure in the cylinder being also at the same time reduced. It will also be seen that the charge drawn into the crank chamber is also being compressed by the downward movement of the piston, ready for the inlet port C to be uncovered by the piston. The mixture, being under slight pressure by means of the descending piston, immediately escapes into the combustion chamber, and by means of deflecting plate G is guided up to the top of the chamber behind the still escaping low-pressure exhaust gases, but before the new gases have time to escape after the exhaust gases the piston is on the return and the inlet port closed, and immediately after the exhaust port is closed likewise, so that the thus imprisoned live gases are compressed and the cycle re-performed. There is no doubt that a reduction in the weight of a given engine can be brought about by this cycle, but it is, in the author's opinion, only suitable for small powers. There is no question, however, as to its reliable working in such. Giving an impulse at every revolution it certainly is the ideal engine for the propulsion of small-powered boats, and especially where simplicity is really required. As is well known, this engine has no valves, so to speak, or tappet rods, cam shafts, springs, etc. It would be difficult to construct an engine with fewer working parts and there is no doubt that its simplicity is the reason why it is largely used, although its fuel economy does not approach that of the four-cycle engine for the previously mentioned reasons. They are reasonably quiet as compared with equal four-cycle engines, owing to the absence of valve gear, etc., and also to the fact that there is a practically constant downward pressure on the head of the pistons, instead of the alternating pressure, and suction on the piston heads of the four-cycle engine, which no doubt tells on the bearings, etc. The consequence is that the two-cycle engine has found a number of admirers, especially where the cylinders are off-set from the centre line of the crank shaft; the consequent wear is then very slight, and they have a good life, and in the engine shown of which the author has had good experience, a novel feature is that the cool incoming mixture through the channels of the piston keeps the piston from overheating, and reduces the carbonising of lubricating oil to a minimum. The arrangement of the distribution is such that the heat is not localised, so that the cylinder and the pistons are of more equal temperature; expansion and contraction are, therefore, at a minimum with little distortion of either. There are, however, some very difficult things to be observed and guarded against in the application of the two-stroke engine for marine and other work in which the engines have to work in confined and possibly inaccessible places, especially when petrol is used as fuel. Some engines give quite a lot of real trouble through what are termed crank chamber fires, which are caused by the charge in the crank chamber being ignited by the still burning charge in the combustion chamber. The remedy for this is to reduce the speed of the engine, or to increase the speed of combustion, by means of a weaker mixture. The faults, however, generally are to be traced in the design of the engine; the most successful and reliable are those engines that have a large area exhaust port, or several, so that the speed of the incoming charge can never catch up the exhaust. However, there are many engines of such design that give no trouble in that direction. At the same time it is as well to have means on any two-stroke engine to provide that the revolution speed cannot be excessive.

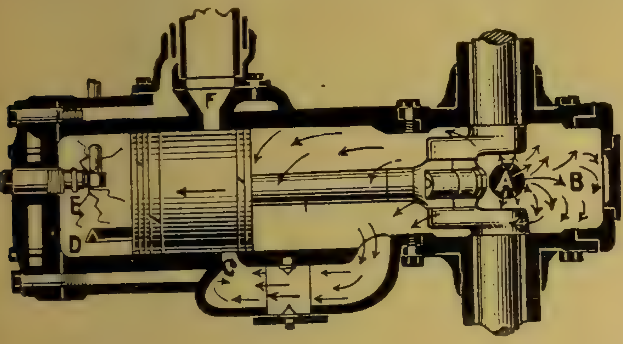


Fig. 1.

With the exception of perhaps the Lenoir engine all the above engines were constructed on the principles of explosion similar to that in the case of a gun. Although very efficient as compared with what can be done with other methods of power production, such as with the application of steam, they have, however, drawbacks that even to-day have not been eliminated, although many designers are at work endeavouring to do so. The ordinary four-cycle explosion engine is in many ways difficult to apply, for instance, to marine propulsion, or other applications in which certain essential requirements have to be considered. These faults are, for instance, inflexibility, as to run these engines really efficiently the revolutions must be kept about constant or otherwise, owing to atmospheric conditions being dominant, indifferent mixture will result in possible heat and other losses. These engines are not self-starting (as compared with steam engines), and other means must be employed to overcome this objection, such as the use of compressed air, or forming an explosive mixture in the combustion chamber when set on the out-stroke, which methods are not the most reliable or ideal. Such engines are, consequently, not reversing in the true sense of the

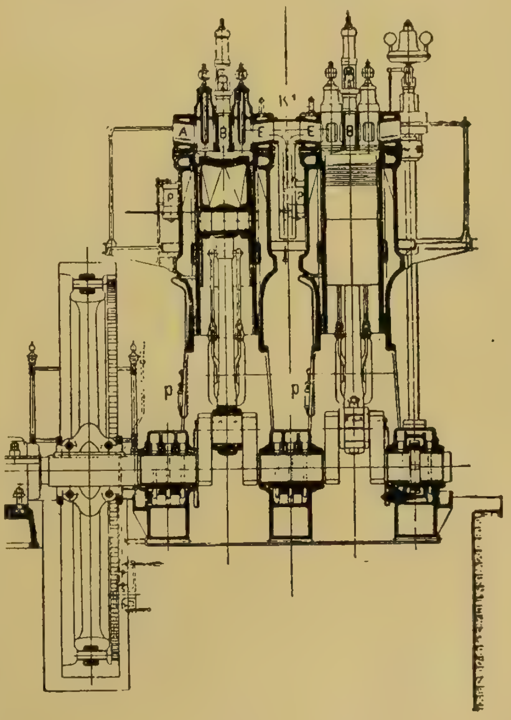


Fig. 2.

word, and other means, such as reverse gear or a complicated system of cam alteration and timing, is necessary, which raises the cost and increases the wear and tear and also takes away the very object of the cycle in the way of simplicity, which is essential.

Such engines, moreover, produce great noise, owing to the pressure at exhaust above atmosphere, which is a loss of power. This should, if possible, be avoided, and must be if the engine is to have the maximum of efficiency. Further, these engines are liable to produce a certain amount of objectionable smoke, and smell, faults which must be considered when attempting to apply them to such vessels as ocean-going passenger boats. At the same time, unless complete combustion is obtained the highest thermal efficiency will not be obtained, which is desired from many aspects commercially. All the above faults are due to the thermo-dynamic principles involved in the engine inself, and it is impossible to avoid them without the use of, say, starting handles, or other means of starting or giving the first necessary movement to the piston, etc. If a change of speed is required on the driven work, it is essential to put in some sort of change speed gear, and if silence is required it must embody a suitable sxhaust or further expansion box, and all the time that such types of engines are used the above parts are absolutely necessary. Further, the admission of gas being constant it is not possible with economy to vary the torque on the crankshaft to any great extent, and even then by such methods as gas variation or alteration of the ignition points which will be shown later are wasteful, and not ideal methods. Owing to the explosion principles being used in such engines, the compression before ignition is limited, and for that reason the clearance between the piston head and the cylinder head must be large, in proportion to the total volume of the sweep of the piston in cylinder. This clearance is in some engines as much as 20 per cent of the total volume, and for that reason alone brings about enormous losses in the possible thermo-efficiency in the engine itself, and is a question that should receive the very closest attention of all designers of engines, especially those who are working on a possible marine engine, as the weight must be considered, and it is the author's opinion that the future marine engine must be designed on the principles that are involved in the gun, that is, on the lines of constant pressure combustion, thus reducing the initial pressure, and increasing the length of expansion.

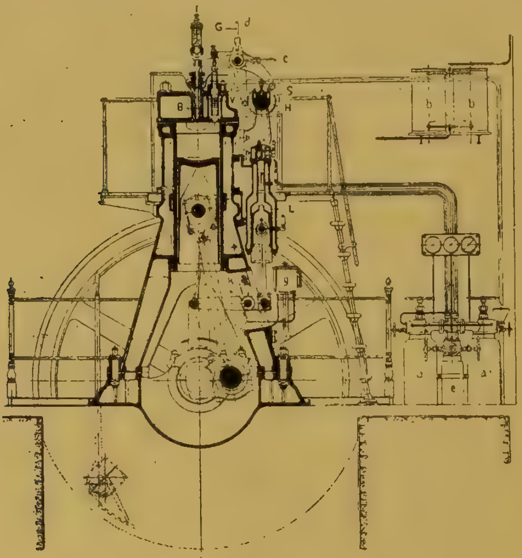


Fig. 3

The idea of securing combustion in an internal-combustion engine at constant pressure instead of constant volume (as in the previous engines) during the period of combustion is not a new idea, for as far back as 1873, Brayton, in Philadelphia, U.S.A., brought out his well-remembered cycle and engine, in which the gas and air were compressed in a separate cylinder and burnt in the working cylinder. In 1878 Messrs. Simon, of Nottingham, acquired the Brayton patents and brought out this type of engine with a miniature steam boiler over the combustion chamber. The steam thus generated was blown into the combustion chamber, and although some very interesting experiments were made, this engine was stated to have not been successful. Messrs. Hennig and Co., in Germany, about this time, brought out the Brayton or Simon engine with many mechanical improvements. Foulis, of Glasgow, in 1878, patented an engine similar to that of Simon, and in 1881 brought it out in improved form, and what is also interesting is the fact that he utilised the heat from the exhaust gases for raising the temperature of the incoming gases, as well as the separate compression principles and constant pressure combustion.

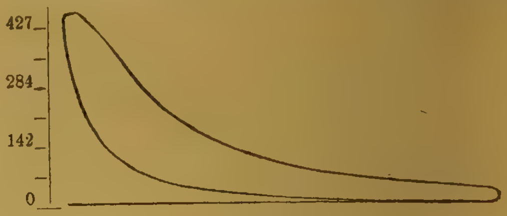


Fig. 4.

In theory all these engines proved very attractive propositions, but as the mechanical (in those days) difficulties multiplied for the small sizes that were required in those earlier days, the truth is that the simple Rochas, or Otto, type of engine was pushed with such a success that designers were not encouraged, so that no doubt the constant pressure combustion type of engine was neglected in favour of the engines which have compression, ignition, and expansion in a single cylinder. In the small type that were then in the majority of cases required, this gave a simplicity with which the small type constant pressure combustion engine could not compete, and therefore they were abandoned.

They have been revived from time to time by various experimenters, but in spite of the great possibilities shown by theory they have until the last few years found little demand of importance, with the exception of the Diesel type of engine, which is based on the principles laid down by both Rochas and Brayton. The author believes that now the question of large power is being suggested for the propulsion of vessels of large tonnage, designers and manufacturers will be driven to take the matter up with a seriousness never before thought of, and that the obstacles that lie in the way of successful construction will, with modern engineering practice and metals, be overcome, also that the constant-pressure combustion engine will be in general use before many years, not only for use with gas made from oil, but also that made from coal or other fuel.

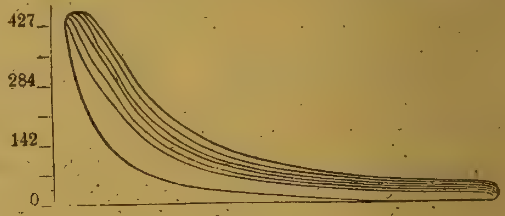


Fig. 5

The designers of guns have seen the advantages of the constant-pressure method of combustion. The advantage of the burning time of powder has been made use of, and in a gun designed on these lines the projectile has travelled some distance before the maximum pressure or the completion of the burning period has taken place. The pressure not rising above 17 tons per square inch, and the charge being larger and longer, the expansion is extended, resulting in an increased velocity being given to the projectile, and no doubt less recoil. Here again is an analogy and a matter which go to show that with the constant-pressure combustion engine less strains are set up and more equal turning moment obtained. So far this matter has received, as far as the author is aware, very little attention by those advocating internal-combustion engines for main propulsion; it is, however, one of very serious moment, and no doubt will be receiving close attention by designers. The multi-cylinder engine would appear to somewhat reduce the strains, but it is a matter that, however, will have to be taken into account when coming up to very large powers. The author's opinion is that as the efficiency of engines of modern power and those of larger power do not alter materially as the power goes up, to overcome the difficulty the most suitable way is to split the total power of the prime movers up in various units, and by some connecting medium such as electrical power transmission bring it about that, say, several engines may concentrate their power into one powerful electric motor driving the propeller shaft; a view that is also held by our highest authority in naval engineering, and many others that have given this application of the internal-combustion engine technical consideration. It will be shown later how such arrangement will facilitate economy all round.

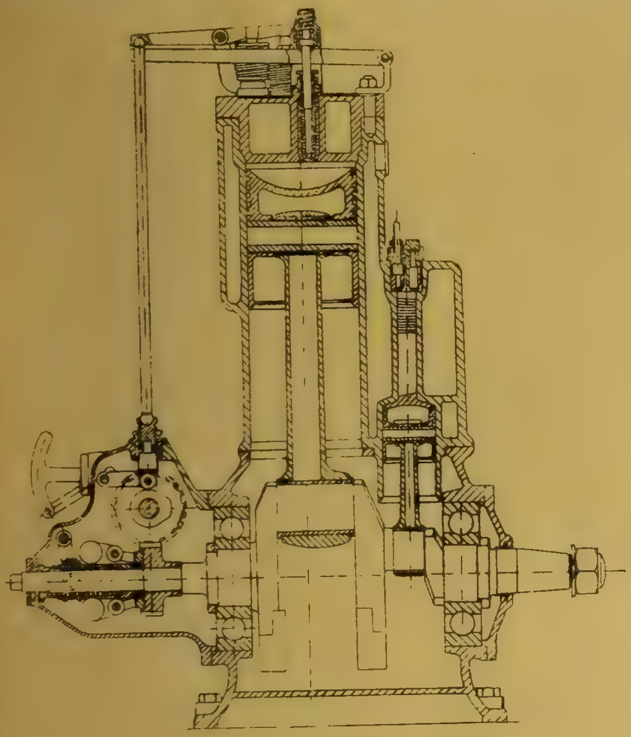


Fig. 6.

Figs. 2 and 3 show side and end sections of the Diesel engine, and it should not be forgotten that nearly every writer on the thermo-dynamic principles of heat engines has drawn attention to the Brayton type of engine and its greater scope for higher thermo-dynamic efficiency, and have lamented the neglect of this cycle by our leading designers and builders of internal-combustion engines. It is, therefore, to the great credit of Dr. Rudolph Diesel, who set to work and brought out the famous cycle under his name, which engines are now meeting with such a large and successful demand in all parts of the world. There is no question that in large or small sizes it is the finest prime mover that we have, and by a study it will be seen that the laws that Rochas and Brayton laid down have been carefully considered by him, as regards high compression and constant temperature, pressure and combustion. Fig. 4 shows a normal curve taken from one of his engines, and fig. 5 shows the action of the governor fitted to the engine, which varies the point of cut-off very similarly to that of a steam engine.

Dr. Diesel has been good enough to forward especially for this paper also a very interesting sectional drawing, shown in fig. 6, of his very latest quick-speed engine using crude oil.

As will be seen, it is entirely a new design for Diesel engines, and is especially brought out to meet the demand for small-powered engines such as are required for, say, driving auxiliary machines, or for the propulsion of small boats, etc. A test made on one of these engines is interesting and is as follows:—

Loading Trial for Small Latest Type "Diesel" Engine.

Rating delivered.	½ load.	¾ load.	Normal load.	Over-load, normal speed.	Over-load at higher speed.
Duration of test .... mins.	28·5	35·2	49·49	31	8·29
Average speed	620·3	610·4	609	603·8	828
Indicated H.P.	6·20	7·24	8·17	9·66	13·26
Brake H.P.	2 61	3·83	4·76	5·58	7·65
Fuel required per H.P. hour in kilograms	0·315	0·262	0·248	0·273	0·284
Cooling water per hour in kilograms	24·2	19·3	18·0	36·0	21·5

The above shows remarkably good results for so small an engine, and the test was carried out by Professor Romberg at the King's Technical High School at Berlin quite recently. The engine can be made at the present time up to 30 B.H.P., in which case there are six cylinders, and the weight is not more than 80 lbs. per B.H.P., which includes a bedplate (not shown), air vessel, oil vessel, and exhaust pipe, etc., which is about one-tenth of the weight of the original stationary Diesel engines of the same rating, but the above sketch shows how the engine would appear for fitting into small passenger and cargo boats. The exhaust is colourless and without fumes, and

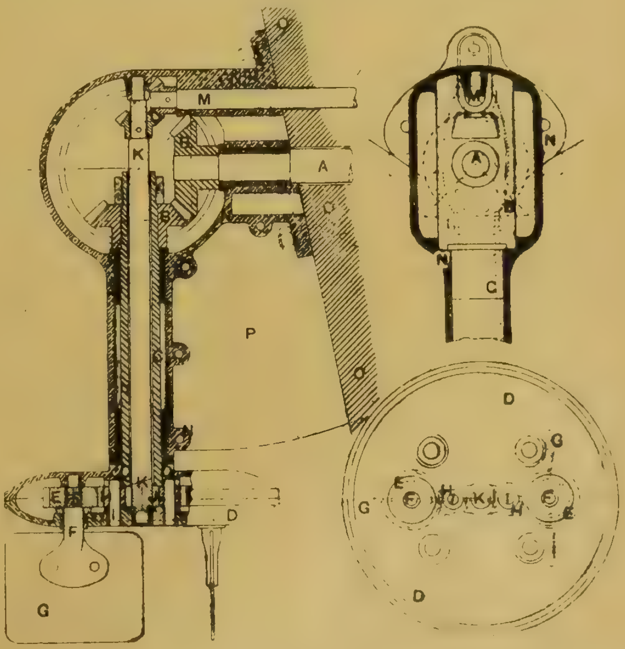


Fig. 7.

the revolution speed can be arranged from 600 to 200 revolutions per minute, or same can be accelerated in such cases as in racing boats for short periods up to 1,000 revolutions per minute. The machine, however, is somewhat different from the usual design of Diesel engine, and I understand that Dr. Diesel in the near future intends to develop an engine that will be suitable for larger powers. He states also that it will be very suitable for use in connection with the Paragon electrical propulsion scheme, in which he has taken an interest, both in its application to marine engineering and also in another sphere of transport, *i.e.*, that of main line railway traction, to which, in conjunction with such efficient internal-combustion engines, the author intends to shortly apply same.

In connection with the above and other high-speed engines, an interesting advance in propeller design has been recently brought out and patented in this and other countries. Fig. 7 shows this propeller; as will be seen, it is constructed on the feathering paddle design, and has some very novel details about it. For instance, the full power reverse can be given under control from the steering wheel with the least exertion, and the ahead speed, or the steering of the vessel, can be carried out by the direct power of the prime mover, and without the necessity of altering the torque or direction of speed of the engine. It is in the author's view a great advance in the most troublesome matter of propeller design for propulsion. Referring to fig. 7, a description will be of interest: A is the power shaft from the engine or turbine, as may be desired; B, equal drive bevel wheels driving vertical revolving power sleeve; C, the above power sleeve coupled to the revolving small case; D, revolving power case, containing feathering small gear wheels; E, two small gears, only carrying the small power for feathering the blades; F, short shaft taking the power from the revolving case D; G, propeller blades, generally two, renewal a very easy matter; H, two intermediate connecting wheels; all these small gears are running below water line and in grease, absolutely quiet and lasting; I, fixed spindle on which run the loose intermediate wheels H; J is a centre pinion that is usually in a stationary condition; by its means, however, the degree of feathering is adjusted, which decides if the reaction from the propeller shall be ahead or astern, or partly so; this position is controlled by means of the steering wheel; K is the small vertical shaft that is attached to the angle bevels above, leading to the steering-wheel shaft; L are the above bevels; M is the horizontal shaft leading to the steering wheel, by which means full control is brought about; N is the stationary case taking the whole propeller, which from the present design will be seen, and the importance of requiring no usual thrust block, this case is bolted direct on to the stern post shown; O is the stern post, and it will be seen that only two small holes are necessary for the application of the propeller to existing boats, etc.; P is a steel plate that takes a part of the direct thrust of the propeller, and also forms a steadying piece.

The above propeller has been tried on various types of vessels with greatly-improved results, as compared with what is possible with the ordinary screw type of propeller, and in some cases as much as 30 per cent more effective thrust per shaft horse power at given revolutions has been demonstrated and accepted by some of the highest authorities on the Continent.

Large Sparking Coil.—The *Technische Rundschau* states that a coil has been constructed that gives a 50-in. spark, with a current of 30 amperes at 110 volts. The iron core is 80 in. in length, and the primary coil consists of six layers of copper tape, making altogether 792 turns. The secondary coil contains 100 miles of copper wire of about one hundredth of an inch in diameter.

AN IMPROVED MACHINE FOR RE-MAKING WIRE DRAWING DIES.

The machine described below is intended for re-making wire drawing dies after they have become worn by the passage of the wire. This operation has usually been accomplished by heating the dies in a suitable furnace to the required temperature, after which the hammering has been effected by hand while the die has been held in a pair of tongs. This hammering process requires great skill on the part of the operator in order to deliver the blows around the eye of the die without striking the edge of the eye.

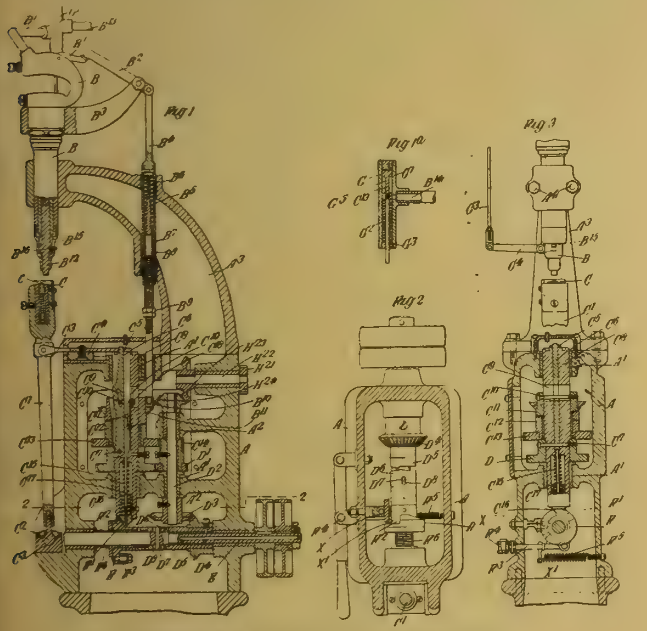
It has been proposed to effect this operation by means of a hand-operated machine in which a die anvil has been rotatably mounted in relation to a hammer capable of delivering its blows in concentric circles, and of being moved radially towards the axis of the anvil by means of a foot lever so as to deliver the blows in a helical line upon the surface of the plate, and thus condense the metal towards a central point. It has also been suggested that such a hammer may be so combined with the revolving anvil that rotation of the latter will cause the hammer to be moved radially towards the axis of the anvil. In this machine the number of blows delivered by the hammer upon the die plate during each revolution was directly dependent upon gearing which connected the hammer actuating mechanism with the mechanism that imparted a rotary motion to the die anvil, consequently the number of blows delivered during the revolution of the die anvil could not be varied without changing the gearing.

In the machine under consideration the reciprocations of the hammer are effected independently of the mechanism that imparts movement to the die anvil; and an important feature of the invention consists in causing the die to describe a predetermined path in relation to a stationary hammering point of a pneumatic or other appropriate hammer, and to effect this movement in such a manner that the hammering operation is commenced at some distance away from the eye and terminates in proximity thereto, with the result that the metal is caused to flow from the outer portion of the die towards the eye, and thereby to effect the closing-in process of the latter more efficiently. Previous to the hammering operation the dies are caused to pass through a furnace, where they are heated to the required temperature, and are fed one by one on to an anvil, where the hammering is effected, the feed being so arranged that when one die has been hammered another die is fed automatically on to the anvil from the furnace, thereby displacing the preceding die, which is allowed to fall into a suitable receptacle to cool gradually. A further important feature consists in providing means whereby the hammering mechanism is rendered inoperative unless a die is placed between the hammer head and the anvil, thereby avoiding damage to the machine.

The present improvement is the invention of Messrs. The British Steel and Wire Co. Ltd., of Trafford Park, Manchester, in conjunction with Mr. N. K. Turnbull, and the construction will be understood from our illustrations, which show the machine in fig. 1 in vertical section, fig. 2 in horizontal section, fig. 3 in end elevation partly in section, and fig. 1A is a detached view of a valve arrangement for rendering the hammer inoperative until a die has been placed in position between the hammer and the anvil.

The machine comprises an upright frame A, which carries a pneumatic hammer B, the anvil C, the mechanism for controlling the movement of the latter, and the mechanism for actuating the pneumatic hammer and for preventing the latter from being brought into operation until a die has been inserted between the anvil and the hammer.

The anvil C is conveniently made in the form of a short tube that is detachably secured within the end of an upright shaft C^1, and carries a spring-controlled centering device *c* adapted to engage with the larger portion of the aperture on the back of the die, and to retain the latter in position upon the anvil during the hammering process. The lower end of the shaft C^1 terminates in a ball C^2 that is enclosed within a spherical bearing C^3 supported by the frame A, this arrangement being provided to permit of the shaft C^1 moving freely in every direction around the centre of the ball C^2. The mechanism for causing the shaft C^1 to describe a spiral path in relation to the hammering point comprises a forked lever C^3 pivoted to the shaft C^1 and also to a block C^4 that is slidably mounted in the frame A. The opposite end of the lever is formed with an aperture C^5, through which passes the end of an upright lever C^6 which is pivoted at C^7 in a recess formed in an upright shaft C^8 rotatably mounted in bearings A^1 carried by the machine frame A. The shaft C^8 derives its rotary motion from a toothed wheel D that is fixed to such shaft and gears with a toothed wheel D^1 fixed to a shaft D^2 rotatably mounted in bearings A^2 carried by the machine frame. The lower end of the shaft D^2 carries a bevel wheel D^3 which gears with a bevel wheel D^4 secured to a clutch member D^5 that is rotatably mounted upon a main driving shaft E. The shaft C^8 is arranged to make three revolutions for each hammering operation, and during these three revolutions the lever C^6 is gradually moved from the position shown in fig. 1 to a position in which the end of the lever will become approximately concentric with the centre line of the shaft C^8. This is effected by forming the lever C^6 with an inclined slot C^9 for a pin C^{10}, which passes through slots formed longitudinally in the shaft C^8 and terminates in the opposite sides of a cam C^{11} that is slidably mounted upon the shaft C^8, but is compelled to rotate therewith by reason of the aforesaid pin C^{10}. Situated below the cam C^{11} is a similar cam C^{12} that is rotatably mounted upon the shaft C^8, and carries a toothed wheel C^{13} that gears with a toothed wheel C^{14} fixed on the shaft D^2. Each cam C^{11} C^{12} is formed with an inclined stepped surface, and the ratio of the gear wheels C^{13} and C^{14} in relation to the gear wheels D and D^1 is such that during three revolutions of the shaft C^8, the cams C^{11} C^{12} make one complete revolution relatively to each other, whereby the cam C^{11} is raised the full depth of the stepped surface. This motion of the cam C^{11} causes the pin C^{10} to travel up the inclined slot C^9 in the lever C^6 as the spindle C^8 is making its three revolutions, and thereby to move the lever C^6 to its innermost position. The said lever is thus caused to describe a spiral path, and its motion is transferred to the anvil C through the pivoted and sliding lever C^3 connecting the shaft C^1 and the lever C^6. As soon as the spindle C^8 has made its three revolutions, the stepped portions of the cams C^{11} C^{12} become linable with each other, and the cam C^{11} is returned to its lowermost position upon the cam C^{12} by a spring C^{15}. The latter exerts pressure upon a plunger C^{16} that is cone-shaped at its outer end and is slidably mounted in the spindle C^8 and connected by a rod C^{17} and transverse pin C^{18} to the cam C^{11}, the said pin passing through a slot C^{19} formed longitudinally in the spindle C^8. Slidably mounted upon the driving shaft E is a clutch member D^6 that is prevented from rotating upon such shaft by a pin D^7 which passes transversely therethrough and through slots D^8 formed in the said clutch member. Rotatably mounted upon a continuation of the clutch member D^6 is a cam F, hereinafter referred to as the starting cam. This cam is formed with an inclined surface F^1 and with a stepped portion F^2, and is connected by a link F^3 to a starting handle F^4. A spring F^5 is connected to the said link and normally retains the starting handle and cam in the position indicated in the drawings. In this position the inclined surface F^1 of the cam is caused by the spring F^6 to engage with the conical surface of the plunger C^{16}, and so maintains the driving clutch member D^6 out of engagement with the clutch member D^5.



Machine for Re-making Wire-drawing Dies.

The pneumatic hammer B is clamped in a curved arm A^3 of the machine frame by the screws A^4 so as to permit of vertical adjustment of the hammer to compensate for dies of different thicknesses. B^1 represents the lever of an air inlet valve, which normally remains closed when the machine is not in operation. This valve is adapted to be actuated by a lever B^2 pivoted to an arm B^3 carried by the hammer, and such lever is connected to a rod B^4 that is capable of longitudinal adjustment, and is provided with a spring escapement which will permit of the contraction of the rod in an endwise direction. In the arrangement shown the rod B^4 is connected with an outer tubular portion B^5, within which is situated a spring B^6 adapted to exert pressure against the inner end of the rod B^4 and a tubular member B^7 that is slidably mounted within the tubular portion B^5. Passing through the tubular member B^7 is a screwed rod B^8, which engages with a screwed portion of such member, and is provided with lock nuts B^9 for securing the rod B^8 in any adjusted position in relation to the member B^7. The outer end of the rod B^8 is provided with a detachable shoe B^{10} which rests upon a collar B^{11} that is supported by a shoulder on the cam C^{11}. This arrangement is designed to open fully the air inlet valve at the commencement of the upward movement of the cam C^{11}, the remaining upward movement of the latter compressing the spring B^6 without imparting any further movement to the valve. In order to prevent the hammer being put into operation in the event of the machine being started when there is no die upon the anvil C, the hammer is so arranged in relation to the anvil that before a die can be inserted between the hammer head B^{12} and the anvil, it is necessary to raise such head slightly. This motion is utilised to open a supplementary valve which normally closes the communication between the air inlet pipe B^{13} and a passage B^{14} leading to the air inlet valve. In the arrangement shown the supplmentary valve comprises a piston valve G (fig. 1A) that is normally retained at the top of a cylinder G^1 by a spring C^2. In this position the valve blocks the communication between the air inlet pipe B^{13} and the passage B^{14} leading to the air inlet valve. The valve G is connected by a rod

G^3 to a lever G^4 (fig. 3) pivoted to the casing of the hammer B, and the inner end of this lever passes through a slot B^{15} formed in such casing, and enters an aperture B^{16} (fig. 1) formed in the side of the hammer head. When the latter is raised by the insertion of a die, the piston valve G is lowered until an annular recess G^5 extending around the same puts the air inlet pipe into communication with the passage leading to the air inlet valve. If the starting handle F^4 (fig. 2) is now moved to its starting position, the stepped portion F^2 of the starting cam is brought into line with the plunger C^{16}, with the result that the spring F^6 imparts an endwise movement to the cam F and causes the driving clutch D^6 to gear with the clutch member D^5. Motion is now transmitted to the shaft D^2 from the bevel wheels D^4 D^3, thereby rotating the spindle C^8 and the cam C^{11} through the toothed wheels D^1 D and the cam C^{12} through the toothed wheels C^{14} C^{13}. The difference in the speed at which the cams C^{11} C^{12} revolve causes the cam C^{11} to rise and to incline the lever C^6 towards the axis of the spindle C^8. This motion, together with the rotary motion of the spindle, is transmitted through the lever C^3 to the anvil C, with the result that the latter is caused to describe a spiral path under the point of the hammer head B, and as the hammer is put into operation as soon as the cam C^{11} begins its upward movement, the hammering process is commenced at some distance from the eye of the die, and is continued around the same at a gradually decreasing distance. When the spindle C^8 has completed three revolutions, the lever C^6 has arrived at its innermost position, the cam C^{11} is in its highest position and is about to return to its lowest position in relation to the cam C^{12}. In this position the plunger C^{16} clears the stepped portion F^2 of the starting cam F, whereupon the spring F^5 returns the latter, together with the starting lever, to their original positions, so that when the cam C^{11} is returned to its lowest position by the spring C^{15}, the plunger C^{16} comes into contact with the inclined portion F^1 of the starting cam and withdraws the driving clutch D^6 out of engagement with the clutch member D^5, and thereby stops the machine. To enable the machine to be instantly stopped at any period of its cycle, an adjustable stop X is situated in proximity to the starting cam F, and the latter is formed with an inclined portion X^1 that is adapted to be brought into engagement with the aforesaid stop by moving the lever F^4 from its starting position to its extreme out position. This movement causes the driving clutch D^6 to be disengaged from the clutch D^5 whereupon the machine stops.

Any suitable furnace can be used in combination with the machine for heating the dies preparatory to the hammering operation, and if desired the furnace can be provided with a suitable feed motion, which may be operated from the shaft D^2 through the bevel wheel H^{23}, shaft H^{22}, and pinion H^{21}.

BOILER EXPLOSIONS.

ABSTRACTS FROM RECENT BOARD OF TRADE REPORTS.

Explosion from a Marine Multitubular Boiler on Board.

Report of Preliminary Inquiry, No. 1,958.—The explosion occurred on the 14th June last, on board the s.s. Snaefell, when the vessel was on her official speed trials between the River Mersey and the Isle of Man. No one was injured by the explosion. The boiler is of the usual cylindrical, multibular type, having an inside diameter of 15 ft., and a length of 11 ft. 7 in. The shell plating is 1$^{15}/_{32}$ in. in thickness, and the longitudinal seams are fitted with double butt straps, the rivets being 1½ in. in diameter, pitched 9¾ in. apart in the outer rows, with five rivets in each pitch, and the circumferential seams are lapped and double riveted. The boiler is fitted with three corrugated furnaces 4 ft. 2 in. in external diameter and 8 ft. 6 in. in length. The combustion chamber back plates and wrapper plates are $^{19}/_{32}$ in. thick, and the bottom plates are $^{15}/_{16}$ in. in thickness. The chamber tops are 2 ft. 9 in. in width, and they are supported by girder stays, each made from two plates 7¾ in. deep and $^{29}/_{32}$ in. thick. These are placed 7¾ in. apart on the wing boxes, and 7⅝ in. on the centre box, the pitch of the supporting bolts being 7½ in. The combustion chamber back plates are supported by screwed stays 1⅝ in. in diameter, pitched 7⅜ in. by 8¼ in. in the wing boxes, and 7 in. by 7⅜ in. in the centre box. The top marginal stays in the wide water spaces are 1⅜ in. in diameter, and, at the sides, the pitch of the screwed stays varies from 7⅜ in. to 7¾ in. The back tube plates are $^{13}/_{16}$ in. thick, and the distance between the front and back tube plates is 8 ft. The smoke tubes have an external diameter of 2½ in., and the usual number of stay tubes are fitted. The through stays are 2⅝ in. in diameter in the body, and are pitched 15 in. to 15½ in. apart horizontally and 15½ in. vertically. The end plates are 1 in. in thickness. The boiler was designed for a working pressure of 195 lbs. per square inch, and is made of steel throughout, with the exception of the smoke tubes and screwed stays, which are iron The boiler is a new one. The back of the starboard combustion chamber of the starboard after boiler collapsed. The nuts were forced off twelve screwed stays, and the back plate was forced over the ends of eight of these stays, permitting the steam to escape through the stay holes into the combustion chamber. The plate was bulged between the upper five rows of stays, the maximum deflection of the plate from the normal being 5⅜ in. The flanges of the tube and back plates in this combustion chamber were considerably depressed vertically, and the six top rows of holes in the back tube plate, and the tubes therein fitted, were badly distorted. The combustion chamber top was forced down for a distance of about 4½ in. from the normal, but no rupture took place here. The tube plates and the combustion chamber plates in the remaining two boxes were also badly distorted, but not to the same extent as the starboard one, and no ruptures further than those already mentioned occurred. The explosion was due to the water in the boiler having become too low, allowing the combustion chamber plates, stay ends and nuts to be overheated, in which condition they were unable to resist the pressure of the steam in the boiler.

Explosion from a Steam-heated Cast-iron Box.

Report of Preliminary Inquiry, No. 1,959.—The explosion occurred on the 20th June last, at the Wall Paper Manufacturers Ltd., Walker Carver Branch, Orchard Street, Pendleton, near Manchester. A labourer was slightly scalded on both arms; he has now recovered and returned to work. The steam-heating box was made of cast iron. It was 24 in. long, 23 in. wide, and 3 in. deep. From a projection at each end were flanges, 6½ in. in diameter and ¾ in. thick, for attachment to the steam inlet and outlet pipes. The box formed one flat hollow casting. The thickness of the metal where the fracture took place varied from $^{5}/_{16}$ in. to ½ in. There were six chaplets cast into the body of the box, each about ⅝ in. in diameter. The box had only just been erected in position when the explosion took place. The bottom of the box fractured, leaving an opening of about 23 square inches, through which the steam escaped into the atmosphere. The explosion was due to the box being subjected to a steam pressure greater than that which it was able to withstand.

Explosion from a Cast-iron Steam-heated Table for Melting Glue.

Report of Preliminary Inquiry No. 1,960.—The explosion occurred on the 12th May last, at the cabinet factory of Messrs. Maple and Co. Ltd., 39, Highgate Road, London, N.W. No person was injured by the explosion. The table was of rectangular shape, 7 ft. 3½ in. long, 2 ft. 9½ in. broad, and 9½ in. deep. It was made of cast iron in two portions, top and bottom, and jointed at the centre, and held together with 58 bolts, ½ in. in diameter, of an average pitch of 4 in. The thickness of the metal in the top and bottom parts varied from ½ in. to $^{21}/_{32}$ in., in the sides and ends from $^{11}/_{32}$ in. to $^{25}/_{64}$ in., and on the webs, of which there were two in the top portion and three in the bottom, from ½ in. and $^{7}/_{16}$ in. The flanges were from ⅝ in. and $^{11}/_{16}$ in. in thickness. The whole apparatus was carried on four cast-iron legs, bolted to the corners. There was a steam inlet pipe at each end of the table ⅜ in. in bore, and these were connected by a tee piece in the centre, into which was screwed a steam supply pipe ⅜ in. in bore, and to this pipe a steam stop valve was attached. At one side of the bottom, at about the middle of its length, a small well was formed in the casting, fitted with a portable cover, to which was attached the outlet pipe, having an internal diameter, at its smallest part, of $^{9}/_{16}$ in. At each end of the top portion of the apparatus, there was a water well, into which the glue pots were immersed, and at each end of the bottom portion a hot-water well, from which the water of condensation was drawn for replenishing the glue wells. According to the makers' statement, the table was not designed to sustain any internal pressure; it was, therefore, never tested hydraulically. The explosion was of a violent character. The greater part of the apparatus was hurled vertically, and struck and indented the flange of a large channel iron which supported the floor above. The bottom of the apparatus was fractured. No damage other than that referred to above was, however, done to the building. The explosion was due to a greater pressure of steam being admitted to the table than it could safely withstand.

AN IMPROVED PLANING MACHINE.

A DEVELOPMENT in the driving of planing machines has recently been brought out by Messrs. Redman and Sons, Halifax, which embodies a reversible motor drive and other features. The system, which has been termed " The Lancashire, consists of a motor generator running at a high speed, mounted on the upright or in any convenient position, the motor end being supplied with power from the electricity supply available. Any kind of either alternating or direct current may be supplied, and if no current is available the special generator may be driven from a line shaft. The generator end is connected electrically direct to the planer motor, which is direct coupled or geared to the planer driving shaft. This generator and motor are direct-current machines, and wound for any convenient voltage.

A reversing switch is actuated by a tappet rod from the reversing gear of the planer, and when this is thrown over it reverses the direction of the current in the field winding of the generator, thus reversing the direction of rotation of the planer motor, and at the same time it so regulates the voltage of the generator, by which the speed of the planer motor is decided, as to cause the planer motor to run at the speed required according to whether it is on the cutting or return stroke. The tappet rod mentioned above is the only mechanical connection between the switch gear and the planer, the maximum cost of this being only a few shillings.

The cutting speed may be varied by hand to suit the work being done by means of a regulating resistance in the generator field, this resistance being put in circuit by the reversing switch on the cutting stroke only. This gives a constant return speed, but if desired the return speed can be varied also. By this means the speed of cutting may be varied, by turning one handle, from 15 ft. per minute, or even less if desired, to the full return speed of the planer, and any number of intermediate speeds are obtainable. Of course, the maximum speed of cutting is limited by the speed the tool will stand.

This system is a truly regenerative one, as the energy stored in the planer table and its load, as well as that stored in the revolving parts of the planer and motor, is returned to the circuit at each reversal by causing the planer motor to become a generator at this instant, and to give out energy through the motor-generator to the line.

This not only results in a considerable saving in power, but gives a powerful braking effect, which causes the motor to reverse instantaneously. The switch gear required is simply that for an ordinary variable-speed motor, and is made in ordinary starting panel form. The only switch moving at each reversal of the planer is the reversing switch, which only deals with the field current of the generator, this being equivalent to the current required by a few incandescent lamps. There are no switches or resistances in the main circuit except the ordinary starting switches, which are operated only when starting or stopping the motor generator.

If it is desired to control the planer from various points round it, small switches for the field circuit will be supplied by means of which the planer may be instantly stopped and started from any point at which one of these switches is fixed.

LITERATURE.

All books received or noticed in this column can be had through " The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

" Electric Circuit Problems in Mines and Factories." By E. H. Crapper, B.Eng., M.I.E.E. London: The Colliery Guardian Co. Ltd. Price 3s. 6d.

THE extensive use of electricity in connection with mining operations, and the growing tendency to completely equip mines with electric power, has called for a class of attendant practically non-existent. Hence there is a lack of technical knowledge in this direction, with the consequent element of danger where currents of high potential are employed. Professor Crapper has stepped into the breach and given us a work, though small, yet one that exactly meets the needs of those in charge of electric mining plant. A good deal of space is devoted to the insulation and testing of cables—perhaps the most important branch of the several duties of an attendant—as upon the knowledge that can be brought to bear quickly in case of failure or the installing of new work will continuity be maintained. The information on the principles of continuous and alternating current working and the operation of the various machines is given in a manner as may be best understood by any person of ordinary intellect desirous of becoming efficient in his duties. Mathematics is unavoidable in a work of this nature, but the author handles this in a manner that makes it simple to anyone familiar with the elements of electricity.

We heartily commend the book to the attention of those for whom it has been specially written, and it will assuredly fulfil a definite purpose.

BOOKS RECEIVED.

" Official Gazette of the United States Patent Office." Vol. CLIX., No. 4. Published by Authority of Congress, Washington.

" Handbook to the Commercial Intelligence Branch of the Board of Trade." From the Director. Price 2d. To be had through any bookseller.

AN IMPROVED POWER PRESS.

The power press described in this article comprises an improved form of ejector; an arrangement of locking and retaining nuts to prevent relative movement between the ram and the connecting rod, thereby providing for the accurate working of such ejector; an improved means for preventing the working of the machine at certain times, as, for instance, when adapting the ejector after changing the dies, and an improved feed gear having for its purpose to more accurately feed the work and so permit of a better co-operation with the improved ejector.

The construction of the press, which is the invention of Mr. C. J. Rhodes, Director of Messrs. J. Rhodes and Sons Ltd., of Grove Iron Works, Wakefield, is clearly shown in our illustrations, fig. 1 being a front elevation, fig. 2 a side elevation of the power press, fig. 3 a plan, fig. 4 a front elevation, and fig. 5 is a side elevation, drawn to a larger scale, of the mechanism whereby the automatic feed is effected.

In order to provide for the ejectment of the stamping from the die, a hole f^1 is provided in the ram, preferably from front to back through which hole is projected a rod or lever F pivoted at the rear. The rod or lever upon the upstroke of the ram collides with the point of the screw f^2, and the resulting relative motion of the lever and ram is transmitted to an ejector pad disposed in the cavity of the upper tool through the medium of a suitably mounted rod placed between the said lever and ejector pad. The adjustment screw f^2, which is provided upon an arm f^3, may be kept in place by a lock nut f^4, and its position in front of the ram permits of a more easy and ready operation of adjustment than has previously been the case, while the provision of a hole f^1 in the ram from front to back enables the operative to more easily ascertain the degree of adjustment necessary. The transvere hole in the ram may, however, be adapted to permit of the disposal of the rod from left to right or from right to left if desirable.

The ram, with its attendant mechanism for ejecting the stamping, is coupled to the connecting rod as is usual by a ball and socket joint, the connecting rod having a ball at its lower extremity, which ball is retained within a corresponding socket in the ram, the ball having a threaded stem which is screwed into the connecting rod and secured therein by a retaining nut encircling the screw stem and bearing against the extremity of the connecting rod. According to this invention, in order to obviate the objectionable looseness prevalent between the retaining nut k^1, ball stem k^2, and connecting rod K, an additional locking nut k^3 is provided upon the screw stem, to be tightened in relation to the retaining nut and to thereby ensure a lock which remains in effective security throughout the operation of the machine; in addition to this, the screw threads are better able to withstand the concussive effect of the stamping operation. The coupling of the aforementioned type is disposed centrally in relation to the crank and the guides by which the ram is carried, while the arrangement is such that the retaining nut may be of the hexagonal form to be tightened without inconvenience.

The provision for putting the machine into operation by means of a foot lever may be of the class in which the flywheel is enabled to impart a single revolution to the driving shaft through the medium of a rocking key, which, upon the completion of a revolution of the flywheel, is automatically displaced to a position in which it is flush with the shaft, thereby permitting the flywheel to run idle. In some cases, there is a possibility of the foot lever being accidentally depressed, or the flywheel otherwise clutched to the shaft, with great danger to the operative, and it has heretofore generally been necessary, for safety, to throw off the belt, thereby completely disconnecting the machine. By the present invention the necessity for disengaging the belt is obviated, provision being made whereby the rocking key g^1 may be safely locked in the position in which it is unable to clutch the flywheel G to the shaft g^2, notwithstanding any operation of the foot levers J, and by retaining it in such position any changing of the dies, or other operation, may be effected with safety. It is obvious that various means may be incorporated for so retaining the rocking key g^1 out of engagement with the flywheel G; as an example, the cap or detachable boss H, which is secured to the extremity of the driving shaft g^2 to retain the flywheel G in position, and which may form a bearing for the rocking key, may be perforated for the reception of a headed pin h^1, the reduced point of which may be adapted to take into a recess in the enlarged or other extremity of the rocking key g^1. When the machine is to be used the pin h^1 is removed either entirely or partially, and upon the operation of the foot lever the section of the rocking key which was locked within the recess in the shaft can be caused to project and thereby temporarily lock the flywheel to the shaft in the usual manner.

In the power press illustrated the ram is operated by crank or similar action, after the manner of previous power presses. The blanks are fed into position between the dies by roller or other automatic feed mechanism, but in order to provide for an accurate and certain operation of the feed, the feed mechanism is driven by motion which is imparted by frictional transmission instead of through the medium of teeth; by this means the traverse may be adjusted to a fine degree of nicety without changing the part, whereas with ratchet or other teeth the traverse is governed by the pitch of the teeth. Where small teeth have been used, difficulties have ensued by reason of breaking of the teeth. The driving wheel A of the roller feed is arranged in conjunction with a co-axially fulcrummed arm B which, by a jointed link b^1, is oscillated during the working of the machine. The driving wheel A has preferably a V-shaped groove a^1 at its periphery, and a gravity or other pawl b^2, having a corresponding V-shaped nose, is mounted or pivoted upon the arm B in such a manner as to normally rest in contact with the periphery of the driving wheel A in such a manner that when the arm B is raised the pawl b^2 is pressed into engagement with the periphery of the wheel A, and thereby caused to rotate the latter. Conveniently the length of the pawl may be such that it very slightly exceeds the distance between the pawl pivot and the periphery of the driving wheel.

The entire feed mechanism is advantageously mounted upon a plate or other part, which is so connected to the

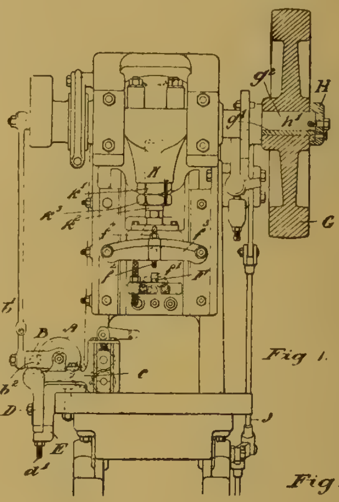


Fig 1.

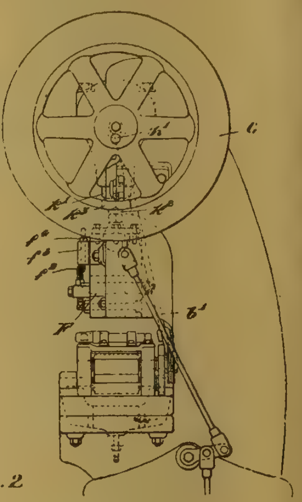


Fig. 2

machine that it can be displaced, without being disconnected, to a position in which it is below the bed of the press, or otherwise positioned to provide for work in which the feed rollers are not required. By this arrangement the necessity for detaching the feed motion from the press is obviated, and the feed motion being self-contained saves time incurred in removing and re-fixing the feed device, and also removes the necessity for providing lugs, faces, or other suitable means for the detachable adaptation of the feed device. Conveniently the rollers and other mechanism are mounted upon a plate C which is hinged at c^1 to a vertical plate D in such a manner that the feed mechanism plate can be swivelled about its hinge c^1 to the desired position when out of use. The vertical plate D is slidably mounted upon a casting E, which is fixed to the bed plate of the machine, and the said vertical plate D may be adjusted vertically by a single screw d^1 to provide for different thicknesses of the dies, other screws d^2 being provided to permit of the locking of the vertical plate D in the desired condition of adjustment.

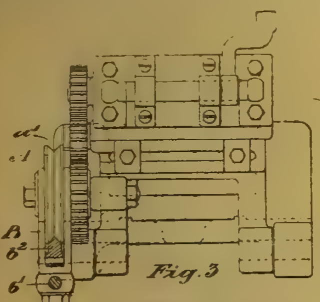


Fig. 3

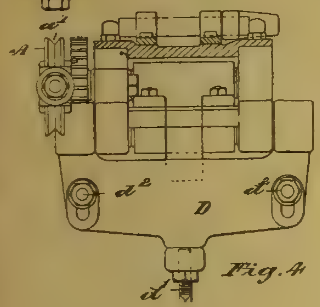


Fig. 4

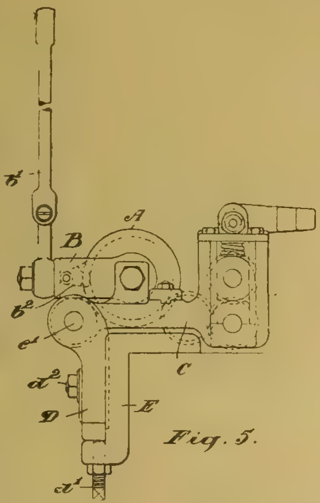


Fig. 5.

THE ELEMENTS OF ENGINEERING ESTIMATING.

By A. Suggate, A.M.I.C.E.

(Continued from page 611.)

Profits.

It is desirable to anticipate a little here what will be amplified later on, and examine the general principles guiding the adding to cost estimates the firm's profits. All correctly made out cost estimates contain the following:—

1st. Total cost of worked up raw material.
2nd. Total cost of labour.
3rd. Total cost of articles bought out for the work.
4th. Establishment charges.

Now, though the sum of these four items make up the prime cost of the work, it is obviously only correct to reckon the profit as a percentage on the first two, as these two items only contain the direct labour spent on the work. Take a crane for an illustration; the steel gearing, chain and hook, wood for jib, are as a rule bought out, and the cost of these would be included in item 3, while it is evident no profit could be charged on the rent and rates of works, proportionate amount of manager and clerks' salaries, coal consumed, gas burnt, stationery and stamps used in correspondence, etc., etc., all of which are included under the head of item 4. The correct handling of the last two items will be discussed later on.

Some firms calculate their profit by fixing a certain percentage on the whole money turnover of the work, but unless much labour be spent on book-keeping no correct idea of the amount of profit realised can be ascertained. For one description of work may have much material and little labour spent upon it, while the next work following will reverse these conditions, having little amount of material, involving much labour. A little reflection will show that though the prime cost of the two kinds of work may be nearly identical, the same percentage for profit cannot be applied in the two cases, otherwise in the first case the amount of profit on labour would be too much, and in the second case too little. In these articles the profit will be considered as a percentage solely on the first two items, as the only sound method of procedure.

In the smaller firms the cost estimate is made out by the clerk, and the amount of profit added, as a rule by the manager, and it is convenient here to inquire into some of the considerations that will influence him in determining the amount of his firm's tender. If trade is bad and orders scarce it may be better for a firm to take a contract at cost price, in order to keep the establishment in working order, even on three-quarter time, than be without it; but this course should only be adopted when absolutely unavoidable, as the price which any firm quotes should be one that will leave some amount of profit, if small. Nearly always the firm will know that they are in competition with other firms for the same work, and adjust their price accordingly. Representative agencies of other engineering establishments resident in the firm's neighbourhood will suggest the names of rival firms, bearing in mind that the larger the contract the further may be the distance off of the competing firms. Again, the contract may be for work in the firm's locality, in which they may deservedly have a good reputation. In this case something may be added to what would be considered a cutting price, on account of the same reputation, or the firm's competitors may be at a distance, and they may then increase a trifle their tender in consequence, bearing in mind that their competitors may also drop altogether, or in part, cost of carriage or freight in order to secure the same contract. It is advisable to avoid quoting a very high or very low price in tendering, as though the latter may secure the contract with a small profit, the after reflection that a higher price might have been asked and still have secured the order to the firm is not pleasant. On the other hand a very high price would not only lose the contract, but would prejudice the firm from being asked to tender in future. It is always preferable to write declining to tender than to "choke it off" by asking a very high figure.

(To be continued.)

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 10th November, 1910.

Greenock.—*First class:* A. R. Fleming, T. Herbertson, J. Mitchell. *Second class:* J. A. Rankin.

Hull.—*First class:* F. Hilling.

Liverpool.—*First class:* C. Craske. *Second class:* C. H. McAulay, E. E. Barclay, J. Corbett, T. W. P. Guthrie.

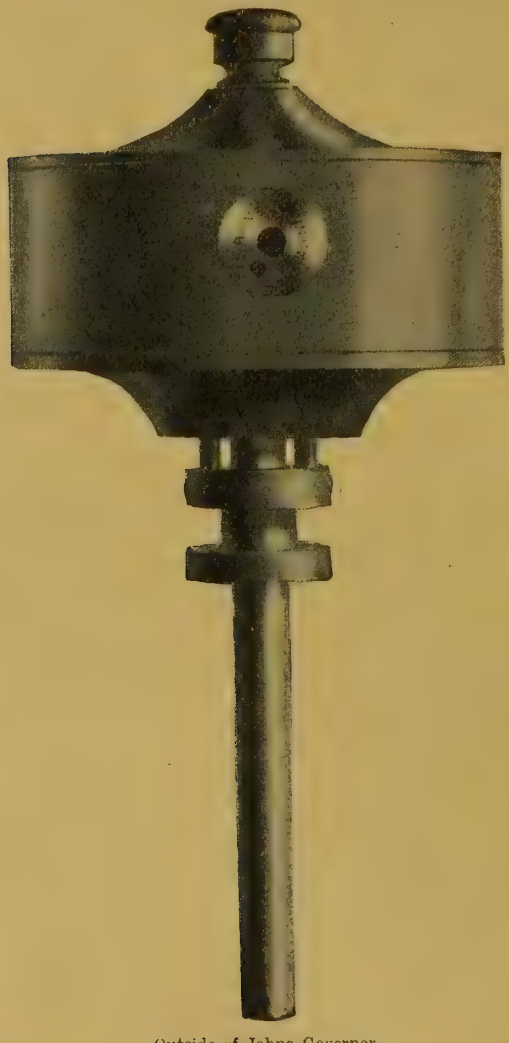
London.—*First class:* A. L. Gatland, E. B. Finney, A. B. Rankin. *Second class:* C. J. Barker, John B. Hyde, W. S. Lochhead., W. R. Roddick, A. E. Smyth.

North Shields.—*First class:* F. Lawson, A. R. Allen, H. Hunt, R. H. A. MacLaren.

The Ostasiatiske Kompani, of Copenhagen, have ordered a 7,000-ton steamer from a Copenhagen firm. The vessel is to be propelled by a Diesel motor, which will give a speed of 13 knots.

THE JAHNS GOVERNOR.

The demands made upon the governing mechanism of engines and turbines become more exacting every year, particularly for electrical generator driving and for cotton mill service, for both of which an absolutely uniform drive is essential. As a result, a large number of new types of governor have been put on the market, with more or less success; until quite recently, however, the correct theory of centrifugal and inertia governors does not seem to have been very well understood, and it would seem that the majority of inventors have been groping more or less in the dark. There would appear to exist, moreover, a certain amount of conservatism which has seemingly prevented the design of any type of governor not provided with swinging arms terminating in balls, similar to Watt's old pendulum type. The requirements of a governor may be summed up as follows:—When a certain load is thrown on or off an engine or turbine, the speed drops or rises, and causes the governor to act on the regulating gear. The amount of such momentary change in speed depends mainly on two factors, that is to say—the time which elapses before the governor actually sets the regulating gear in motion, and the momentum of the rotating masses. These two factors must be carefully considered for each individual case and made to correspond. The quicker the action of the governor the smaller may be the momentum of the rotating parts. It is therefore clear that the governor which responds most quickly to a variation in speed is the best, and also the most economical as regards total first cost; but a quick-acting governor must be designed on three theoretically correct principles, and these are: (1) Maximum uniformity of action throughout the stroke; (2) maximum sensitiveness; (3) maximum regulating force.

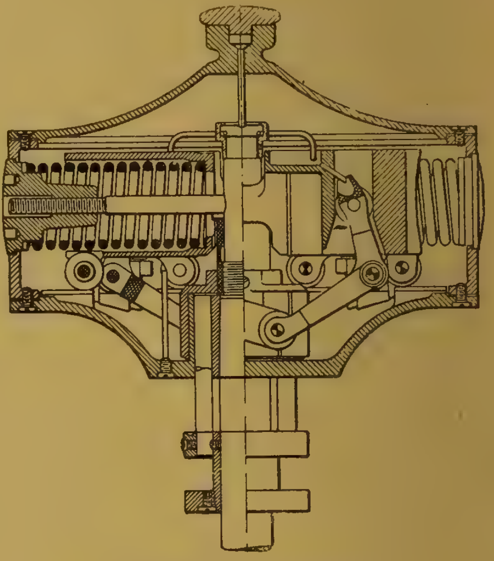


Outside of Jahns Governor.

As regards the first of the above principles, the greatest possible uniformity of working is attained in a governor which gives the full sleeve stroke with a minimum change in speed and at the same time has an absolutely uniform sleeve travel throughout its whole stroke. It is, moreover, essential that the lifting force of the sleeve be constant in every position for a given change of speed. In the second the sensitiveness of the governor varies in inverse ratio to the internal friction, so that the less the friction the higher the sensitiveness. The insensitiveness (or sluggishness) due to the internal friction of a governor may be given a numerical value by defining it as the proportion which the change in speed necessary to produce motion in the sleeve bears to the total speed. Thus, if at any time the speed of the governor has been rising and comes to a steady value $n1$, and if it then begins to fall, the sleeve, owing to internal friction, will not begin to move downwards until the speed has fallen to a value less than $n1$, which we may call $n2$. Then the insensitiveness will be

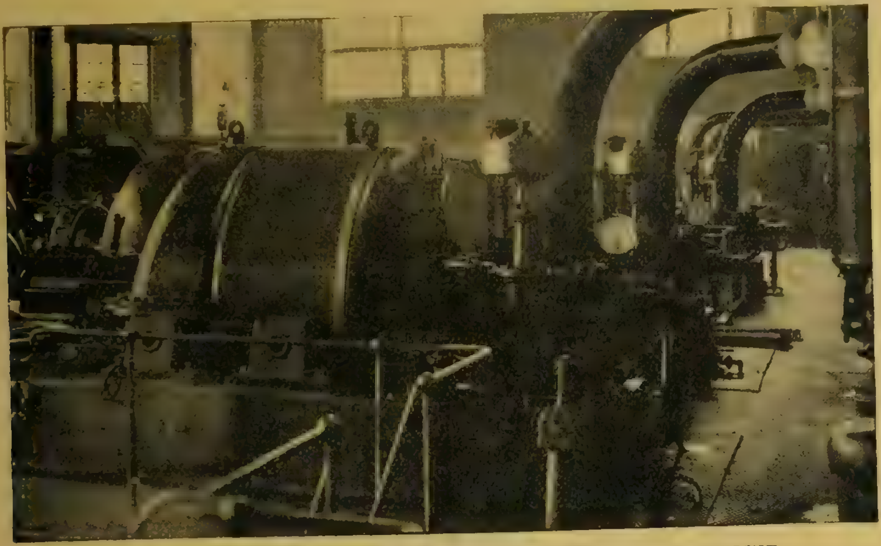
$$\frac{n1 - n2}{n1}$$

Lastly, the greatest regulating force is attained by the governor which brings the regulating or valve gear to the position corresponding to the new load conditions in the shortest possible time. In the governor under consideration this quantity has a value of ·00175, or ·175 per cent, which is considerably lower than in any other governor on the market. The inventor, after making a most intricate study of the theory of the subject, introduced, in the year 1901, a governor, the latest type of which we illustrate. Balls and swinging arms are replaced by a neat enclosed system with suitably formed and guided weights and balanced levers, powerful adjustable springs, ball or roller bearings at every friction point, and perfectly automatic lubrication throughout. Friction is reduced to a minimum, and the result is a governor of great power, efficiency, and stability. The design is in accordance with correct theoretical principles, and the curve connecting sleeve travel and speed is more nearly a straight line than has hitherto been attained in any other governor, indicating a remarkable degree of sensitiveness, uniformity, and stability.



Section View of Jahns Governor.

Highly sensitive governors are frequently objected to on the ground that they allow hunting to take place. This is not because they are sensitive, but because they are unstable, which is the worst of all faults.



VIEW SHOWING APPLICATION OF JAHNS GOVERNOR TO TURBINE.

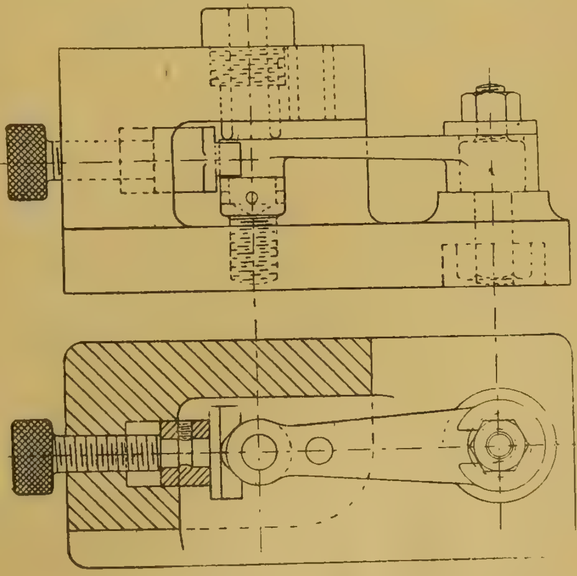
The sectional view shows a cross section of the standard C type governor. The mechanism is enclosed in an oil-tight polished cast-iron casing consisting of three parts, viz., the bottom, the cylindrical centre casing, and the cover; on the top is an oil cup. The cover and bottom are fixed to the centre by means of the screws, packing rings of hard paper being used. The tapered end of the shaft is fixed into the bottom casing and clamped by a nut. The governor weights move absolutely radially in straight lines on steel rollers, which carry the weight as well as the side pressure, and the springs shown act directly on the weights themselves, without the intervention of any pins or levers. The straight line movement of the weights ensures a straight line law for the travel of the weights, and is a feature not possessed by any other governor; while in nearly all other governors the springs control the weights through a system of levers and pivots, and thus introduce a serious amount of friction. The springs are kept in position by a bolt and two nuts. The nuts are set tight against the centre casing. tightness being ensured by means of rubber rings. One or several adjusting rings are inserted to set the springs for the correct engine speed. A bolt passes through the spindle, and is secured against turning or coming out by a pin, as shown. This arrangement of bolts and springs is another important feature since it enables the two sides of the governor to be adjusted independently.

The sleeve consists of two parts—the upper part inside the casing, and the lower part outside the casing, which acts on the lever of the throttle or valve gear. These two parts are connected by rods, which slide up and down in corresponding holes in the bottom casing, thus avoiding the friction due to the more usual arrangement of feathers. All parts move in an oil bath, and the upper levers are lubricated through oil pipes, which are fed from a common oil cup. The bell cranks transmit the motion of the weights to the sleeve, as shown, and are fitted with rollers to minimise friction.

The makers do not claim for the governor that it can be turned out cheaply, as obviously an article of good design and workmanship cannot be made at as low a price as an inferior article, but the construction is not of an expensive kind, and the standard patterns of governors are turned out in such large numbers as to enable the cost of production to be reduced to a minimum.

DRILL JIG FOR LEVERS.

The following handy form of drill jig for levers is described and illustrated by a correspondent of our contemporary, *The American Machinist*:—Clutch withdraw levers are brought to the jig here shown with the hole bored in the large boss and the small boss milled to thickness. The jig body itself is of cast iron, with the base bored to receive a locating peg, in which the levers are placed. Two holes are bored and bushed at correct centres from the locating peg. The lever is located by means of a vee block fastened to a screw, thus giving adjustment endways to allow for variation in the length of the levers. The pressure of the drill is taken by a screw jack in the base of the jig, this jack having clearance to miss the drill coming through the boss. The lever is held down by the screwed bush, which is drilled for tommy holes. A U washer is used for quickness in slipping the lever off the locating pin. The writer states that he has several of these jigs in use of different sizes, drilling steering levers, single and double.



Drill Jig for Levers.

HUMPHREY PUMPS AND COMPRESSORS.*

When requested by your Council to prepare a paper for this Association some doubts occurred in the author's mind as to whether there was sufficient new material left, in view of the very full statement of the new principles involved in his inventions as given in a paper before the Institution of Mechanical Engineers only last year. However, matters have progressed with unexpected rapidity, and the flexibility of his system has been demonstrated by its ability to meet conditions which were thought by some to impose limitations.

It was, for instance, pointed out that the only Humphrey pump having a suction lift, and described in my first paper, had a change-over valve which was objectionable in large sizes. The author and those associated with him were at once able to produce designs of suction lift pumps without this objectionable feature. Again, it was stated that the level of the supply water affected the volume of the explosive charge, and that it was not in practice desirable to be obliged to keep the supply level constant. Now we can show designs in which the charge volume is automatically maintained constant in spite of varying water levels, the device producing this result being of the simplest kind. Once more, it was urged against the system that it was bulky, and although this was never true if the comparison was made as between Humphrey pumps and ordinary reciprocating pumps, yet the criticism held when considering the use of the Humphrey pump for power production and comparing it with an ordinary gas engine. Well, this point has been met also, and the 1,000 H.P. Humphrey pump now being constructed in Germany will compare favourably as to space occupied with a tandem double-acting type of gas engine of the same power. The fact is that those friends who believed that they saw limitations did not fully realise that the resources available to increase the output of gas engines were equally open to adoption by us, and that high pressures and high speeds could be applied wherever occasion required. The result has been that no case has been submitted to us for solution in which the system has not proved elastic enough to meet the conditions. One must add that some of these solutions are yet untried, and are based on mathematical calculations to show the possibility, and designs to show the practicability of the several cases. But having in mind the established simplicity and reliability of the pumps so far tested, and which embrace the main principles, there is little room for doubting that the new proposals will mature into efficient and commercially successful machines.

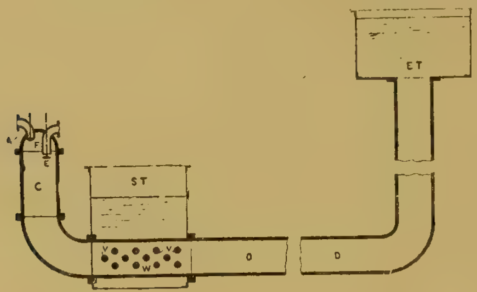


Fig. 1.

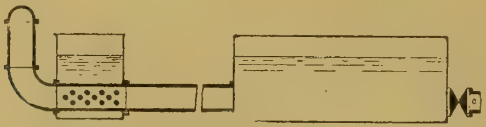


Fig. 2.

In the present paper it is intended to deal with the subject of pumps and compressors from the broad point of view, omitting all details as to types of valves and valve gear except in one instance just to illustrate the kind of device which has been found suitable. Also, to make the paper more complete in itself, some of the old ground will have to be covered again, and it may be as well to start with a definition of the new system. Such a definition might read as follows:—A method of raising or forcing liquid which consists in applying the energy of expansion of an ignited combustible mixture to one end of a column of liquid so as to propel the column along a discharge pipe, and to cause it to oscillate in the pipe under such conditions of energy of the moving liquid, that everything necessary for preparing for the next ignition is performed during one or more oscillations, and wholly or partly owing to it or them.

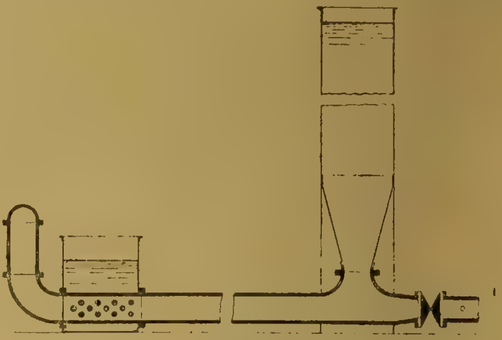


Fig. 3.

Take the simplest case of Humphrey pump, as illustrated in fig. 1. Water has to be raised from supply tank S T to an elevated tank E T. C is the combustion chamber, W the water-valve box with valves V opening inwards, and D the discharge pipe. In the top of the combustion chamber are fitted an inlet valve A and an exhaust valve E. A simple interlocking gear is arranged between these two valves, so that when valve A opens and closes it locks itself shut and releases the valve E, and when valve E opens and closes it locks itself shut and releases valve A. Consequently, each time that suction occurs in the chamber these valves open in turn.

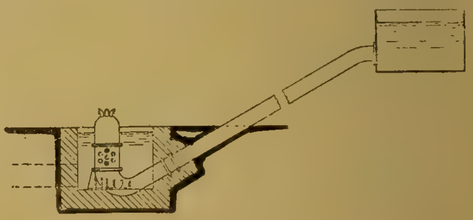


Fig. 4.

Imagine a charge of gas and air to be compressed in the top of chamber C, and fired by a sparking plug which projects through the top casting. All the valves are shut when explosion occurs, and the increase in pressure drives the water downwards in the pump and sets the whole column of water in the discharge pipe in motion. The column of water attains kinetic energy while work is being done upon it by the expanding gases, so that when these gases reach atmospheric pressure the column of water may be moving with considerable velocity. The motion of this column of water cannot be suddenly arrested, hence the pressure in C tends to fall below that of the atmosphere, the exhaust valve E opens and also the water valve V. Water rushes in through the water valves mostly to follow the moving column in pipe D, but partly to rise in chamber C in an effort to reach the same level inside the chamber as exists in the suction tank.

When the kinetic energy of the moving column has expended itself by forcing water into the high level tank, it comes to rest, and there being nothing to prevent a return flow, the column starts to move back towards the pump and gains velocity until the water reaches the level of the exhaust valve, which it shuts by impact. A certain quantity of burnt products is now imprisoned in the cushion space F, and the energy of the moving column is expended in compressing this gas cushion to a greater pressure than that due to the static head of the water in tank E T. Hence a second outward movement of the column results, and when the water reaches the level of valve E the pressure of the space F is again atmospheric, and further movement of the water opens valve A against a light spring and draws in a fresh charge of gas and air. If there were no friction the water would fall to the same level as that from which the last upward motion started, but the amount of combustible charge drawn in is slightly less than this movement would represent. Once more the column of water returns under the elevated tank pressure and compresses the charge of gas and air, which is then ignited to start a fresh cycle of operations.

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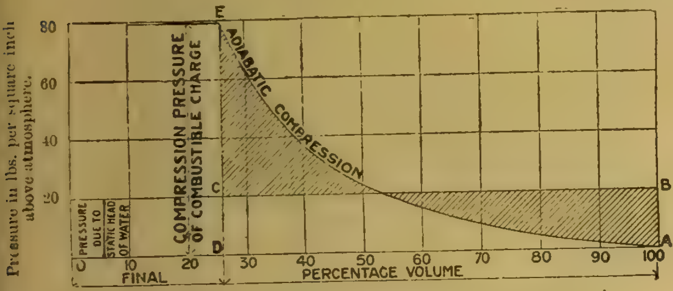
* Paper read by Mr. Herbert A. Humphrey, M.I.C.E., before the Manchester Association of Engineers.



Compression volume. Stroke of water column during compression.

FIG. 5

The action of the pump is not altered if, instead of delivering into an elevated tank, it discharges into an air vessel, as shown in fig. 2, or into an open-top stand pipe or tower, as shown in fig. 3, and both these arrangements are useful if a continuous flow from the outlet O is desired. In many cases the pump can be placed directly in a concrete pit, which serves also as a foundation, and the discharge can be by an inclined pipe, as shown in fig. 4, where the water-valve box is shown vertical. This arrangement is very satisfactory, and is economical in material.

In the simple form of pump the degree of compression of the combustible charge prior to ignition depends on the height to which the water is raised, and exceeds the static equivalent of the head. This can be made clear by reference to fig. 5, where water returning under a pressure A B, and moving through a stroke A D, does work in compressing the gas equal to A B C D. The gas is compressed from A to E, and the work of compression is A E D, consequently the shaded area above the line C B must be equal to the shaded area below it, and E, the maximum compression pressure, is much above C. This result is obvious if one remembers that the kinetic energy acquired by the liquid column on its return flow is utilised in compressing the combustible gas while the compression brings the column to rest.

The same considerations enter into the question of the cushion pressure attained, but here we are dealing with the compression of a volume of gaseous fluid which occupies the clearance space only, and the stroke of the water column is greater in proportion, because for the first part of the stroke exhaust products are being expelled and no compression occurs. Without going into the mathematics of the subject, it is sufficient to say that the cushion pressure rises rapidly as the height to which the water is lifted increases, and at the maximum lift of about 40 ft. to which the simplest type of pump is limited, it may exceed the explosion pressure when using producer gas, or may approximately equal the explosion pressure when working with town gas or petrol.

Without much sacrifice of simplicity, the cushion space may be kept separate from the combustion chamber, and can then be made relatively large because the products of air in the cushion do not then mix with the new charge. This forms one way of keeping the cushion pressure low, and is explained later. Again, if air scavenging is employed, as is now usual, the residual burnt products left in the clearance space are mixed with air and the latter may constitute the greater part of the mixture; a rather excessive clearance is then permissible as compared with an ordinary gas engine, and the simple pump will work throughout its whole range of lift with very moderate cushion pressures.

No simple means of indicating the work done by the expanding gases has been found, so that the indicated horse-power of a Humphrey pump cannot be directly ascertained, but indicator cards showing pressures on a time basis are interesting. Such an indicator card is given in fig. 6, and is taken from a 45 B.H.P. four-stroke pump, lifting to 39·4 ft. head, and working on town gas. The figures relating to this card are:—

Compression pressure at ignition, 56·5 lbs. per square inch.
Explosion pressure, 163 lbs. per square inch.
Cushion pressure, 185 lbs. per square inch.
The pump was delivering 306 gallons per working stroke.
The card may be explained as follows:—
Compression of charge from *a* to *b*.
Explosion from *b* to *c*.
Expansion from *c* to *d*.
Taking in water and scavenging air and partly exhausting, *d* to *e*.
Return stroke completing exhaust till valve shuts, *e* to *f*.
Cushioning, *f* to *g*.
Cushion expansion, *g* to *h*.
Intake of new charge, *h* to *j*.
Next compression of charge, *j* to *k*.

The stiff spring used does not permit the suction to be shown on this card, but the partial vacuum at the end of cushion expansion may momentarily be as much as 4 lbs. per square inch, and the water suction may at first be equal to 2 ft. or 3 ft. of water, both dying down to atmospheric pressure during the respective strokes.

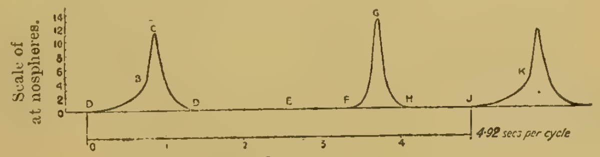


FIG. 6.

If one thinks of the reciprocating column of water as representing the pendulum of a clock it is easy to appreciate the fact that the length of the column governs the period of the swing, and if one assumes other things to be equal, and the column to be of uniform section, then the period is almost inversely proportional to the square root of the length. Mr. H. M. Martin, the clever assistant editor of *Engineering*, has worked out a number of examples illustrating the effect of the length of the discharge pipe under a given set of conditions, and his results are here produced from *Engineering* of 11th February, 1910:—

Diameter of play pipe, two feet.
Maximum velocity of flow permitted, 14 feet per second.

Length of pipe, feet	25	50	100	200
Cycles per minute	61	31	14 3	7·0
Discharge, cubic feet per minute	527	486	447	417
Efficiency $\frac{\text{P.H.P.}}{\text{I.H.P.}}$	0·98	0·95	0·91	0·82

Evidently, for a simple type of pump taking in its charge at atmospheric pressure, the first and last columns do not represent practical conditions, the cycles being too rapid in the first and too slow in the last, the two middle columns are possible cases, and a length of 60 ft. to 80 ft. is generally found advisable. The maximum velocity chosen is merely an example and may be exceeded.

The author has dealt at some length with the four-cycle pump, because its construction is exceedingly simple, and it is the key to all the others. Moreover, its reliability has been amply proved, and its elasticity in meeting changes of lift without altering the mixture of gas and air or the clearance volume has been demonstrated. The four unequal strokes which result from the free oscillations of the water column give rise to a cycle which is superior to the Otto cycle, and is in fact the theoretically-perfect heat cycle described in text books. On the subject of heat efficiency more will be said later, but we must now pay a little attention to mechanical details.

(*To be continued.*)

GERMANY'S REMARKABLE NEW ARMOURED CRUISER.

Germany's new armoured cruiser, the Von der Tann, has excited much interest, both on account of the secrecy which has been observed concerning her and the various armaments with which she has been credited, and also from the fact that she is Germany's first attempt at what is known as a "Dreadnought cruiser." The Von der Tann belongs to the same year's programme as the Rheinland and Posen, and she was laid down in October, 1907, by Messrs. Blohm and Voss, at Hamburg. Her length (560 ft.) makes her by far the longest ship in the German Navy, and 65 ft. longer than the cruiser Blucher. The Von der Tann has a breadth of 87 ft., and a draught of 26 ft. 7 in., and her displacement of 19,000 tons exceeds that of the battleships of the Nassau class by several hundred tons. She is fitted with Parsons turbines, driving four screws, capable of developing 70,000 shaft horse-power. The boilers are of the Schulz-Thornycroft type, as fitted to German warships. For ordinary purposes the amount of coal carried is 1,000 tons, although there is a bunker capacity of 2,800 tons. The armament consists of eight 11-in. guns, 10 5·9-in., and 16 24-pounder guns, with six submarine torpedo tubes. The ammunition is kept in one central armoured compartment. The principle of having clear decks has been carried out as far as possible, and besides masts and funnel uptakes there is little on the decks in addition to the turrets. The first turret is on the middle line forward, and the second further aft on the starboard side, the third still further aft on the port side, and the fourth in the middle line abaft. The two side turrets can fire ahead and astern. All eight guns fire on either broadside, and six ahead or astern. Nothing is known definitely as to the exact thickness of the Von der Tann armour. The total cost of the vessel is stated to be approximately £1,835,000. In view of the naval programmes of several of the South American republics, and of the favourable impression which will be created by the arrival at Rio de Janeiro of the two Brazilian Dreadnoughts—Minas Geraes, recently built at Elswick, and the Sao Paulo, lately built at Barrow-in-Furness—the German Government have decided that upon the conclusion of the official trials of the Von der Tann this battleship will shortly leave for an extended cruise in Central and South American waters, and visit not only Rio de Janeiro, Buenos Ayres, Bahia Blanca, but, proceeding round by Cape Horn, calls will be made at Valparaiso, Callao, and other places on the west coast of Central and South America. By way of comparison, it might be stated that the Minas Geraes and Sao Paulo have each a length over all of 543 ft., a breadth (moulded) of 83 ft., a depth (moulded) of 42 ft. 3 in., a draught of 25 ft., a displacement of 19,280 tons, and a total bunker capacity of 2,360 tons.

ELECTRICAL ENGINEERING.

Mr. J. S. Peck, in his inaugural address as chairman of the Manchester section of the Institution of Electrical Engineers, took as his subject the progress of electrical engineering in the United States of America. He said he was struck by the enormous amount of standardisation going on in the electric workshops of America, and by the fact that in the region of electric traction railway motors were becoming a more important item of manufacture than tramway machinery. There was a constant tendency to increase the size of tramcars and to "scrap" the old types; and as an instance of the development of tramways, he mentioned a journey outside Pittsburg in which thirty miles are covered in thirty minutes for a fare of fivepence. He went on to describe the extension of high-tension transmission lines. The Ontario Power Company, he said, transmitted power at 60,000 volts, and an electrical engineer was looking forward with confidence to the early possibility of transmitting electric current at 200,000 volts. Much less trouble had been experienced with these high-tension lines than had been expected. It had been discovered that steel towers were the best for the lines, and that they should be flexible in the direction of the line, with great rigidity to lateral stress, so that if the line broke the strain might be taken by two or three of the towers bending away from the region of the break.

In the manufacture of turbo generators the tendency in America was towards higher speeds, and it was noticeable that in direct-current turbo generators much less progress had been made there than in England. It was difficult for American engineers to understand the conditions in England. An American electrical engineer had asked him why there had not been more electrification of the railways here, and he explained that some locomotives here had been giving good service for forty years, and that difficulties often occurred in connection with building a permanent way over private land. The American could hardly realise the difficulty, and asked, "Why don't you build the road first and get permission afterwards?"

Referring to the position of technical education in America, he said there were more graduates in technical subjects from one college there than from all the English universities put together. He explained that there was far less difficulty in a graduate's obtaining a position on the staff of a manufacturing firm than in England. The members of a whole class often had positions offered to them before they left the university, and Mr. Peck mentioned an instance of a telephone company which allotted positions to a whole group of university students at salaries of £12 a month. The students were often useful to the manufacturing companies after they had gone. During their stay with the company they became familiar with the products of the works, and as they came to occupy important positions elsewhere their acquaintance with those products proved very profitable to the company. It was not only in America that technical education was better than in England. Germany held such a lead that she was the centre of technical education for the whole of Europe, and there was no doubt that the profit American firms received through students was also enjoyed by Germans, for engineers trained in Germany never forgot the German products.

LAUNCHES AND TRIAL TRIPS.

Harpalion.—On the 10th inst. the handsome steel screw steamer Harpalion, built by Messrs. Wm. Gray and Co. Ltd., to the order of Messrs. J. and C. Harrison Ltd., London, was taken to sea for her trial trip. The Harpalion has been built to Lloyd's highest class, and is of the following dimensions, viz.: Length overall, 441 ft.; breadth, 53 ft. 6 in.; and depth, 31 ft. 8 in.; with two decks laid, extra long bridge, poop, and top-gallant forecastle. The hull is built with deep frames and holds quite clear of all obstructions, cellular double bottom, and large aft and fore peak ballast tanks, ten steam winches, return exhaust pipes and winch condenser, steam steering gear amidships, hand screw gear aft, two masts with telescopic top masts, derrick tables, outriggers, and 18 derricks; also Porter's patent derrick sockets for dealing with heavy lifts, patent direct steam windlass, fresh-water distiller, shifting boards, trunks, and feeders for bulk grain cargoes, stockless anchors, steel lift boats, ice house, ventilation for the Eastern trade, electric lighting, and all the requirements of a first-class cargo steamer. The machinery has been supplied by the Central Marine Engine Works of the builders. The main propelling engines are of the triple-expansion type, with cylinders 28 in., 45 in., and 75 in. diameter, and a piston stroke of 51 in. A leading feature in the design is the very large port openings in the cylinders to ensure an easy passage of the steam and so obtain the maximum efficiency from it. The main condenser has also been designed to maintain a high vacuum in all seas, whilst special attention has been given to ensure a high temperature in the boiler feed water. During the trial a vacuum of 28 in. of mercury was maintained. Steam is generated in four large steel boilers, of the builders' well-known "flanged shell" type, at a pressure of 180 lb. per square inch, which, in conjunction with Howden's system of forced draught, will enable the vessel to maintain a speed of about 11 knots per hour at sea. The engine room auxiliaries are very complete, and include a number of duplex pumps of the builders' "C.M.E.W." type, and also one of their large atmospheric type winch condensers. Special attention has been paid in the design and construction of the vessel and machinery to ensure the utmost economy in fuel and upkeep. With this in view the vessel has been built with fine lines, and a bronze propeller has been fitted, which with the special features named above will enable the maximum amount of cargo to be carried at a fair average speed on a very low consumption of coal.

Messrs. Wm. Simons and Co. Ltd., of Renfrew, launched from their yard on the 7th November, complete and ready for work, a powerful twin-screw bow-well barge-loading bucket dredger, which they have constructed to the order of the Canadian Government, and which has been under Lloyd's rules for their A1 steel dredger class. The dredger is fitted with two sets of compound surface condensing engines, each driving its own propeller, steam being supplied by two steel multitubular boilers constructed to Lloyd's requirements for 120 lbs. working pressure. Suitable clutches are provided for engaging to and from the propelling and dredging machinery. The dredging wheel gearing is of very strong and massive construction. Each set of engines is arranged to give two speeds of buckets, so that either set of engines is available for driving the dredging gear irrespective of whether the material is of a hard or soft nature, a constant piston speed being always maintained. The bucket ladder, which is constructed of the best form of girder work in accordance with the builders' latest practice, is designed for dredging her own flotation and to a depth of 50 ft. below water level. The bucket-dredging capacity will be from 1,000 to 1,200 tons per hour. Steam hoist gear fitted with the builders' friction arrangement is provided for controlling the bucket ladder. The engine room fittings include all the latest appliances for a vessel of this type. The vessel is fitted with a complete electric light installation, including searchlight at bow, so that the vessel can work day and night. Refrigerating plant for cold storage is also fitted up on board.

NOTICES OF MEETINGS, &c.

November 18th.—The Institution of Mechanical Engineers. General Meeting at 8 p.m., to be held in the Institute House, Storey's Gate, St. James's Park, Westminster, S.W. A paper will be read and discussed on "The Development of Road Locomotives in Recent Years," by Mr. L. A. Legros.

Institute of Marine Engineers. Bohemian Concert.

The Institution of Electrical Engineers (Glasgow Local Section) Meeting of the student's section at the Glasgow Technical College, at 8 p m.

November 19th.—Engineering and Scientific Associaton of Ireland. Visit to Belfast.

Leicester Association of Engineers. A paper will be read on "The Water Supply of Hinckley," by Mr. E. H. Crump, A.M.Inst.Mech.E.

The Birmingham Association of Mechanical Engineers. Ladies' Night.

November 21st.—Engineering and Scientific Association of Ireland. Meeting to be held in the Physics Theatre of the Royal College of Science, St. Stephen's Green, at 7-45 p.m. "The Weathering of Coal," by John Holliday, M.I.M.E.

Institute of Marine Engineers.—Meeting at 58, Romford Road, Stratford, London, E. Paper on "Indicator Diagrams," by Mr. W. G. Winterburn.

The Society of Engineers.—Mr. L. W. J. Costello, M.A., L.L.B. (Cantab.), will deliver his 4th lecture on "The Law and Its Relation to Engineering," at Caxton Hall, Westminster, at 7-30 p.m.

November 22nd.—The British Foundrymen's Association: Sheffield Branch.—Meeting to be held at the Literary and Philosophical Society Rooms, Church Street, Sheffield, at 7-30 pm. Paper on "The Growth of Cast Irons after Repeated Heatings," by Prof. H. C. H. Carpenter, M.A., Ph.D., Manchester.

Manchester Local Section of the Institution of Electrical Engineers.—Meeting at the Physical Laboratory of the University of Manchester, at 7-30 p.m. "The Conditions affecting the Life of Electrical Machinery," by A. B. Mallinson, A.M.I.E.E.

November 24th.—The Institute of Electrical Engineers. Meeting to be held at 8 o'clock.

Institution of Civil Engineers (Association of the Birmingham Students). Meeting at the Lecture Theatre, Birmingham University, Edmund Street, Birmingham. "The Development of Canal Engineering," by H. W. Jelf-Reveley, Stud.Inst.C.E.

November 25th.—North-East Coast Institution of Engineers and Shipbuilders.—General Meeting.

Coventry Engineering Society. Paper on "Electricity Applied to Mining," by Mr. C. F. Jackson.

November 26th.—The British Foundrymen's Association: Birmingham Branch. Meeting to be held in the Technical School, Suffolk Street, Birmingham, at 7 p.m. "Blowers and Fans for Cupola Purposes." (*a*) "Blowers," by Mr. Arthur D. Ellis; (*b*) "Fans," by Mr. Cleworth.

Association of Engineers-in-Charge. Social and Dance.

The Institution of Civil Engineers (Association of the Birmingham Students). Visit and Demonstration, Engineering Department, Birmingham University.

The Manchester Association of Engineers. A paper will be read by Mr. S. H. Rowley, on "Involute Cut-gearing, and Methods of Producing Same."

TRADE NOTES.

Messrs. Henderson have received an order to build a 9,000 tons steamer for Gow, Harrison, and Co.

Messrs. Russell and Co., of Port Glasgow, have received an order for a steamer of 10,000 tons for the Prentice, Service, and Harrison Co.

We are informed that **Messrs. Wm. Simons and Co. Ltd.,** Renfrew, have been awarded "grand prix" for their exhibit of dredge plant at the Railway and Transports Exhibition in Buenos Ayres.

Exhibition at Great Yarmouth.—One or two of the firms which are showing marine oil engines at the Yarmouth exhibition report that the prospects of business are promising, and **Messrs. Norris and Henty** are said to have booked an order for Gardner engines for a Cockenzie drifter of the same type as Harmonious and Boy's Own.

Messrs. Alex. Turnbull and Co. Ltd., of St. Mungo Works, Bishopbriggs, Glasgow, inform us they have recently heard that a report is being put round that they are not now making the Harrison steering gears. This is wholly untrue. Messrs. Turnbull have in hand at present quite a number of Harrison steering gear for steamers being built for leading shipping lines.

Electric Tramway and Railway Station Material.—The British Acting Commercial Attaché at Yokohama reports that the Japanese Railway Board have decided to lay down a narrow gauge electric tramway alongside the railway track from Yokohama to Tokio. This tramway may subsequently be extended to Kozu and Kamakura. It is intended also to build a railway passenger station at Takashima-cho, between Hiranuma and Kanagawa stations, and to use the present Yokohama station for goods only.—*Board of Trade Journal.*

Railway Plant Contracts for India.—The East Indian Railway Co., who operate 2,477 miles of track, have recently placed several large contracts for steel rails and permanent way material required in connection with proposed extensions and also for renewal purposes. One has been given out to Messrs. Dorman, Long, and Co. Ltd., of the Britannia Works, Middlesbrough, for the supply of 118,738 pairs of steel fish plates; another to Messrs. Guest, Keen, and Nettlefolds Ltd., of Birmingham, for 300,000 cone-headed dogspikes for timber sleepers and 50,000 steel fish bolts with nuts; whilst a third order—for the supply of a large quantity of helical and volute springs—has gone to Messrs. Cammell, Laird, and Co. Ltd., of the Cyclops Works, Sheffield.

Messrs. Hans Renold Ltd. inform us that they have opened an office in Kingsway House, Kingsway, London, W.C. It will be managed by Mr. Charles E. Holliday, M.I.M.E., who has held a leading position with the firm in Manchester for many years. At present the London office will deal particularly with matters requiring personal attention, but ordinary inquiries and correspondence should be addressed to Manchester as hitherto.

Pumping Machinery at the Belfast Dry Dock.—The pumping machinery for the new dry dock at Belfast has been made by **Messrs. Barclay, Sons, and Co.,** Caledonia Works, Kilmarnock. The pumping installation consists of three sets of compound non-condensing marine type engines, with cylinders 22 in. and 38 in. diameter by a stroke of 20 in., and working at a pressure of 120 lbs. per square inch. Three sets of centrifugal pumps are coupled direct to these engines, with impellers 7 ft. 5 in., and discharge pipes 54 in. in diameter. The total capacity of the dock is 21,000,000 gallons, and the three sets of engines are designed to discharge the whole of this water in 100 minutes.

We are informed that **Messrs. E. G. Appleby and Co.** are at present installing a number of "Kerpely" gas producers at the works of Messrs. John Summers and Sons, of Shotton, and at those of Messrs. The Shelton Iron, Steel, and Coal Co., Stoke-on-Trent. Messrs. Appleby have also other important contracts for these gas producers pending.

Railway Construction.—The *Diario Official* (Brazil) contains two decrees, approving the plans submitted on behalf of the Goyaz Railway Co. ("Companhia Estrada de Ferro de Goyaz") for the construction of (1) a section of line, 32 miles long, from Uberaba in the direction of Pedro de Alcantara, and (2) a section, 30 miles long, from Formiga to Goyaz. The cost of construction of the two sections is put at 10,367,337 milreis (about £720,000). The same journal also publishes a decree approving the plans submitted on behalf of the Sao Paulo-Rio Grande Railway Co. ("Companhia Estrada de Ferro Sao Paulo-Rio Grande") for the construction of another 45 miles of the S. Francisco section of the company's line, viz., between the River Negrinho and the River Negro. The cost of the work is estimated at 5,381,276 milreis (about £370,000).—*Board of Trade Journal.*

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2282. **Safety Valve Design.**—Will any reader give the main points to take into consideration in safety valve design? How is the area of the valve determined? Also outline the design of a spiral spring type valve for a 6 ft. Lancashire boiler, 150 lbs. pressure.—K. T.

2286. **Conical Steel Tubes.**—Could any reader inform me where I could obtain conical-shaped steel pipes as follows: Inside from 6 in. to 14 in. diameter, $\frac{3}{8}$ in. thick, with flanges 12 in. and 18 in. diameter; length of pipe, flange to flange, 12 in.?—A READER OF YOUR PAPER.

2287. **Balance Ring Slide Valves.**—I should be glad if some reader would explain the nature, object, and applications of balance ring slide valves; what are the advantages and disadvantages of same, and how far are they used?—M. T.

2288. **Ornamental Hammer Work.**—Information is wanted as to the best sort of material to use when making ornamental scrolls, names, letterings, etc, for what is called ornamental hammer work—that is, the best substance or composition to hammer upon.—PERTH.

2289. **Heating Steam Tank.**—Will some reader give me a rule by which I can determine the final temperature assumed by a steam heated water tank (naked steam) into which I feed steam, and from which I draw water at a uniform rate? Express general result in terms of steam used.—TANK.

2290. **Diesel Engines for Power Stations and Ships.**—Will one of your readers please consider the advantages and disadvantages of engines of the Diesel type; state the sizes in which these can be made, and give results of tests on same; in particular, deal with the use of such engines for generating electrical energy? Is there any probability of such engines being used for marine propulsion, and, if so, on what kind of ship?—COALER.

2291. **High-pressure Water.**—Will some experienced reader give me detailed information concerning the cost of high-pressure water and its value as a source of power? What are the average efficiencies and plant factors of various hydraulic engines?—HYDRIC.

MISCELLANEA.

PUMPS FOR CHINGFORD RESERVOIR.—The Metropolitan Water Board passed a resolution recently accepting the recommendation of their Works Committee to provide a battery of Humphrey gas pumps for the reservoir now being constructed in the Lea Valley.

MARINE ENGINEERS' DINNER.—The twentieth annual dinner of the Institute of Marine Engineers took place in the King's Hall, Holborn Restaurant. Sir David Gill, K.C.B., president of the institute, presided, and among the guests were a number of well-known gentlemen.

A VERY rapid passage to Calcutta has just been made by the Ellerman City liner City of Paris, which left Liverpool on October 13th and arrived at Calcutta on the 5th inst., thus having made the voyage in less than 23 days. This is a record for the run from Liverpool to Calcutta.

THE November issue of the "I.C. Student" is interesting as containing illustrations of drawings sent in for competition by students. Other articles comprise an appreciative notice on architectural education, a student's monoplane, besides others of value to present and prospective students. The price is 2d., and copies can be had at Kingsway.

A BRIDGE built of concrete, recently completed near Lyons, France, has molten zinc instead of cement employed to join the stones of two elliptical arches, the span of which is 82 ft. Molten zinc at 800 deg. Fah. causes no fracture in dry stones, so metallic joints have been formed of $\frac{1}{2}$ in. thick. The increase in cost is about 10s. per square foot of the bridge's horizontal surface.

THE production of tinplates and terne plates for 1909 in the United States is placed at 612,951 tons, as compared with 537,087 tons for 1908. This is an increase of 75,864 tons. Of the total in 1909, 527,714 tons were tinplates, as against 468,297 tons in 1908, being an increase of 59,417 tons, and 85,236 tons were terne plates, as compared with 68,829 tons in 1908, an increase of 16,407 tons. Besides tin and terne plates, pure lead-coated and aluminium-coated steel sheets for special roofing purposes were produced in both 1908 and 1909 in small quantities. There were 45 plants in use in 1909, and 11 not in use.

ROAD ROLLER FALLS OVER A SEA WALL.—A 10-ton steam road roller belonging to the burgh of Oban fell over the breastwall into the sea near the north pier recently. The roller had been working in Stafford Street, and had been standing at the corner where George Street intersects, and where there is an open space with a considerable slope towards the sea wall. The engineman was off the engine oiling some part of the works when the roller started backwards down the slope. He jumped on to try and stop it, but was unable to do so, and had just time to jump off when the roller went over the sea wall, and had one of his legs broken in two places when jumping off. The roller was badly damaged.

INSTITUTION OF ELECTRICAL ENGINEERS.—A meeting of the Birmingham local section of this institution was held on the 16th November, when an inaugural address was delivered by the chairman, Mr. W. J. Railing. The speaker took for his subject the welfare of our industries, and through them that of the profession of electrical engineering. During the course of the address the speaker observed that he had referred to the welfare of electrical engineering, and he thought the most optimistic member of his audience must needs agree that all is not "well" with our industry and our profession. All of us, in whatever branch of engineering we may be, whether scientists, consultants, station engineers, or those connected with the manufacturing industry, cannot help admitting that our position is not what it ought to be.

THE INSTITUTION OF CIVIL ENGINEERS.—At the ordinary meeting on Tuesday, the 8th Novemebr, Mr. Alexander Siemens, president, in the chair, the paper read was "The London County Council Holborn to Strand Improvement and Tramway Subway," by G. W. Humphreys, M.Inst.C.E. The following is a short abstract of the paper: The subject of the paper is the carrying out of the largest scheme of street improvement ever effected in London, having as its result the establishment of through communication between north and south London, the removal of one cause of congestion of traffic passing from east to west, and the purging of the insanitary areas lying in a portion of central London. The magnitude of the undertaking may be judged by the fact that the gross cost is approximately £6,078,324, of which £385,041 was for works, which were executed well within the limit of the estimates of the Council's officers. Tables in an appendix to the paper give details of the cost of the acquisition of properties and the execution of works, with particulars of cost of some of the more important items of the latter.

COAL-MINING MACHINERY.—At the opening meeting of the present session of the Institute of Electrical Engineers (Glasgow local section) Mr. Sam Mavor, chairman of the section, presided, and delivered his inaugural address. Mr. Mavor, whose subject was "Power Equipment of Collieries," said it was surprising that so much attention and capital had been devoted to the general equipment of modern collieries while so little relatively had been expended upon direct attack on the coal by mechanical appliances in view of the immense interests concerned and of the arduous character of the manual operation of hewing. It was singular that coal mining—one of the most ancient and important of our industries—should be the last to avail itself of the aid of machinery in its primary process. The introduction of the Longwall coal cutters, however, marked the beginning of a revolution in the practice of mining in this country, and it was satisfactory to note that in the manufacture and use of Longwall cutters this country was so far ahead of foreign competition that we are alone in the field. Machine mining had, he said, particular interest to Scotland, for there coal was mined under conditions much less favourable than existed in most of the mining areas of England and Wales. The thicker seams, except in Fife, had been for the greater part exhausted, and in the thin seams the problem was to so reduce the cost of working that thin seam collieries might be able to hold their own in the coal-selling markets. Colliery managers in Scotland had also distinguished themselves by initiative and ingenuity in devising underground conveyers.

OSRAM·LAMPS

PATENTEES' CHRONICLE

OF

Applications for British Patents.

The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.*

NOVEMBER 7th, 1910.

25768 Spittoon. Fingerhurt.
25769 Cooking device. Thompson.
25770 Valve. Crowe.
25771 Ruler. Vaughan.
25772 Hatpin stand. Tomey.
25773 Small arms. Norman.
25774 Alarms. Oswald.
25775 Submarines. Crochart.
25776 Scoops. Flint.
25777 Boot uppers. Lees.
25778 Game. Dorman.
25779 Garment presses. Lilly.
25780 Baker's ovens. Clifford.
25781 *Game. King.
25782 Railway lock. Bohling.
25783 Gun. Jeffries.
25784 Vessels. Foulis.
25785 Carriage lock. Brownlow.
25786 Looms. Ward.
25787 Internal-combustion engine. Gillibrand.
25788 Yarn tension device. Sykes.
25789 Electric switch. Townley.
25790 Cycle forks. Davies.
25791 Textile fabric manf. Mycock.
25792 Wheels. Evans.
25793 Valves. Byron.
25794 Transport device. Mitchell.
25795 Checker. Gilmore.
25796 Storage cereals. Walpole.
25797 *Game. Ormston.
25798 *Game. Maclean.
25799 *Ships' hatch covering. Bisson.
25800 *Hydraulic apparatus. Frame.
25801 *Electric control. Baldwin.
25802 Spanners. Agard.
25803 Window securing. Rayner.
25804 *Nasal inhalers. Richards.
25805 *Spindle packing. Plane.
25806 Cotton presses. Shield.
25807 Cycle frames. Quarnström.
25808 Saws. Wethered.
25809 Clutch. Ionides.
25810 Valveless engine. James.
25811 *Shoe lasting. Bonney.
25812 Alarm device. Bridge.
25813 Gas manf. Southey.
25814 Postage machine. Barton.
25815 *Cleaning apparatus. Winans.
25816 Reflectors. Coles.
25817 *Pneumatic tube. Marks.
25818 *Transfer tube system. Marks.
25819 *Dispatch tube. Marks.
25820 *Flying machine. Reiche.
25821 *Reproducing device. Sextone.
25822 *Sign controlling. Huver.
25823 *Hardening stove. Green.
25824 *Engine control. Coggin.
25825 Gas mantles. Harrop.
25826 *Furnace. Delattre.
25827 *Gas producer. Delattre.
25828 *Cover for cushions. Aron.
25829 *Draw-off taps. Love.
25830 Engine. James.
25831 *Boilers. Laughton.
25832 *Envelopes. Bartlett.
25833 *Utilisation of tide. Quedens.
25834 *Concrete manf. Cohn.
25835 Bottle stoppers. Johnson.
25836 Sewing machine. Peter.
25837 *Seat. Bennett.
25838 *Guns.
25839 Squeegees. Bilhom.
25840 Railway vehicles, etc. Rowntree.
25841 Signs. Codd.
25842 Illuminated signs. Bailey.
25843 *Steam engine. Stumpf.
25844 *Casting ingots. Gathmann.
25845 *Vibration absorber. Prache.
25846 Fastening device. James.
25847 *Heel pads.
25848 *Dispenser appliance. Schloss.
25849 Gas fires. Carpenter.
25850 *Caoutchouc manf. Bayer.
25851 Targets. Bennett.
25852 Gearing. Armstrong.
25853 Asbestos packing. Mancha.
25854 *Air gas production. Joseph.
25855 Woodworker. Waring.
25856 Boiler tube cleaner. Campbell.
25857 Hoists. Campbell.
25858 Horns. Tate.
25859 *Diving apparatus. Blaubach.
25860 Spring suspension for vehicles. Searle.
25861 Pumps. Vail.
25862 Washing granular material. Corbett
25863 *Fly wheel. Heine.
25864 *Trolley replacers. Buck.
25865 *Door closer. Tietze.
25866 Pumps. Blair.
25867 *Stencilling pots. Ardizone.
25868 Cutting machine. Shaw.
25869 Animated pictures. Bjerregaard.
25870 Colour printing. Bendixson.
25871 Amusement device. Rexworthy.
25872 *Manf. of anhydrous hydrosulphites.
25873 Compounds. Wellcome.
25874 Wheels. Webb.
25875 Lay figures. Edwards
25876 *Fuel burners. Field.
25877 Signs. Thomas.
25878 *Stamp cancelling. Haddan.
25879 *Gas cells. Braun.
25880 *Kneading machine. Schrieber.
25881 Sledge. Hieber.
25882 *Water purification. Heuri.
25883 *Water purification. Henri.
25884 Air whistles. Jensen.

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25885 Flushing apparatus. Downes.
25886 Quartz manf. Burckhardt.
25887 Quartz manf. Burckhardt.
25888 Vehicle spring mountings. Gilbert.
25889 Scribing blocks. Grant.
25890 Oil, etc., engines. Laybourne.
25891 Kitchen ranges. Pullan.
25892 Ovens. Horlington.
25893 Clutch. Aeltree.
25894 Cycle frame. Robb.
25895 Cleaning device. Smyth.
25896 Furnace. Porter.
25897 Lampholder. Copland.
25898 Valves. Cummins.
25899 *Brackets. Richardson.
25900 Boots. Wurfel.
25901 Hoisting machinery. London.
25902 Toy. Chapman.
25903 *Trimming mechanism. Michener.
25904 Evaporators. Bartram.
25905 Food. Triany.
25906 Time switch. McCaffey.
25907 Internal-combustion engine. Ghee.
25908 Cycle cranks. Turner.
25909 Amusement. Coombs.
25910 Brake. Toyn.
25911 Trousers' protectors. Hall.
25912 Internal-combustion engine. Steel.
25913 Advertising device. Hoorn.
25914 Hat clip. Williams.
25915 Printing plates. Swan.
25916 Coin counters. Burdick.
25917 Vapour baths. Fleming.
25918 Gun. Shaw.
25919 Rubber protectors. Fullaway.
25920 Belt shifter. Kenyon.
25921 Ear ornament. Adams.
25922 Closet seats. Crook.
25923 *Electric switch. Hope.
25924 Signalling device. Sunpar.
25925 Looms. Jones.
25926 Bottle stopper. Bushby.
25927 Looms. Bolsworth.
25928 Wind screen joint. Chandley.
25929 Lubricating cans. Fearnhead.
25930 Loose-leaf books. McLaren.
25931 Fire damp detecting. Guy.
25932 Yarn manf. Jackson.
25933 Presses. Warren.
25934 Cycle stand. Feeny.
25935 Window. Bastow.
25936 Game. Strudwick.
25937 Tobacco pipe.. Mawson.
25938 *Shuttle. Schoenfeld.
25939 *Twisting machine. Hiller.
25940 *Rock drill. Waugh.
25941 *Window casement. Weston.
25942 Lamp. Anderson.
25943 Gas meter. Bennett.
25944 Hinge. Vigo.
25945 Sewing machine. Pepperling.
25946 Veil clip. Green.
25947 *Gripping device. Vietor.
25948 *Advertising device. Lyon.
25949 Clothes-drying rack. Baggs.
25950 *Match box. Brazill.
25951 Alarm apparatus. Franke.
25952 Scale case. Kunczi.
25953 *Mowing machine. Damm.
25954 *Spark extinguisher. Riefstahl.
25955 Laundry irons. Glover.
25956 Air cooler. Booley.
25957 Production of discharge effect on fibre. Johnson.
25958 Production of discharge effect on fibre. Johnson.
25859 Nickel-lined articles. Johnson.
25960 Nut locks. Reid.
25961 Electric lamps. Meszaros.
25962 *Mining machine. Lake.
25963 Riding exerciser. Altman.
25964 *Speed regulating of motors. Siemens..
25965 Telephone head piece. Grant.
25966 *Piston rod packing. Copeland.
25967 *Acetylene tetra-chloride.
25968 *Putty manf. Ljungdahl.
25969 *Iron manf. Pfanhauser.
25970 *Neckties Mitchell.
25971 Curtain rods. Johnson.
25972 Dynamo. Leitner.
25973 *Concrete floors. Kelp.
25974 *Mining machine. Lake.
25975 Electric switch. Jones.
25976 Thermopiles. Giglio.
25977 *Measuring device. Antonioli.
25978 Forceps. Fowler.
25979 Curtain suspender. Depledge.
25980 Double lift jacquards. Hardaker.
25981 Glass windows, etc. Salmons.
25982 Couplings. Thorn.
25983 Pipe couplings. Thorn.
25984 Kitchen ranges. Woodhouse.
25985 *Syringe construction. Millingan.
25986 *Silk manf. Guadagni.
25987 Mining machine. Lake.
25988 *Looms. Sohn.
25989 *Gyrsocopic compasses. Anschutz.
25990 *Treatment of hides. Simeon.
25991 Lamps. Rutter.
25992 Indicating instrument. North.
25993 *Glazing device. Ziegler.
25994 *Driving belt. Pollin.
25995 Sped gear. Hooke.
25996 Lamps. Russell.

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25997 Seats. Fletcher.
25998 Stocking toe protector. Black.
25999 Conveyor. Bennis.
26000 Spinning device. Smith.
26001 Mops, etc. Lester.
26002 Refrigeration chamber. Webb.
26003 Ladies' combinations. Higgs.
26004 Table. McPetrie.
26005 Lawn cutters. Main.
26006 Studs. Griffith.
26007 Spinning machines. Miller.
26008 Pistons. Spence.
26009 Electric switch. Railing.
26010 Synchronising apparatus. Law.
26011 Piano player. Cornford.
26012 Fibrous material drying. Hey.
26013 Gas meter. Orme.
26014 Hose coupling. Muskett.
26015 Internal-combustion engine. Ashworth.
26016 Side car attachment. Tomson.
26017 Cycle forks. Silver.
26018 Wheels. Crawley.
26019 Game. Jameson.
26020 Hat securing device. Follows.
26021 Road construction. Robinson.
26022 Control gear. Scholefield.
26023 Ceramic material treatment. Podmore.
26024 Saline. Carmichael.

26025 *Pivot. Parkes.
26026 Back rest. Lewis.
26027 Aeroplane. Hayes.
26028 Turbine. Maurice.
26029 Cutting arch bricks. Hulbert.
26030 *Pumps. Heys.
26031 Fly proof latrine. Muirhead.
26032 Motor car bodies. Salmons.
26033 Internal-combustion engine. Lloyd.
26034 Motor cycle. Lloyd.
26035 *Looms. Peck.
26036 Ships' bottoms. Beresford.
26037 Looms. Kay.
26038 Advertising device. Thickbroom.
26039 *Shaping machine. Melloy.
26040 Carburetters. Bainbridge.
26041 *Motor cycle side cars. Fulford.
26042 *Toy. Klann.
26043 *Embroidering machine. Schoenfeld.
26044 *Typewriters. Klaczko.
26045 *Incandescent bodies. Krannichfeldt.
26046 *Formaldehyde manf. Blank.
26047 *Perfume grease.
26048 Cigarette packets. Joy.
26049 Brake blocks. Brown.
26050 Brake blocks. Brown.
26051 Game. Slater.
26052 Letter box. Slater.
26053 Vacuum cleaner. Genzel.
26054 Tie holder. Bernard.
26055 Hinge securing device. Wedderburn.
26056 Ladies' hat securing. Roberts.
26057 Amusement device. Holz.
26058 Gas producer. Armstrong.
26059 Aeroplanes. Short.
26060 Submarine sounds. Gwilym.
26061 *Pumps. Stones.
26062 Tobacco cartridge. Oldcorn.
26063 Oxygen generator. Budai.
26064 *Process of pasteurisation. Wojik.
26065 Potato planting. Wieghard.
26066 Cleaning tramway lines, etc. Lauschke.
26067 *Kite. Mobins.
26068 *Locking nuts and bolts. Zenker.
26069 Aeroplanes. Cox.
26070 *Milk cooling. Heyman.
26071 Guns. Johnstone.
26072 Gas producer. Bickerton.
26073 *Toys. Adler.
26074 *Blow pipe. Dissons.
26075 Ticket printing. Giepel.
26076 *Game. Roch.
26077 Electric terminals. Muirhead.
26078 Letter file. Taylor.
26079 *Telephone exchange.
26080 Lawn sprinkler. Burridge.
26081 Carburetters. Kenouf.
26082 Coin freed mechanism. Mason.
26083 Aeroplanes. Thornton.
26084 Tooth brushes. Dotesio.
26085 *Forming parallel forces. Goldschmidt.
26086 Boot manf. Boult.
26087 *Coin counter. Maschanka.
26088 Sock manf. Roberts.
26089 Feeding bottle teats. Ingram.
26090 Feeding bottle teats. Ingram.
26091 Steam traps. Burby.
26092 Potato digger. Mitchell.
26093 Artificial rubber manf. Turns.
26094 *Water softening.
26095 *Carburetter. Carter.
26096 *Carburetter. Carter.
26097 *Pumps. Axien.
26098 *Eliminating vibration in ships. Stettiner.
26099 *Motors. Broc.
26100 Tubular bells. Synge.
26101 Tyre covers. Brown.
26102 Lamps. Inrig.
26103 Electric regulator. Inrig.
26104 Aerial navigation. Mitchell.
26105 *Submarine dress. Kermode.
26106 *Rescue apparatus. Kermode.
26107 *Cooking vessels. Zyoset.
26108 *Internal-combustion engine. Kiesel.
26109 Gas mantle manf. Weldon.
26110 *Strengthening buildings. Zeiller.
26111 Building blocks. Greenwood.
26112 Knife cleaner. Hesketh.
26113 Internal-combustion engine. Charley.
26114 *Pumps. Thompson.
26115 Treatng iron ore. Stockmann.
26116 *Pumps. Snee.
26117 *Chairs. Cambier.
26118 *Internal-combustion engine. Hudson.
26119 Electric motor. Gray.
26120 *Electric heater. B. T.-H. Co.
26121 *Measuring instrument. Gerdes.
26122 *Looms. Elmendorf.
26123 Piano player. Lanchester.

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26124 Electric cable conductor. Doel.
26125 Swing gates. Emery.
26126 Suppling measured quantities. Hughes.
26127 *Carpet dust extractor. Kirby.
26128 Salt distributing device. Green.
26129 Releasing gear. Stubbs.
26130 String cutters. Taylor.
26131 *Cattle food manf. White.
26132 Drying fabrics. Knecht.
26133 Grass cutters. Park.
26134 Process for dessicating air. Mackenzie.
26135 Aeroplane. Holt.
26136 Feeding bees. Peirce.
26137 Cattle food manf. White.
26138 Time indicator. Hame.
26139 Sparking plug. Wiles.
26140 Propeller. Bowie.
26141 Wash tub stands. Simpson.
26142 Enamelling wire. Coster.
26143 Looms. White.
26144 Sewing machine shutter. Green.
26145 Wheels. Challiner.
26146 Internal-combustion engine. Wansbrough.
26147 Vehicle wheels. Everard.
26148 Polishing, etc., metal sheet. Hentschel.
26149 Cycle forks. Warren.
26150 Tip-up seat. Stephany.
26151 Hat fastener. Hazell.
26152 Puncture proof bands. Day.
26153 Billiard marking device. Cole.
26154 Distributing fertilisers, etc. Chafer.
26155 Mudguard flaps. Birt.
26156 Gas, etc., compressing. Howard.
25157 *Steam regenerator. Hodgkinson.
26158 Talking machine. Reddie.
26159 Cornice, etc., poles. Shettle.
26160 Relating to golf. Whitehouse.
26161 Lamps, etc. Wright.
26162 Animal feeders. Adamson.
26163 Binding mechanism. Farrell.
26164 Briquette manf. Suske.
26165 Camera stand. Hoyer.
26166 Yarn reel. Beyreuther.
26167 Wearing apparel fastening. Palmer.
26168 *Gas analysis. Simmance.
26169 *Spinning machine. Mamloff.
26170 Lifting jacks. Dixon.
26171 *Cigarette manf. Brul.
26172 *Pumps. Scholz.
26173 *Caoutchouc producing plant. Pahl.
26174 *Play pipe pressure equaliser. Glazier.
26175 Game. Hallamore.
26176 Turbine. Formby.
26177 Pumps. Mackley.
26178 Wearing apparel. Cohen.
26179 Waterproof coats, etc. Cohen.
26180 *Impregnating paper. Dobber.
26181 Furniture. Chamberlain.
26182 Rotary engine. Hanbner.
26183 *Fire escape. Petersen.
26184 Piano player. Grimsdale.
26185 Purification of alkali metals. Ashcroft.
26186 Gas burners. Yates.
26187 *Electric generator. Breslauer.
26188 Rim brake. Barnes.
26189 Aeroplanes, etc. Fox.
26190 Moulding small blocks, etc. Downs.
26191 *Lighting, etc., device. Pintsch.
26192 *Motors. Pintsch.
26193 Attaché cases. Balch.
26194 Boot protector. Summers.
26195 Matches. Daniels.
26196 Boots, etc. Mayer.
26197 Flying machine. Barry.
26198 *Capstans, etc. Archer.
26199 *Belt fastener. Conn.
26200 *Line drawing. Meyer.
26201 Wheels. Hampson.
26202 Bottle. Shanks.
26203 Pumps. Bedell.
26204 Pumps. Friedricks.

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26205 Dog collar. Sharp.
26206 Spindles. Whipp.
26207 Looms. Crowther.
26208 Printing machine. Nicolle.
26209 Dye manf. Vanicek.
26210 Trouser shield. Holt.
26211 Table. Price.
26212 Arithmetical processes. Smith.
26213 Tyre valve cleaner. Girling.
26214 Cake tins. Biss.
26215 Printing machine. Wright.
26216 Carriage windows. Doobs.
26217 Curtain poles. Harrison.
26218 Time limit appliance. Statter.
26219 Looms. Taylor.
26220 Looms. Wareing.
26221 Advertising rolls. Era.
26222 Heel pads. Mercer.
26223 Safety lamps. Cremer.
26224 Internal-combustion engine. Williams.
26225 Armature winding. Brooks.
26226 Rugs. Petavel.
26227 Match delivery stand. Stewart.
26228 Window fastener. Woollard.
26229 Wheels. Alexander.
26230 Woven fabric. Andrew.
26231 *Filter presses. Jones.
26232 Lamp holder. Barnes.
26233 Invalids' beds. Austin.
26234 Furnace. Clayton.
26235 Elevators. Boaler.
26236 Substitute for bone. Mollart.
26237 Motor mascot. Fray.
26238 Acid proof label. Rice.
26239 Measuring device. Ryland.
26240 *Advertisement displaying device. Pirkis.
26241 Iron corrugated sheeting. Ray.
26242 Gas calorimeters. Simmance.
26243 *Wedge terriers. Dehl.
26244 Carburetters. Binks.
26245 Bookmarks. Brimfield.
26246 Back axles. Codd.
26247 Floor cloth fastenings. Sorembe.
26248 Electric switch. Kennedy.
26249 Dye manf. Newton.
26250 Internal-combustion engine. Suckling.
26251 Rotary machine.
26252 *Reversing gear. Dannemann.
26253 Friction clutch. Lamplough.
26254 Coke ovens. Jones.
26255 *Steam engine. Stumpf.
26256 Ladies' hat securing. Jelinek.
26257 Target. Spiegel.
26258 *Ball and socket joint. Bosch.
26259 *Printing plates.
26260 Metal strip manf. Strange.
26261 Brush manf. Grimand.
26262 Ore dressing. Holloway.
26263 Carriage coupling. Radford.
26264 Milk testing. Faitelowitz.
26265 Lamps. Pfizer.
26266 *Box. Robertson.
26267 Indicators. Hill.
26268 *Electrical device. Lange.
26269 Tyre. Jenkins.
26270 Valves. Walker.
26271 Turning device. Wallace.
26272 Tipping wagons. Bennis.
26273 Rail wagons, etc. Edwards.
26274 *Pipe coupling. Wilkins.
26275 Imitation metal. Lean.
26276 Mat securing. Golding.
26277 Boiler side flues, etc. Scholes.
26278 Prepayment mechanism. Mackay.
26279 Fish drying, etc. Phillips.
26280 *Boots, etc. Mitchell.
26281 *Door closer. Werner.
26282 Boot lace fastener. McAlpin.
26283 Ore treatment. Cassel.
26284 *Paint cleaning. Pire.
26285 Clutches. Griffin.
26286 Aeroplanes, etc. Westaway.
26287 Aeroplanes, etc. Westaway.
26288 Toy. Herring.
26289 *Type casting machine. Degener.
26290 Speed gear. Weller.
26291 Motor vehicles. Weller.
26292 Bedstead. Neyler.

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26293 Propellers. Harrison.
26294 Carburetter. Meredith.
26295 Grinding machine. Dronsfield.
26296 Hatpin sheath. Dick.
26297 Lamp. Haworth.
26298 Trousers presses. Farnsworth.
26299 Testing armour plate. Dixon.
26300 *Moving appliance. Holmes.
26301 Looms. Flintoff.
26302 Pumps. Shore.
26303 Buttons for upholstery. Birngruber.
26304 Petrol can. Roberts.
26305 Vessel closing, etc., device. Atkinson.
26306 Electrical transformer. Macfarlane.
26307 Internal-combustion engine. Turner
26308 Ticket holder. Rushton.
26309 Pipe coverings. Forrest.
26310 Doors. Colman.
26311 Spinning textile fabrics. Hincliffe.
26312 Carriage lighting. Seal.
26313 Disposal of sewage matter. Cordy.
26314 Crushing mills. Hague.
26315 Windows. Molloy.
26316 Gas rings. Downes.
26317 *Relating to photos. Zeiss.
26318 *Eyeglasses. Blume.
26319 Furnace smoke preventative. Stevenson.
26320 Game. Roger.
26321 Recording tachometers. Bachhoffner.
26322 Lubrication. Kay.
26323 Boot heels. Prebble.
26324 Bottling aerated water. Osborne.
26325 *Railway ties. Crossley.
26326 *Nailing machines. Boult.
26327 *Boot manf. Boult.
26328 *Animal marking device. Andrews.
26329 *Cure for rheumatism. Kanyo.
26330 *Camp furniture. Watson.
26331 Tyres. Thomas.
26332 *Rolling mills. Harrison.
26333 Electric alarm. Davy.
26334 *Explosives. Colaget.
26335 *Steel, etc., manf. Smith.
26336 New compounds. Newton.
26337 Electric heaters. Martin.
26338 *Lock nut. Kutter.
26339 Children's wrap. O'Sullivan.
26340 *Aeroplane. Wetterwald.
26341 *Contact breaker. Gebbert

26342 *Heating system. Dormus.
26343 *Lemon squeezers. Marsch.
26344 *Distributing apparatus. Saussard.
26345 *Bags, etc. Faulkner.
26346 *Indicator file. McLean.
26347 Wire mattresses. Fraser.
26348 Cargo winches. Reavell.
26349 *Propellers. Rheinische.
26350 Bakers' ovens. Callow.
26351 *Watch case. Chaumet.
26352 *Jewellery. Chaumet.
26353 *Copying documents. Frydmane.
26354 *Cinematographs. Bettini.
26355 Type casting machine. Burgess.
26356 *Treatment of metals. Roux.
26357 Buffers. Spencer.
26358 Steel grinding. Jones.
26359 Golf clubs. Yates.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to December 19th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

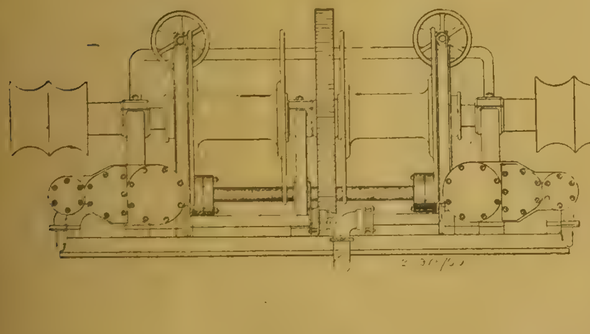
Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

5950 Rhodes and Rhodes: Machinery or apparatus for winding yarn into cheeses or the like. [Post-dated October 12th, 1909.] 10276 Gajardo: Machine for washing plates, dishes, and the like. [Post-dated October 15th, 1909.] 16036 Rootham: Hand or power-driven water elevator. [Post-dated November 29th, 1909.] 16300 Bullock and Calcott: Process for the treatment of iron or steel to prevent rusting. 18208 Michalski: Typewriters. 18234 Wetzel: Dirigible airship. 18441 Sharpe: Protectors for tyres. [Post-dated August 16th, 1909.] 18633 Hildebrandt and Hickson: Bakers' and similar ovens. [Post-dated February 14th, 1910.] 19121 Dudley, Dudley, and Simmons: Collapsible blouse display stand. [Post-dated February 18th, 1910.] 20470 Carver: Guiding and tensioning of warp threads in looms, warping machines, and the like. 20508 Mortimer, Mortimer, and Wilkins: Methods of and apparatus for attaching rubber feathers to the insoles of boots and shoes. 20539 Strathern: Plate-holding clamps or holding dogs. 20638 Lancaster: Coin-actuated or coin-freed apparatus. [Post-dated April 9th, 1910.] 20932 Pugh: Detachable wheels. 22743 Coslett Anti-rust Syndicate, and Coslett: Treatment of iron or steel to prevent oxidation or rusting thereof. 22784 Fischer: Sound conduits or amplifying devices for talking machines and the like. 22787 Bruun: Process for the production of a substitute for eggs in the preparation of food stuffs. 22837 Martin and Walters: Combined pump and propelling mechanism for motor boats. 22914 Trotter: Device for securing lamp glasses to burners. 22932 Heyland: Circuiting arrangement for working mono and polyphase alternating-current motors. [Date applied for under International Convention, October 10th, 1908.] 22957 Purser: Appliances for delivering, spraying, or distributing disinfecting and other liquids and substances. 22972 Gray and Hull: Construction of automaton apparatus for use on show grounds. 22975 Davies: Valves and valve gear of internal-combustion engines.

22978 Charles D. Holmes and Co., and Holmes: Steam winches.

This invention relates to winches of that class which are driven by compound or triple-expansion steam engines, and consists in providing single and double-barrel winches for steamships, and steam fishing vessels in particular, with simple means whereby increased expansion of steam is obtained, and to this end one or more sets of two or more cylinders are employed in which the steam is expanded, the same steam acting on a piston in each cylinder of any particular set, with the result that the steam is utilised to its full extent. The illustration shows the improvements applied to a double-barrel winch designed particularly for steam fishing vessels.

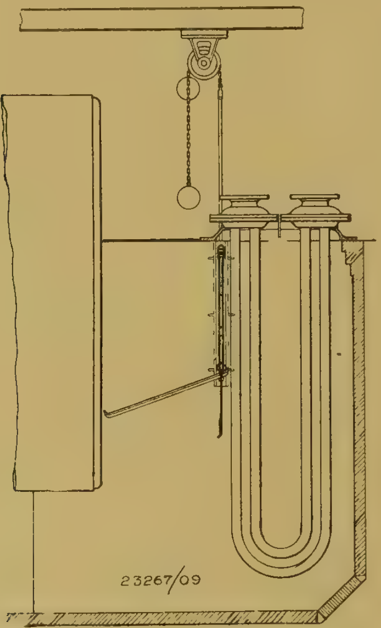


22980 Barbour and Crosbie: Gill boxes. 22988 Simpson: Chains for suspending electric pendants, electric chandeliers, and the like. 23014 Neu: Electric arc lamps. 23015 Soper: Aeroplanes or flying machines. [Cognate Application. 5573, 1910.] 23035 Turnbull, and British Steel and Wire Co.: Machine for re-making wire-drawing dies. 23041 Ehrhardt and Sehmer Ges.: Regulation of jet condensers. [Date applied for under International Convention, July 5th, 1909.] 23083 Christensen: Convertible ladders, trestles, and scaffoldings. 23104 Mort: Explosion engines. 23107 Janecke: Process for the continuous production of liquid air and for the continuous separation of the same into its constituents. 23117 West: Motive power mechanism for use as propellers for aerial machines and marine vessels and for other purposes. 23118 Neale and Martin: Manf. of cart lamps and the like. 23126 France and France: Nosebags or food containers for the feeding of horses, cattle, or other animals. 23127 Bond: Utilisation of whey for dietetic purposes. 23133 Horstmann, Horstmann, Horstmann, Horstmann, and Edgar: Pilot lights for gas burners. 23135 Hicks: Billiard cue chalkers. 23161 Horstmann, Horstmann, Horstmann, Horstmann, and Edgar: Gas controllers, electric time switches, and other timing devices. 23180 Miller, Du Brul, and Peters Manufacturing Co., and Du Brul: Speed-changing devices. 23186 Forbes: Flying machines. [Cognate Application. 6180, 1910.] 23208 North and Kirby: Taximeters or fare and the like indicators. 23216 Maley: Manf. of electrical resistances. 23217 Leake: Control of electric motors. 23230 Geb. Heyl and Co. Akt.-Ges.: Disinfectant and the method of producing the same. [Date applied for under International Convention, June 30th, 1909.] 23260 Jones and Jones: Chairs. [Cognate Application. 732, 1910.]

23267 Cruse: Dampers for bye-passing gases in the flues of steam boilers and the like.

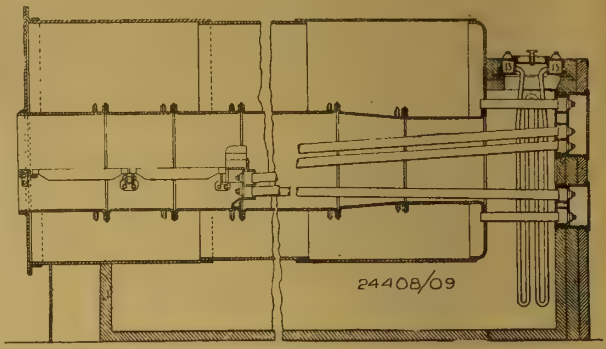
This invention relates to improvements in dampers for bye-passing gases in the flues of steam boilers and the like, and comprises a damper of suitable size and shape preferably constructed of two or more steel or iron plates riveted or otherwise secured together and having a space between them, thus forming a cavity damper; but where the gases to be dealt with are not of high temperature a simple corrugated or shaped plate may be employed. The sides of the damper are provided with two lifting gudgeons to which are attached the lifting rods or connections. The lower end of the damper is provided with anti-friction rollers or wheels arranged to run upon rails or guides built into or secured to the side walls of the flue at a suitable inclination. The lifting gudgeons pass into or through vertical or inclined slots or guides provided in the sides of boxes secured in the walls of the flue and are fitted to the lifting rods or connections inside these boxes wherein both gudgeons and connections travel and are shielded from the action of the gases. An iron or steel apron or supplementary damper, if required, may be suspended from the lower end of the damper. The lifting of the damper is effected by chains and pulleys or other suitable tackle.

23344 Young: Automatic water and lever power engine. 23347 Wright, and Dunlop Pneumatic Tyre Co.: Wheels of road vehicles. [Cognate Application. 8110, 1910.] 23348 Wohle: Petroleum and other hydrocarbon oils. 23349 Mackenzie (Grappin-Brochot): Cap or covering for the mouthpiece ends of tobacco pipes, cigar holders, and the like. 23355 Bullivant and Selby: Means for connecting ropes or cables to their anchorage devices. 23359 Groll: Carding machines. 23373 Gray, and T. Cooke and Sons Ltd.: Aiming point instrument for directing the fire of guns at concealed targets. 23376 Tiddeman: Steam or gas meter. 23392 O'Brien (Kearton): Underclearers for the drawing rollers of drawing, slubbing, intermediate and roving frames, and similar machines for preparing cotton, flax, wool, or other fibres for spinning. 23403 Carre: Process of treatment of straw, dried grasses, or the like for the production of articles of commerce, a machine for carrying out the process and the products derived therefrom. [Cognate Application. 11895, 1910.] 23405 Schicht: Windows. 23420 Jalsoviczky: Automobile ploughs. 23440 Johnson (Chemische Fabrik Griesheim Elektron): Purification of magnesium and magnesium alloys. 23441 Johnson (Chemische Fabrik Griesheim Elektron): Manf. of dense castings of magnesium or magnesium alloys. 23442 Chemische Fabrik Griesheim Elektron: Manf. of sulphuric acid. [Date applied for under International Convention, April 15th, 1909. Application for Patent of Addition to 20401, 1909.] 23446 Pugh and Pountney: Detachable wheels. 23470 Homan: Sun dials. 23481 Walker: (Mergenthaler Setzmaschinen-Fabrik Ges.): Means for supporting matrices or type dies in typographical composing machines, and spacers to co-operate therewith. 23491 Coulson: Lens. 23498 Welman: Propellers, more particularly for use with aerial craft. 23553 Stern: Windings for alternating-current motors. [Date applied for under International Convention, October 31st, 1908. Request under Section 19 of the Act not granted.] 23584 Hulme: Carding engines. 23602 Rhodes: Power presses. 23615 Walker (Mergenthaler Setzmaschinen-Fabrik Ges.): Means for cleaning the spacers of linotype machines. 23633 Cooke: Incandescent gas burners. 23637 Bradford Dyers' Association, Thornton, and Metcalf: Apparatus for printing textile fabrics. 23641 Beskow and Ramen: Feeding device for mechanical roasting furnaces. [Date applied for under International Convention, August 24th, 1909.] 23671 Muller: Manf. of coke and gas and apparatus therefor. 23682 Hewett: Means for the attachment of auxiliary or spare wheels to the wheels of road vehicles. 23726 Hall: Clocks or apparatus for timing and recording pigeon races or the like. 23756 Lippelt: Dynamo electric machines. [Date applied for under International Convention, October 16th, 1908.] 23757 Creese and Dederich: Flying machines. 23758 Creese and Dederich: Flying machines. 23808 Vitanoff: Portable electric lamps. 23818 Bell and Pletts: Apparatus for cooking or for heating air and other media by means of electricity. [Application for Patent of Addition to 22598, 1908.] 23819 Bell and Pletts: Apparatus for cooking and like operations by means of electricity. 23826 Michaelis: Duplicating machines. 23840 Torkington: Laminated springs for carriages, motor cars, or the like. 23872 Preston and Deeley: Slide valves for motive power engines. 23934 Barr: Automatic check-printing and recording machine. 23949 Wichterle: Threshing machines. 23890 Harrison: Means for supporting electric lamps. 24044 Henderson and Russell: Adjustable platforms and tables for paper-cutting and like machines. 24125 Langslow: Coin-controlled closure releasing mechanism. 24161 Lewis and Zepler: Stoppering appliances for bottles and jars. 24208 Dey: Apparatus for controlling electric motors. 24251 Gayraud: Threshing machines for wheat and the like. 24397 J. Stone and Co., Jakeman and Wells. Gully gratings. 24406 Routh: Machines for moulding articles such as flower pots.


23267/09

24408 Davies: Steam boilers.

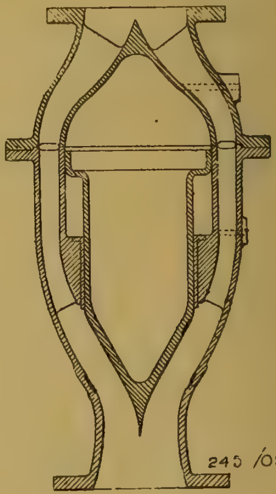
This invention relates to improvements in Lancashire, Cornish, dry back, marine, and other boilers of this type with the object of increasing their circulation and steam evaporation and a better combustion of the gases. According to the invention a system of inclined water tubes is fitted in the large internal flue or flues of a boiler of this type, the system of tubes being adapted to connect the bottom of the boiler with its upper part and being arranged in such a position that they are in contact with the heat directly radiating from the furnace.


24408/09

24533 Kenrick: Elastic tyres or wheels for use upon motor or other road vehicles.

24559 Orten-Boving and Johnson: Valves for controlling the flow of fluid through pipes.

This invention relates to an improved construction of valve for controlling and arresting the flow of fluid in a pipe, it being particularly intended for use in large hydraulic installations for regulating the flow of water in pipes of large diameter. The invention consists essentially in providing in combination with a pair of valve elements for intercepting and regulating the flow of fluid in a pipe operated by the direct pressure of the fluid, the line of relative displacement of which valve elements is coincident with that of the pipe, the stream diverging to one of annular section and then converging, an arrangement in

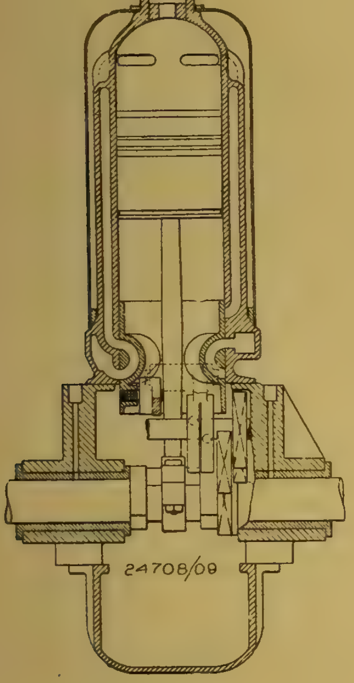

245 /09

which the movable element of the valve is formed on the continuously curved end of the plunger of a piston plunger device mounted to work fluid-tight within a chamber surrounded by the annular passage.

24645 Connor: Means for raising and lowering curtains and other scenery in theatres, music halls, and like places.

24708 Silverman: Internal-combustion engines.

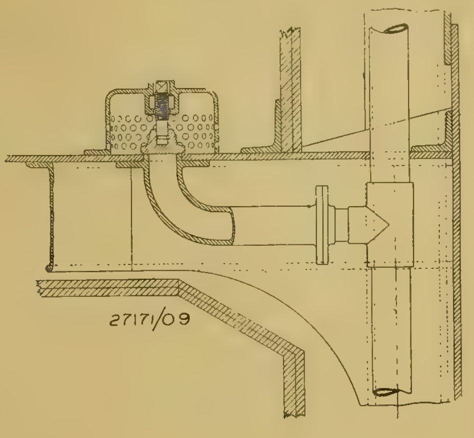
This invention relates to internal-combustion engines of the type in which reciprocatory, oscillatory, or rotary cylindrical valves are arranged co-axially with the main cylinder below the piston or in a separate chamber above it for controlling the admission and exhaust of the gases. The object of the invention is to produce an improved engine of simple and efficient construction and capable of being manufactured at small cost. It consists in an engine of the above type wherein the valves are provided with independent U-shaped channels respectively adapted to control the admission to and exhaust from the cylinder.



24715 Thompson (Hamblin): Railway vehicle buffers and couplings. [Cognate Application. 5833, 1910.] 24776 Hollingworth (Crompton and Knowles Loom Works): Production of intermediate or inner selvages on woven fabrics. 24783 Wellcome and Johnson: Dental syringe. 24924 Weir: Feed-water heaters adapted for use on warships and other vessels. 24940 Bendixen: Stereotype paste. 25078 Tonks, Tonks, Tonks, and Tonks: Cylinder locks for use with locks, latches, and other fastenings. 25084 Cooper: Non-heat-conducting composition for covering steam generators, steam pipes, refrigerating apparatus, and the like. 25115 Rogers: Line-casting machines. [Date applied for under International Convention, November 9th, 1908.] 25123 Kelly: Fore carriages of four-wheeled vehicles. 25198 Parker: House boots, shoes, and slippers. 25210 Brown: Appliances for inducing sleep. 25216 Sanders: Water elevators and distributors. 25275 Scribner: Apparatus for forming a lap or fleece of fibres. 25324 Woodland: Internal-combustion engine. [Post-dated April 29th, 1910.] 25499 Atkins: Sprinklers for liquids, semi-liquids, powders, and the like. 25614 Lord: Bobbins for spinning, twisting, and winding yarn. 25997 Harvey and Crosby: Cricket bat handles. 26009 Barron: Interceptors, gulleys, grease, and other traps, and the like. 26135 Toupillier: Stereoscopic apparatus for use with photographs. [Date applied for under International Convention, November 13th, 1908.] 26209 Whyte: Method of and means for winding yarns into conical forms. 26261 Paddison: Blinds, curtains, and the like. 26311 Enfield Cycle Co., and Smith: Brake mechanism for carrier cycles. 26399 Valentine: Postal missives or cards. 26404 Oliver and Eastwood: Lever press for tiles, earthenware, or other articles. 26410 Witter: Separation of zinc and lead from mixed sulphides, ores, or products. 26413 Bignold: Games imitating golf. 26656 Jelfs: Appliance for teaching young children their letters, how to spell, and such like. 26663 Rollason: Game. 26970 Tucker: Tension regulation or adjustment of corsets, belts, and the like. [Post-dated January 26th, 1910.] 26973 Dickinson: Boxes for holding textile materials. 26982 Allsop, Richardson, and Lamb: Preparation for damp walls and the like.

27171 Webb. Brettell, and Adamson: Drainage of ships' refrigeration holds or chambers.

This invention refers to the holds of navigable vessels which are used for the carriage of meat and other perishable cargo, and the temperature of which is artificially maintained at a low degree, such as slightly above, or at, or below freezing point. It particually refers to the carrying away of water from the floors of such holds, the invention being especially advantageous in cases where a plurality of refrigerating holds above one another are employed. The invention comprises a valve situated on the floor of the hold and adapted to be opened and an untrapped scupper pipe disposed between it and a down pipe terminating in the lower part of the vessel, as the bilge, and open to the atmosphere above, so as to allow the entrance of air to the down flowing water and to cause the water to be drawn off from the scupper pipes.

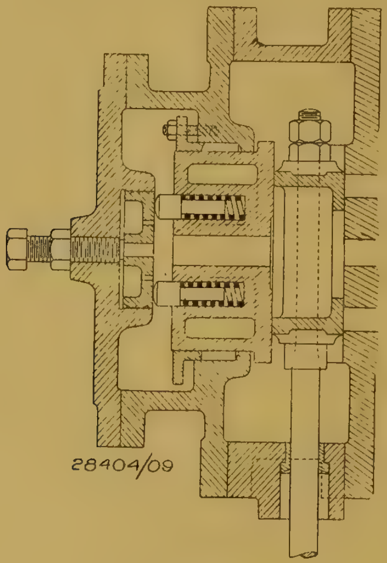


27280 Colbran: Globe holders for inverted incandescent gas lamps or the like. [Cognate Application. 864, 1910.] 27478 Mavor, and Mavor and Coulson Ltd.: Power plants embodying alternating-current generators and motors. 27683 Langford: Packing for stuffing boxes of steam engines and the like. 27713 Fabri: Process for obtaining ethyl alcohol from maize, grain, vinaceous materials, molasses, coal, and the like. 27889 Brown: Appliances for inducing sleep. 28007 Paul (Henry): Apparatus for washing crockery, surgical instruments, and the like. 28008 Bowman and Bowman: Workmen's time check apparatus. [Application for Patent of Addition to 28228, 1908.] 28072 Muchka: Steam consumption meters. 28203 Storey: Flying machines. 28302 Vialleix and Perrin: Process and apparatus for condensing acid vapours. [Date applied for under International Convention, December 4th, 1908.]

28404 Gibb and Hogg Ltd., Barclay and Carmichael: Balanced slide and like valves for motive power engines.

This invention relates to improvements in the balancing of slide valves. It consists of a moving piston actuated by the fluid pressure which is fitted to bear on the slide valve to maintain it lightly on the working face such as the port face of the cylinder, the piston being arranged within the cover of the valve chest and a stuffing box and gland, frictionless metallic packing being provided to form cylindrical casing for the piston. The pressure fluid is admitted from a central port through the slide valve which is of open rectangular box section and thence through an opening in the piston to act on its outer surface which is of greater area than that of the exposed portion of its inner face between which and the cylinder port face the valve slides. Small spring-actuated plungers are fitted in the rear of the piston so as to bear on the cover of the valve chest and thus ensure that such pressure will be maintained on the back of the valve to keep it tightly against the port face when not subjected to the fluid pressure.

28418 Woolley and Pollard: Cases for holding cigars, cigarettes, and other articles. 28423 Johnson: Indicator for use in certain games of chance. 28644 Ainley: Attachment to moneybox for prepayment gas meters. 28800 Hynam, Ellis, and Heinke: Combustion engines for motor cars, flying machines, and the like. 28962 Bentham: Flying machines. 29078 Kilburn: Two-stroke cycle internal-combustion engines. 29234 De Laski and Thropp: Machines for wrapping tyres and other annular bodies. 29351 Snape: Lock clip for the pumps of cycles and the like. 29563 Greg: Spinning, doubling, intermediate roving and like machines. 29576 Hunt: Urinals and the like for bed use. 29607 Peregrine: Air carburetting apparatus. [Request under Section 19 of the Act not granted.] 29610 Notley and Taylor: Chimney and ventilating shaft tops. 30000 Reason, and Reason Manufacturing Co.: Automatic electric flash light device. 30019 Yoxall and Thorneycroft: Roller skates. 30312 Gascoigne, and United Kingdom Fireproofing Co.: Joints for ferro-concrete reinforcements. 30419 Rimailho: Shock-absorbing device. [Date applied for under International Convention, January 15th, 1909.] 30457 Whiteley: Life guards or obstruction removers for tramcars and other vehicles. 30539 Collier: Machines for making sanitary pipes, conduit blocks, bricks, and the like. 30571 Havinden: Combined furnace stopper and steam producer for bakers' ovens.


28404/09

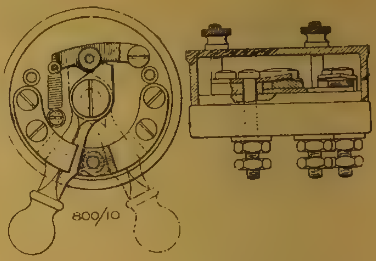
1910.

245 Fardell: Cartridges for use in filling tobacco pipes. 418 Weiss: Cod liver oil preparations. 531 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new formyl derivatives of alcohol bases. 606 Tolhausen: Loom picker. 643 Ludw. Loewe and Co. Akt.-Ges., Millington and Munthe: Clamping mechanism for multiple spindle lathes. 732. *See* 23260, 1909.

800 Brooks and Alston: Electric switches.

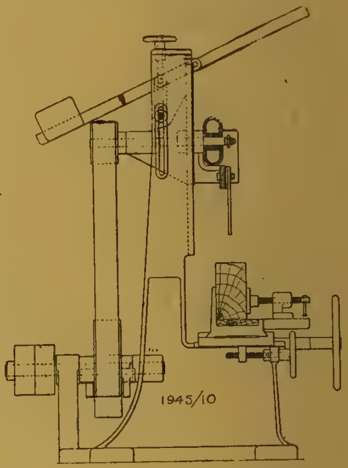
This invention relates to electric switches principally of the two-way type such as are used in connection with ignition systems of internal-combustion engines in which two batteries or a magneto electric machine and a battery are employed, either of which can be brought into use or cut out as required by placing the change-over switch in one or other of two positions, a third or " off " position being also provided in which both are out of use. According to the invention the switch arm moves over a contact plate fixed to the base and connected to an external terminal, whilst the arrangement of the contact jaws (which extend over the contact plate for a considerable distance so as to form a wedge-shaped space corresponding to the shape of the arm) is such that the wear of the contacting parts is automatically compensated for.

864. *See* 27280, 1909. 1025 Gill: Means for testing fabrics. 1032 Jenkinson: Construction of wheel for vehicles. 1238 Ross: Bullets for firearms. [Date applied for under International Convention, January 18th, 1909.] 1280 Self: Brickwork for chimneys, flues, and the like, or as a setting for boilers, furnaces, ovens, and the like. 1313 Powell: Manf. or production of barrel keys for locks and latches. 1455 Tauleigne and Mazo: Illuminating apparatus for projection lanterns. [Date applied for under International Convention, January 26th, 1909.] 1549 Smith: Rocking chairs. 1616 Foelsing: Process of producing a zinc salt of boro-disalicyclic acid. 1622 Felt: Calculating machine. 1898 Thompson (Baker): Sash structure. 1926 Montmeny and Monnie: Breech-loading small arms.


800/10

1945 Oliver Machinery Co., and Haigh: Wood-mortising machines.

This invention relates to wood-mortising machines, and consists of an improved driving arrangement for the cutter chain of chain-mortising machines, and to combine improved means for raising and lowering the slide carrying the cutter chain for adapting the machine to work upon varying dimensions of material.

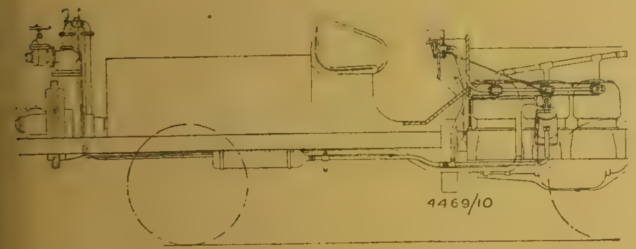

1945/10

2019 Lentz and Lentz-Getriebe Ges.: Method of regulating the speeds of motor vehicles with fluid-pressure gear and apparatus therefor. 2041 Roe: Anti-window-rattling device. 2115 Thring: Device for use in teaching, learning and practising, balancing, and turning movements of skating. 2274 Moss: Methods of working decorations, drawing designs, advertisements, photographs, and the like in colours. 2439 Lee: Furnaces. [Date applied for under International Convention, February 19th, 1909.] 2511 Robinson: Bars for reinforcing concrete. 2639 Humphrey: Non-refillable bottle. 2784 Smith, and Stott and Smith: Terry motions for looms for weaving. 2971 Hugo: Machines for making paper bags. [Date applied for under International Convention, March 12th, 1909.] 2993

Virck: Construction of concrete floors, ceilings, roofs, and the like. [Date applied for under International Convention, December 15th, 1909.] 3005 Parkes and Tooze: Portable adjustable folding apparatus for screens and the like. 3094 Perret: Construction of reinforced concrete flooring. 3117 Siemens-Schuckertwerke Ges.: Arrangements for transmitting power by means of polyphase alternating electric currents. [Date applied for under International Convention, February 27th, 1909.] 3231 Mackenzie (Westmoreland Automatic Machine Co.): Coin-controlled apparatus. 3261 Brown and Hardacre: Thread guides or lappets for spinning and doubling frames. 3344 Farnell and Farnell: Step ladders. 3597 McDowall and Piper: Apparatus for coaling vessels at sea. 3601 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of a new leuco-derivative of the gallocyanine series. 3620 Rockstroh: Means for registering or positioning sheets in platen printing presses. 3664 Slay: Reversible brush. 3850 Rozic: Apparatus for indicating and recording the course of navigable vessels. 4202 Hanwell: Flexible joints for gas pendants and the like. 4218 Allday: Cases or holders for smokers' use. 4249 Reid and Riekie: Spring wheels. 4311 Dowler: Pie crust supports. [Cognate Application. 7853, 1910.]

4469 Argylls Ltd., and Perrot: Motor fire engines.

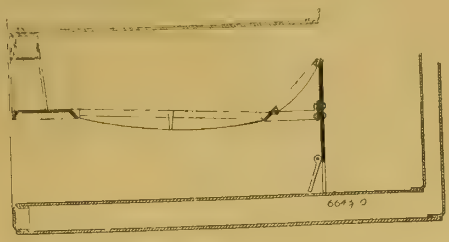
This invention relates to motor fire engines driven by engines of the internal-combustion type and arranged to drive a centrifugal or turbine pump, and it consists of an improved arrangement combining together means for providing a supply of compressed air for the purpose of starting the engine and means for exhausting the air from the suction pipe of the water pump so as to create the necessary vacuum to enable the pump to start lifting the water, the elements of the combination being in themselves more or less well known.



4537 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new dyestuffs of the anthracene series. 4540 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of diaphenylene dioxide. 4662 Nagy: Furnaces or fireplaces. 4675 Kron: Process and apparatus for spinning or twisting strips or small bands. 4713 Barnes and Jensen: Electric lifts and other lifts and like apparatus. 5125 Mavrogordato: Pressure-reducing valve. 5139 Coen: Cigar or cigarette holders. 5151 Bland: Inverted incandescent gas lamps. 5225 Firm R. Ernst Fischer: Box-making machine. [Date applied for under International Convention, April 22nd, 1909.] 5262 Soc. Francaise de Chaleur et Lumiere: Manf. of incandescence mantles. [Date applied for under International Convention, March 5th, 1909.] 5458 Gear: Method of preserving natural fish for use as bait or for taxidermical purposes. 5573. *See* 23015, 1909. 5587 Blackstone and Watts: Root cutters. 5604 Pilkington, Briggs, and Bradshaw: Loom dobbies. [Application for Patent of Addition to 19921, 1906.] 5833. *See* 24715, 1909. 6092 Smith: Spring waist sash fastener. 6180. *See* 23186, 1909. 6211 Nitschke: Telescopic lifting gear. 6483 Cheneau and Prevost: Propellers. [Date applied for under International Convention, March 15th, 1909.] 6541 Knight and Lum: Air-circulating systems. [Date applied for under International Convention, March 17th, 1909.]

6643 Hamilton, Hamilton, and Hamilton: Furnaces.

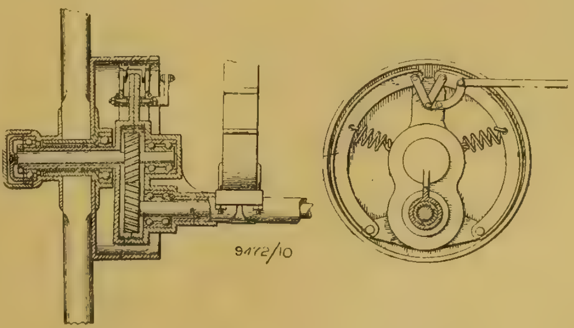
This invention consists in substituting in place of a brick fire bridge an inclined grate of firebars extending upwards from the rear of the firegrate towards the combustion chamber in which the firebars of the inclined grate are provided with pockets on their fire-exposed surface adapted to contain a refractory material.



6756 Rahn: Fastenings for sash windows. 7279 Calphas: Machines for cutting candied peel and for analogous purposes. [Date applied for under International Convention, August 23rd, 1909.] 7291 Planecki and Drobniak: Cash-paying tills. [Request under Section 19 of the Act not granted.] 7321 Jensen: Clamps. 7328 Djounkowsky: Device for tightening and securing bale and the like ties. 7609 Davis: Package lining. 7661 Bauwens: Nail or staple-spacing device. 7853. *See* 4311, 1910. 7905 Duncan: Wheels and tyres of motor cars and other vehicles. [Post-dated July 15th, 1910.] 7941 Feig and Feig: Spring upholstery. 8009 Johnson (Philadelphia Textile Machinery Co.): Drying machines. 8110. *See* 23347, 1909. 8314 Rheinische Metallwaaren-und Maschinenfabrik: Guns adapted to fire at high elevations. [Date applied for under International Convention, September 25th, 1909.] 8352 Rockwell: Motor vehicles. 8388 Garnett: Pallet setting and adjusting tools. 8389 Watzlawik: Spinning, twisting, and like frames. 8456 Nouveau Moulin J. M. Bastin and Petitsfils (Soc. Anon.), and Meneux: Bran brushes. 8545 Malfitano: Apparatus for filtering liquids. [Date applied for under International Convention, April 9th, 1909.] 8751 Lewis and Adair: Light projecting apparatus for attachment to small arms. 8882 Edgar and Co., and Jay: Loose-leaf binders for transfer cases, files, and the like. 9039 Box: Internal-combustion engine. [Date applied for under International Convention, July 12th, 1909.] 9175 Williams: Apparatus for propelling vehicles applicable also for other purposes. 9193 Houdaille: Shock-absorbing devices. [Date applied for under International Convention, April 20th, 1909.] 9277 Mitchell: Construction of building blocks for walls.

9472 Hill: Drive mechanism for motor cars.

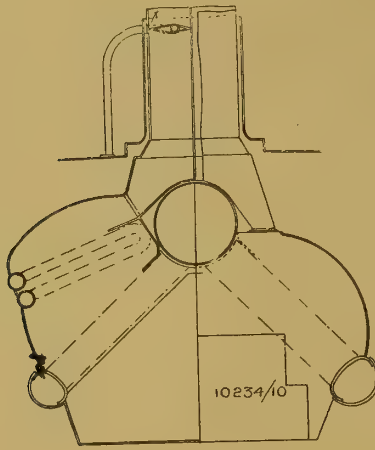
This invention relates to improvements in drive mechanisms for motor cars. It consists chiefly in a hollow supporting axle, a shaft journaled therein, casings extending upwardly from the ends of the axle and provided above the latter with co-axially arranged journal bearings and hollow stub axles, driving wheels on the stub axles, spindles journaled in the bearings and extending through the stub axles, means for connecting the spindles to driving wheels, and actuating connections between the shaft and spindles.



9609 Plinatus: Production of elastic or resilient masses. [Date applied for under International Convention, September 6th, 1909.] 9645 Justice (Going Manufacturing Co.): Machines for shaping blanks, such as button blanks. 9744 Kalle and Co. Akt.-Ges.: Manf. of azo colouring matters from a new amino-oxy-naphthalene sulphonic acid. [Date applied for under International Convention, May 12th, 1909. Samples furnished under Section 2 of the Act.] 9941 Wilde and Petrie: Means or apparatus for controlling winding engines used in connection with mines, hoists, lifts, and the like. [Application for Patent of Addition to 12006, 1908.] 9972 Kohnle and Hunter: Means for attaching tickets, tags or labels. 10201 Petersen: Woven tubular fabric. 10210 Thompson (Ges. fur Drahtlose Telegraphie): Apparatus for strengthening weak electrical impulses, particularly applicable for use in wireless telegraphy.

10234 Yarrow: Dampers for water-tube boilers.

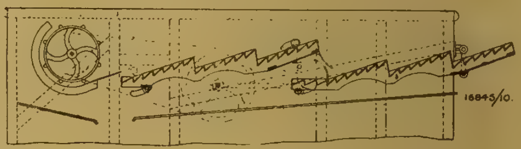
This invention relates to steam generators of the water-tube type, and more particularly to dampers for the control of the flow of the furnace gases in boilers of this class. According to the invention such dampers are made hollow and are kept more or less cool by introducing air into them; the air may be supplied from any convenient source, but usually in the case of forced draught boilers it would be drawn from the stokehold or from the delivery side of the forced draught fan. For the purpose of introducing the air into the dampers the latter are preferably mounted upon a hollow spindle, the interior of which is connected with the source of air by suitable pipe connections.



10310 Reuter and Hatz: Bail handles for sheet-metal vessels. 10374 Daimler Motoren Ges.: Carburetters for internal-combustion engines. [Date applied for under International Convention, December 17th, 1909.] 10619 Hadley: Filter for filtering beer, wine, and other liquids. 10689 Nilsson: Refrigerating devices. 10760 Davis: Talking machines and piano-recording devices. 10761 Davis: Combined piano players and talking machines. 11118 Macdonald: Firegates. 11438 Vose: Machines for trimming the edges of the heels and soles of boots and shoes. [Date applied for under International Convention, May 14th, 1909.] 11454 Kochling: Drawing moulds of turn-over moulding machines. 11461 Schneider: Apparatus for the liquefaction of gases for demonstration purposes. [Date applied for under International Convention, June 8th, 1909.] 11563 Francis: Barrel heads. 11630 Message: Rotary washing machines. 11691 Spencer: Central buffing and draw gear. 11695 Shelley: Security bolts for wheel tyres. 11886 Duckworth, and Twelve Hours Stove Syndicate Ltd.: Slow combustion stove for greenhouses, forcing houses, and the like. [Application for Patent of Addition to No. 7317, 1909.] 11895. *See* 23403, 1909. 12108 Hart: Table cutlery. [Date applied for under International Convention, May 25th, 1909.] 12172 Aikman: Automatic signalling devices for railways and the like. 12255 Brohmann: Locks. [Rights under Section 91 of the Act not granted.] 12500 Quentin: Kneading machines. [Date applied for under International Convention, May 22nd, 1909.] 12505 King: Hand-pleating attachments for sewing machines. 12656 Carlson: Steering mechanism for motor cars. [Date applied for under International Convention, May 25th, 1909. Originally included in 3760, 1910.] 12901 Davies: Body garments. 12934 Bucher: Dirigible airship. [Date applied for under International Convention, June 10th, 1909.] 13155 Whelan: Process and apparatus for drying the toe portion of shoes. 13196 Thornton (Independent Harvester Co.): Drive chain. 13802 Calvert: Scarifying and burnishing. 14396 Niditch: Compounds for railway signal fusees. [Date applied for under International Convention, December 16th, 1909.] 14398 Lemercier: Artificial sleeper for railways. [Date applied for under International Convention, June 14th, 1909.] 14409 Bessonnet-Favre: Apparatus for raising liquids. [Date applied for under International Convention, June 19th, 1909.] 14483 Elia: Submarine mines. [Date applied for under International Convention, January 14th, 1910.] 14847 Widmer: Guards for eyeglasses, pencils, pens, and similar articles carried on the person. 15039 Steinharter: Rolls for staking machines. 15448 O'Hara: Sanitary mouthpieces for telephones and other instruments. 15523 Farbwerke vorm. Meister, Lucius, and Bruning: Manf. of a salmon-coloured vat dyestuff of the anthraquinone series. [Date applied for under International Convention, July 31st, 1909.] 15981 Lange: Safety hook and device for quick release thereof. 16150 Edge: Hinging machines. [Date applied for under International Convention, July 20th, 1909.] 16241 Lock: Linen buttons. 16279 Drummen: Sorting mechanism for tapering or pointed articles. 16321 Brown: Security bolts for wheel tyres. 16356 Eisenstein: Apparatus for producing electrical impulse charges for wireless telegraphy and telephony. [Application for Patent of Addition to 10019, 1908.] 16381 Downing: Buoys. 16458 Porter: Fly presses for making medicinal tablets. 16568 Firm A. W. Nagel: Process of manufacturing lace insertion. [Date applied for under International Convention, June 4th, 1910.] 16627 Waerndt: Inhalers.

16845 Rainforth: Shake boxes of threshing machines. [Application for Patent of Addition to 24032, 1909.]

This invention relates to shake boxes of threshing machines, and consists essentially of a shake box of a threshing machine comprising a plurality of frames provided with apertured or recessed slats or sieve sections, the frames bging arranged and being supported and adapted to be operated by an improved combination of means.



16847 Evon: Feed bags. 16932 Farbenfabriken vorm. Friedrich Bayer and Co.: Process for producing solutions of cellulose esters. [Date applied for under International Convention, July 22nd, 1909.] 16986 Koepe: Method of petrifying in sections water-bearing strata. [Date applied for under International Convention, September 18th, 1909.] 17054 Proudfoot: Safety cage for protecting the manipulator of railway couplings. [Date applied for under International Convention, July 26th, 1909.]. 17242 Benedictus: Manf. of strengthened glass. [Application for Patent of Addition to 1790, 1910.] 17375 Smitt: Tobacco and the like packing machines. [Date applied for under International Convention, March 14th, 1910.] 17891 Fairweather (Elliott-Fisher Co.): Typewriting machines. [Date applied for under Rule 13, November 15th, 1909.] 18388 Bousfield (Wood): Baling press. 18398 Accumulateurs Tudor Soc. Anon.: Process for packing for transport charged negative electrodes of accumulators. [Date applied for under International Convention, August 5th, 1909.] 18465 Quisling: Projectiles. 18539 Fondu: Balancing arrangement for sashes. [Date applied for under International Convention, March 7th, 1910.] 18545 Goodspeed: Control devices for variable gearing and other purposes. [Date applied for under International Convention, August 9th, 1909.] 19259 Droste: Trucks adapted for manual propulsion. [Date applied for under International Convention, August 17th, 1909.] 19315 Stibbe: Knitting machines. 20123 Lassen: Closing or capsuling bottles, jars, and like receptacles. [Date applied for under International Convention, September 2nd, 1909.] 20199 Bevan: External remedy for curing mange in dogs. 20595 Vorwerk: Means for attaching stiffeners to wearing apparel. [Date applied for under Rule 13, October 30th, 1909.] 20596 Eichberg: Reinforced concrete floors. [Date applied for under International Convention, September 3rd, 1909.] 20604 Gilsbach: Rotary engines. 21104 Roellig: Sirens. [Date applied for under International Convention, September 14th, 1909.] 21597 Croft and Perkins Ltd., and Croft: Bushes for pulleys or wheel bearings. 21925 Mallet: Means for steering automobile vehicles. [Date applied for under International Convention, September 22nd, 1909.] 22289 Farbwerke vorm. Meister, Lucius, and Bruning: Manf. of a bluish-red azo dyestuff suitable for preparing lakes fast to light. [Date applied for under International Convention, October 21st, 1909.]

COMPLETE SPECIFICATIONS OPEN TO PUBLIC INSPECTION BEFORE ACCEPTANCE, UNDER THE PATENTS ACT, 1907.

1910.

7042 Millspaugh: Paper making. 7309 Meyer and Young: Apparatus for decorating tile pottery and the like. 10598 Tessier: Apparatus for manufacturing gas for heating, lighting, and power purposes. 12657 Bassett and Hunter, jun.: Flushing apparatus. 12831 Leune: Machine for the centrifugal treatment of liquids. 16050 Patric: Planting machines. 16139 Truelle: Detachable rims for vehicle wheels. 18072 Schoenicke: Feed regulator for steam boilers. 18542 Friedberger: Open-working embroidery. 19866 Geb. Siemens and Co.: Process for the manf. of fireproof electrically conductive materials. 19962 Siemens and Halske Akt.-Ges.: Process for the manf. of metal tubes, especially tubes of tantalum metal. 20347 Von Pebal: Collapsible air cushions. 20766 Stumpf: compressors. 21313 Bille: Joints for conduits and the like. 21856 Greenway: Concentration of ores. 21891 Etrich: Footstep bearings for spindles. 21929 Heron: Typewriter platens, casters, and other rollers. 22014 Farbwerke vorm. Meister, Lucius, and Bruning: Manf. of green-to-black vat dyestuffs. 22107 David: Classifying index with movable tablets carrying cards. 22127 Tessier: Apparatus for manufacturing gas for heating, lighting, and power purposes. 22227 Cox: Devices for recording and computing the value of meter index movements. 22299 Minchinton: Apparatus to be used in making, trimming, and lining hats, bonnets, caps, and such like. 22329 Soc. Brehier et Cie.: Apparatus for the manf. of metallic hoops or circles. 22494 Waller: Process in the manf. of sounding boards of metal or metal alloy for stringed instruments, such sounding boards being fixed to frames and, moreover, sounding boards fixed to frames manufactured according to the process. 22777 Massip: Electric furnaces and the manf. of steel. 22841 Ges. fur Maschinen-und Metall-Industrie: Electric arc lamps. 22844 Nowotnick: Steering airships of the rigid system. 22852 Westinghouse Metallfaden Gluhlampenfabrik Ges.: Metallic filament lamps. 22868 Paraskovich: Device for packing powders. 22914 Weddigen: Superheater for locomotive boilers with superheating chambers arranged above the boiler. 22934 Schou: Pumps. 22961 Baldus: Viscosity meters. 22976 Degener: Matrix-setting and type-line casting machines. 23050

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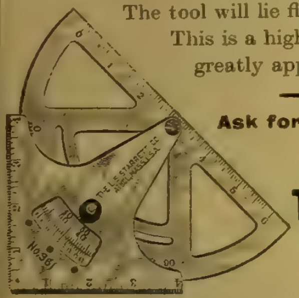

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HOW TO INCREASE HUMAN ENERGY.

THE problem propounded in the title to this article has for long been a favourite one with philosophers, and many more or less plausible theses have been advanced. Amongst the latest scientists who has turned his attention to this fascinating subject is Professor C. A. M. Smith, who, in an inaugural address delivered lately to the members of the East London College Engineering Society, dealt with the problem of improving human efficiency. Although we live in an age of scientific marvels, said Professor Smith, we yet live in a world where things repeat themselves, an old world where men have lived and worked through many generations. The great fundamental truths remained unshaken, as they were thousands of years ago. Yet every generation had for its own new opportunities, new requirements. If there was one inexorable law of nature, it was that men cannot stand still. Forces were urging us on—those which were positive increased the progress of the individual or race, and that those which were negative retarded it. He proposed to consider humanity as a mass—a lump of matter—urged on or retarded by forces. Then the sum of human energy would be represented by $\frac{1}{2}MV^2$. The great problem of science was to increase this energy. There were three ways of doing it. We might increase the span of human life, we might reduce the negative forces, or we might increase the positive forces. In all three cases the engineer was aiding to increase human energy. Careful attention to health, sanitation of cities, provision of good and cheap food—possible only by cheap transport—increased the number of humans available for work. There were a thousand evils, all tending to reduce this number, but all of them would not equal the single one, the want of proper food brought on by poverty and famine. In the Soudan, between the death of Gordon and the fall of Khartoum, the atrocities of the Mahdi's followers reduced human life terribly. The wonderful irrigation schemes of the new order have increased it. Fifty years ago bananas were never seen on the costers' barrows, yet vast quantities rotted under tropical skies. Luscious fruits from the Pacific slopes were nowadays brought across a continent, over the steel rails, in ice-cold vans, and were shipped by mechanical devices into ships, which raced across the ocean at a speed unknown a generation since. Electricity has been used to stimulate wheat growth by being discharged into the atmosphere. Emigration, education, and even agricultural cultivation has been made possible only by mechanical contrivances, one of the greatest of which was the printing press.

The second part of the problem was to reduce the negative forces. Ignorance and stupidity were frictional; insanity, destruction and religious fanaticism were negative. Organised warfare was a horrible negative force. Universal peace was at present only a dream—the applied scientist would convert it to a reality. In the evolution of warfare it was possible that humans as combatants would drop out. Nations would still waste money and brains upon perfecting the machines, but human life would not suddenly cease because of war. That was the first step to universal peace—the self-acting machine to fight the nation's battles. Such fighting units would be controlled by wireless.

The third part of the problem was to increase the positive forces. Every effort, scientifically and rationally employed, must be in the direction in which the mass is moving. Every new fact discovered urged the mass onwards. The busy world around us—the complex mass of humanity as it daily throbbed and moved—was but a huge piece of clockwork driven on by a spring. And that spring was power, in whatever form, chemical, mechanical or electrical. Every object was now manufactured by machinery. Trains and ships brought us our breakfast, cars carried us to our meeting places. The mud hut was replaced by the reinforced concrete structure. Our cheering warmth and light—it was all due to motive power. If we reduced the cost of motive power we should free from terrible monotony much human labour and make it available for higher forms of work.

We were led to ask, what is the source of our motive power? We watched the trains and steamers come and go, we used machine-made fabrics, we heard, instantly, the voice 100 miles away. We lived in an age of miracles —miracles of which the ordinary run of men were but dimly conscious, of which they knew nothing and cared less. But the mainspring of our little universe was the sun. It maintained and sustained all human life and human energy. To increase the positive forces we must utilise more of the sun's energy. The rational method of power production was that energy should be obtained without waste of material. The windmill did that—the sailing ship was man's first effort to make use of the sun's energy. Now we utilised it in a curiously roundabout fashion. We mined coal and iron, but at what terrific sweat and labour and waste. Millions of tons of minerals and human hours wasted! The solidified sunbeams of æons now remote were reproduced at an efficiency of about one per cent. Mr. Ferranti had recently suggested methods of improving the efficiency, but, however we used coal and iron, there would always be terrific waste. It appeared, however, that the iron age was passing, and the age of aluminium, a metal of enormous civilising potency, was coming. Aluminium would down copper, and, unless iron was indispensable for its magnetic qualities, would fiercely assail the position now held by that mineral.

It was calculated that the sun's rays fall upon the earth and supply energy at a maximum rate of over 4,000,000 H.P. per square mile. It was true that the *average* energy was but a fraction of that amount. Crude experiments have been made to utilise this energy. It is not impossible that some thermodynamic process will be evolved by the chemist, physicist, or engineer which will be more commercially practicable than those hitherto attempted. Two thousand years ago crude experiments were made by Hero of Alexandra with a steam turbine; mankind had to wait for a Reynolds and a Parsons to carry the work, by scientific methods, to its present state of development.

Of course, the energy of the sun was now utilised by means of waterfalls. The phenomenal growth in a quarter of a century of power production at Niagara showed that the hub of civilisation might yet leave the grimy coalfields and take up a position near the Niagara or Victoria Falls. There seemed also another method of using the sun's energy in a cleaner fashion than by coal, viz., the alcohol engine. It was a pleasanter prospect to imagine the cultivation of hundreds of square miles of land for thus producing motive power, than the present methods of mining.

It was curious that engineers, although their life efforts were spent almost entirely in the direction of increasing human energy, possessed great inertia. The law of life was change; not destruction, but carefully thought out change. The man who to-day followed the methods of business of his grandfather could not make a living. Yet engineers often said that a thing which was not directly in conflict with the laws of nature was impossible. How often we heard men say that a scheme was impracticable, which sooner or later was done successfully, the impracticable was accomplished. If engineers required any justification for their works, it could be found in the millions paid each year as wages. The coming of machinery had multiplied, not as was foolishly believed at first, reduced the demand for labour. Life had been made possible for millions who would otherwise have been pent up within the narrow confines of this Continent, and who would have persisted in the mad endeavour to strangle each other in the wild struggle for room and bread which would have ensued.

Probability of Railway Extension.—There are large tracts of land in the centre of Uruguay and towards the east coast that are capable of growing good crops, but which, being at present out of the reach of a railway, could not dispose of such crops if grown, and are therefore used for pastoral purposes only. The rich native landowners are losing their simple tastes and becoming extravagant and fond of display, and are awakening to the fact that grain gives them more profit than cattle; they are, therefore, disposed to support projects for the construction of railways that will enable them to grow grain and dispose of it, and so increase the value of their estates. Hence it is reasonable to suppose that Uruguay is on the eve of extensive railway development, with a consequent development of the produce of the soil and an increase in immigration.—*The Board of Trade Journal.*

Proposed Port and Railway.—A project has lately been taken up by an ex-diplomatist of the United States for the construction of a large completely-equipped deep-water port at Punta de la Coronilla on the Atlantic seaboard at the junction of the Brazilian and Uruguayan frontiers, and of a railway running diagonally across the Republic at right angles to the Uruguayan section of the Pan-American Railway, starting from Punta de la Coronilla and reaching the north-western corner of the Republic at Santa Rosa. This scheme contemplates the expenditure of some £9,000,000, of which £2,500,000 would be required for the port at Coronilla alone.—*The Board of Trade Journal.*

Condition of Harbours.—The report by the British Acting Vice-Consul at Canea on the trade of Crete in 1909, which will shortly be issued, states that the harbours at Candia and Rethymo—in no case suited for large ships—are silting up, and will require extensive dredging operations. At Canea a similar shallow harbour exists. Suda Bay, which is only about five miles from Canea, and which is the only natural harbour in the island that can be used in all weathers, may be developed by the construction of wharfage accommodation and of a light railway to Canea.—*The Board of Trade Journal.*

The Price of Radium.—Sir William Ramsey stated recently that the cost of radium was now £420,000 per ounce, which is slightly less than a year ago, when, in an address at the laying of the cornerstone of the radium factory at Limehouse, he said that the value of the substance was £500,000 an ounce, which was at the rate of £18 per milligramme. Not so long previously radium had been obtainable for 8s. a milligramme. In January last the price was said to be £600,000 an ounce. About a year ago there was only a quarter of a pound of radium in the whole world, and the quantity is not much greater at the present time; in fact, literally pure radium only dates from September 5 last, when Mme. Curie told the Academy of Sciences in Paris that she had at last succeeded in obtaining pure radium. For some time past a radium bank has existed in Paris, and last January one was established in London, and similar institutions are to be founded in other great cities. These banks loan the precious substance to scientists and physicians. The cost is enormous, as much as £40 being charged for the use of 100 milligrammes for a single day.

Military Aeroplanes for France.—Reuter's Paris correspondent telegraphs that General Roquez, the director of military aeronautics in France, has given large orders for aeroplanes to be delivered in January. He intends to create a number of aerodromes, two of which will be established in Algeria and Auvergne.

Imports and Exports in the Engineering Trade.—According to the Board of Trade returns for the 10 months which terminated on October 31 the imports of iron and steel and manufactures thereof amounted to £7,297,640, that is to say, £747,107 more than in the same period of last year, while the exports reached £35,671,452, or an increase of £4,357,584. The imports and exports of other metals and manufactures thereof were £19,906,076 and £8,579,103, which, compared with last year, are increases respectively of £13,058 and £1,471,088. The imports of electrical goods increased by £267,204 and the exports by £1,522,050, the totals for this year being £1,311,179 and £3,280,904. The imports of machinery totalled £3,698,431, being a decrease of £38,205, and the exports to £24,185,350, showing an increase of £554,237. Ships (new) were imported to the value of £22,727, a decrease of £996, and were exported to the value of £8,044,529, being an increase of £2,918,066.

Electrical Transmission at 110,000 Volts.—The Berlin correspondent of *The Times* reports that the various works of Messrs. Lauchhammer, situated at Burghammer, Lauchhammer, Gröditz and Riesa, have so far been supplied from separate power stations. Recent investigations, however, have shown that the Lauchhammer works are situated on a rich lignite field, and the company have therefore decided to erect a generating station in order to utilise this fuel. While this scheme was under consideration, plans were matured at Gröba for the erection of a central station to supply electrical energy to four districts in Saxony. These two schemes have been combined, and Messrs. Lauchhammer have concluded an agreement with the managers of the Gröba central station for the sale of a considerable amount of energy which will be supplied to a special transformer station. Three turbo-dynamos, each of 5,000 kw. capacity, are now being installed at Lauchhammer, to which two further units will be added. Messrs. Lauchhammer, after extensive experimental work in Germany and abroad, chose for the transmission of the energy a pressure of 110,000 volts, which is believed to be the highest voltage so far used in Europe. The whole of the switchgear and transformer plant is being supplied by Messrs. Siemens-Schuckert. The transformer plant at present comprises four three-phase oil-cooled transformers, each of 6,800 k.v.a. capacity, which step up the generator pressure from 5,500 volts to the transmission voltage.

Electric Smelting of Iron Ore.—Electric smelting of iron ore is shortly to be taken up on a large scale in Sweden. The enormous water powers of the country will be drawn upon to deliver the necessary current. The Stora Kopparberg Company will erect 10 furnaces, each with an electrical energy of 4,000 H.P., and each yielding a yearly product of 12,000 tons of iron. Other companies will eventually bring the total production of the country up to 250,000 tons per annum. The electrical process of steel making has made its entrance into Russia. The first electric furnace of the Héroult type was put into operation in May at the Obuchoff Works, near St. Petersburg. Two further furnaces are already projected in other parts of Russia, one at Nizhni-Novgorod, and another by a French company in the Donetz district. The two latter will be of the Héroult-Lindenberg type, as used at Remscheid, Westphalia.

STEAM ENGINE DESIGN.—XXX.

(Continued from page 606.)

The curves in fig. 159 have been constructed to find the residual out-of-balance vertical force; the top set are for rotating forces. Throughout the diagram forces are ordinates and positions of the H.P. crank through one revolution are abscissæ. The values of $W_2 \cos \theta$, with due regard to phase, have been plotted for each piston line. Adding the ordinates of these curves, with due regard to sign, the heavy curve is obtained, which represents residual out-of-balance vertical component of rotating weights.

Similarly, by plotting values of

$$W_1 (\cos \theta + \frac{R}{L} \cos 2 \theta$$

for each piston line, the residual curve of reciprocating forces is given in the middle set of curves. The bottom curves are a summation of the above two residuals, and by adding, with due regard to sign, the heavy curve is obtained, which represents the total out-of-balance vertical forces for any position of the H.P. crank during one revolution. It is only necessary to multiply the reading from the curve by

$$\frac{w^2 R}{g},$$

and the free force in lbs. is given.

Residual horizontal forces ($W_2 \sin \theta$), horizontal and vertical couples should be determined in the same way.

In some instances it may be desirable to completely balance the engine for all effects (not including secondary). To do this, the reciprocating forces and couples must be balanced up among themselves. This has been done by the dotted lines in polygons A and B, fig. 158, the balance being obtained by increasing the F.L.P. weight to 10,730 lbs. and making the F.L.P. crank angle 203 deg. and the A.L.P. 262 deg.; of course, many other, and possibly better, solutions are possible.

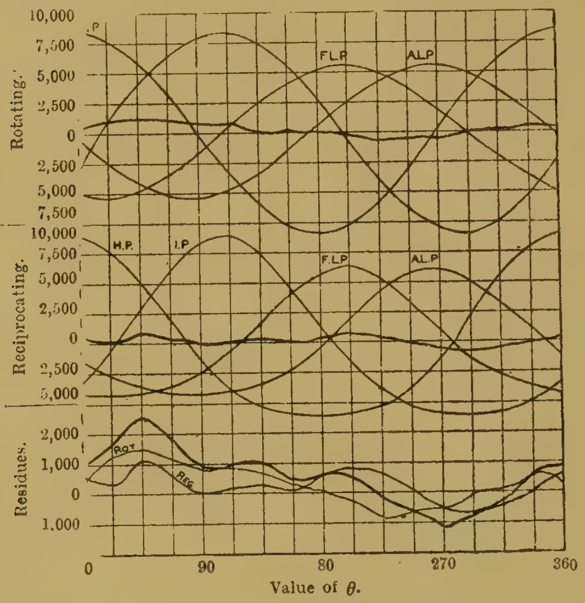

FIG. 159.

If the polygon C is now drawn in for the amended crank angles, it will be found that it fails to close X X, which, when scaled off, gives 3,000 lbs.-feet. Placing a balance weight behind the H.P. crank gives

$$\text{H.P. balance weight} = \frac{3000}{22} = 136 \text{ lbs.}$$

Drawing in the force diagram (D), including the H.P. balance weight, the closing side X X = 1,300 lbs., which must be arranged for on the A.L.P. crank. The engine is now completely balanced for all primary effects.

BALANCE WEIGHTS.

The method of balance weight attachment is subject to a good deal of variation. Four frequently-used methods are shown in fig. 160, while a balance disc crank can be seen in fig. 39.

In fig. 160*a* the crank and weight are all in one. For a double-cheeked crank this, of course, would mean a large forging, but for an overhung crank engine the crank and weight may be of cast steel. The arrangement at *b* is often found on slow-speed engines; the hole for the bolt head is often filled with lead to keep the bolt from slacking back. The methods at *c* and *d* are much used on high-speed engines, and there is no doubt that the first is the safest, although not cheap; still many of the best makers use the straps, as at *d*, with perfect success. The balance weight at *d* is of the shape often required when the weight must be set at an angle with the crank, and it will be readily seen that the stresses set up are not by any means easy to allow for, and therefore considerable care must be taken when using these angled weights.

In some cases, where it is desirable to obtain a big counter balance in a small space, the weights are cast hollow and are filled with lead. It is advisable to allow a low stress on the bolts; this can be calculated from the centrifugal force.

Centrifugal force of one weight = ·00034 W R N².

W = weight in lbs.

N = revolutions per minute.

R = radius of centre of gravity of weight. The centre of gravity can be found by making a card-board model of the weight and balancing it on a compass point.

If a = area of bolt at bottom of thread, in square inches,

n = number of bolts.

$$\text{Stress in lbs. per square inch} = \frac{\cdot 00034 \, W R N^2}{a.n.}.$$

Having in the previous articles dealt fairly exhaustively with the design of the various parts of steam engines, it will now be appropriate to describe a few of the most important types.

Coming first to the marine engine; the standard for warships fitted with reciprocating machinery—battleships, cruisers, and torpedo boats—is to use the four-cylinder, four-crank, triple-expansion engine. Regarding the best disposition of cylinders, there is, as pointed out in the last article, much difference of opinion. Fig. 160A shows a half plan of an engine suitable for a fast cruiser, in which only one condenser would be fitted. The order of cylinders is H.P., I.P., F.L.P., A.L.P. It will be seen that the sequence is a natural one, and that the length of steam and receiver pipes is reduced to a minimum. A great disadvantage is in the inaccessibility of the F.L.P. slide valve, and as a set-off to the saving in receiver pipes, the natural balance of the engine is bad; the heavy cylinders are at one end, and it is frequently necessary to thicken up the L.P. pistons in order to obtain correct balance.

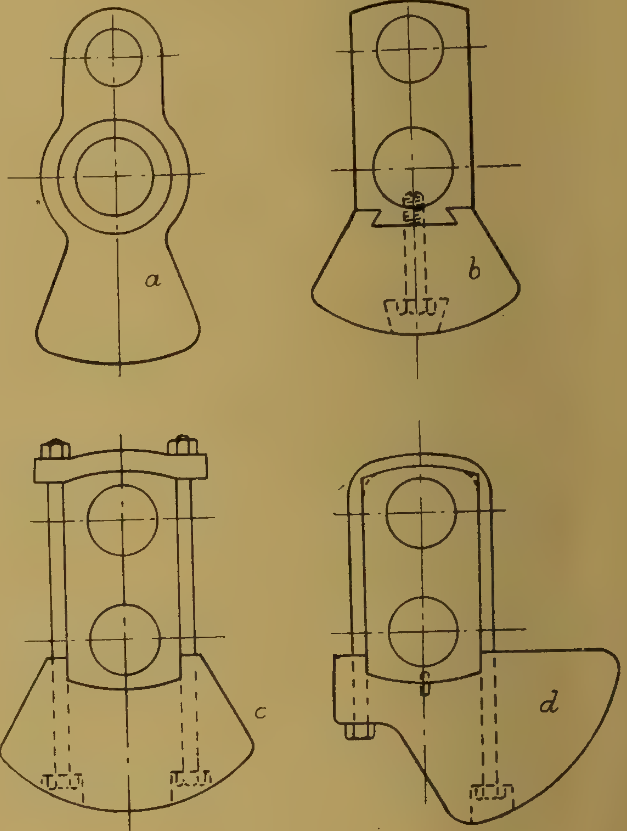

FIG. 160.

To give a good distribution of steam, it is usual with this cylinder arrangement to fit similar steam pipes on the other side.

The arrangement shown in fig. 161B is that adopted for recent warships, and the example of balancing in Article XXIX. is based on it; also in that connection its advantages are fully set out. It will be seen that the engine is thoroughly accessible. So far as the pipe arrangement is concernd, the main steam pipe must be lengthened to reach the H.P. receiver at A. On leaving the I.P. cylinder, steam passes fore and aft to the L.P. receivers. With this type of engine one condenser to each L.P. cylinder is always fitted.

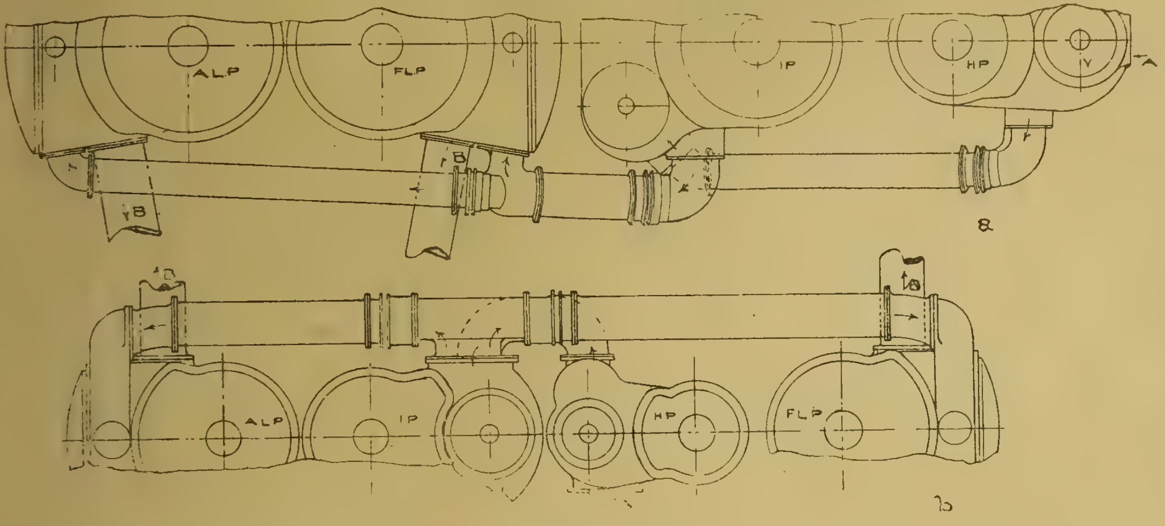

Fig. 161.

The very neat appearance of the front of the engine can be seen from fig. 114; the expansion joints (fig. 13) in the pipes can be seen in both figures. Another pipe arrangement for cylinders placed as fig. 161B will be seen in fig. 166 of the next article.

In the Mercantile Marine the demand for fast liners has resulted in very high-powered engines, and it can be easily understood how circumstances have influenced design. In the Navy weight and height are both reduced as much as possible; on liners, floor space must be small, but there is plenty of head room and reduction of weight is not vital; this last concession allows the steam to be expanded more fully, either by large cylinder ratios, or by quadruple expansion, the weight being utilised by the adoption of tandem cylinders. Examples of cylinder arrangements of modern liners are shown in fig. 162. The Campania's 15,000 I.H.P. engine is seen at A; the Deutschland's and Kronprinz Friedrich's are at B and C, while the Kaiser Wilhelm II. has two engines, each like the one at D, working on the same shaft.

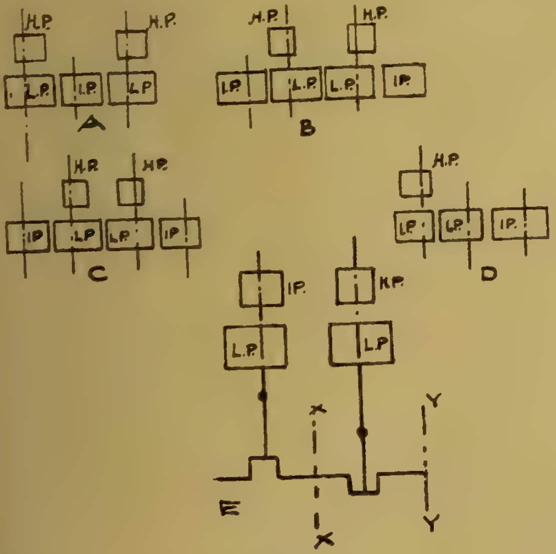

Fig. 162.

Triple-expansion engines are the most used for ordinary steamers of the Mercantile Marine; they are simple and economical, and are well adapted to the usual steam pressure, viz., about 150 lbs. per square inch. The arrangement in fig. 163A is a most compact one, and dispenses with all inter-receiver pipes, the only connection being for steam at A and exhaust at B. It will be seen that the steam passages are formed round the cylinders, and the only disadvantage is that the L.P. slide valve is rendered rather inaccessible. For large engines the disposition shown in fig. 163B is very suitable—all the valves can be easily got at, and the cylinders are in the best position for balancing.

Compound engines are not much used for marine purposes, but where they are, the arrangement of fig. 163A is usually followed, the two cylinders either being cast in one or bolted together.

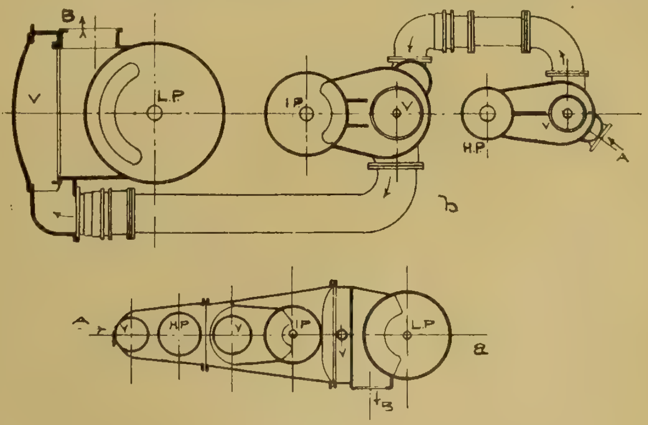

Fig. 163.

High-speed Stationary Engines.

High-speed engines are always vertical; for a compound engine the sequence of cylinders and valves can be seen from fig. 60, although some makers put the valves on the outside, while others use only one special valve between the cylinders. Triple-expansion engines are always like fig. 123.

Slow-speed Vertical Engines.

If triple-expansion, three-cylinder, slide-valve engines, they would probably be like either figs. 163 (A or B); if Corliss, like fig. 164A; and if drop valve, like fig. 164B (the drawing shows only two cylinders). These two last views show how simply Corliss and drop-valve engines can be arranged, and when compared with the torturous, radiating pipes of figs. 161 and 163, there can be little wonder that they are so economical, and the appearance of the engine, always excepting the valve gear, is much neater.

Stationary triple-expansion, four-cylinder engines are seldom, if ever, built like fig. 161; the cylinders are placed in tandem and work on two cranks, like fig. 162B; of course, all kinds of valve gear are used. Sometimes the load is between the cranks (as X X); in this case the cranks would probably be overhung (figs. 34 and 39), but if placed at the end (as Y Y), the cranks would be supported on both sides.

Two-cylinder compound engines may be similarly arranged.

Stationary Horizontal Engines.

These are always slow speed, and never have more than two cranks, both of which are usually "overhung." The arrangement for a single-cylinder engine is shown in fig. 62, and a compound tandem engine can be seen in fig. 100. Four cylinder engines may be either twin compound or triple expansion; in either case the arrangement of fig. 100 would be duplicated, the load being carried between the crank on a shaft like that described in connection with fig. 34.

Special Types of Engines.

Broadly speaking, all the leading types of engines are included in the above descriptions, but for special purposes there must be special arrangements. For instance, paddle steamers usually have the engines inclined or the cylinders oscillating.

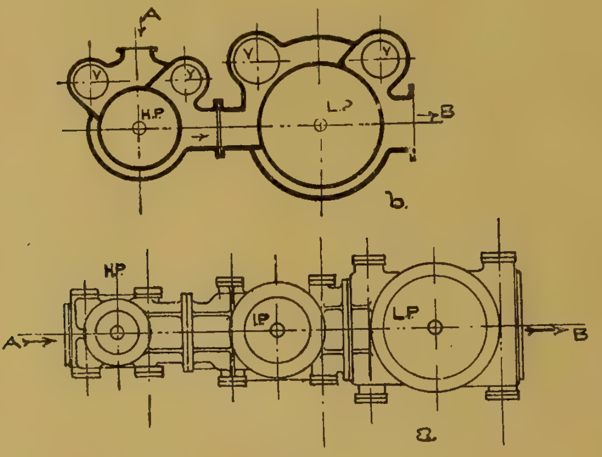

Fig. 164

In valve gear there is endless variety; many types are described in Articles XV. to XIX.; nearly every maker has his own kind of Corliss gear. Special kinds of drop valve are shown on pages 772 and 774; both are specially adapted to use highly-superheated steam. Whereas it used to be considered that high economy could only be obtained by means of triple-expansion engines, nowadays the use of superheated steam allows a large temperature range per cylinder, without excessive initial condensation, and therefore high-pressure steam can be expanded in only two stages, dispensing with the third cylinder and its consequent complication and cost.

In all ordinary engines, the incoming steam is cooled by contact with the cylinder walls, which have been washed by the low-temperature exhaust; obviously, if the steam is expanded too far, the temperature range will be so great that excessive initial condensation will result. Professor Stumph has invented an engine (fig. 165), in which he claims that steam can be satisfactorily expanded in a single cylinder. The improvement in design consists in the reduction of temperature variation of the cylinder walls. Referring to the drawing, steam reaches the inlet valve K by passage C, and on expanding drives the piston before it until nearly the end of the stroke, when the exhaust ports B are reached. On the return stroke, the steam is compressed to its initial pressure. It will be seen that there is a gradual fall in the temperature along the cylinder walls from K to B, and that the steam at entry meets with steam and passages as hot as itself. This type of cylinder has been applied to all classes of work, and has shown high economy, and the manufacture of the engine has been taken up by many leading firms, both at home and abroad.

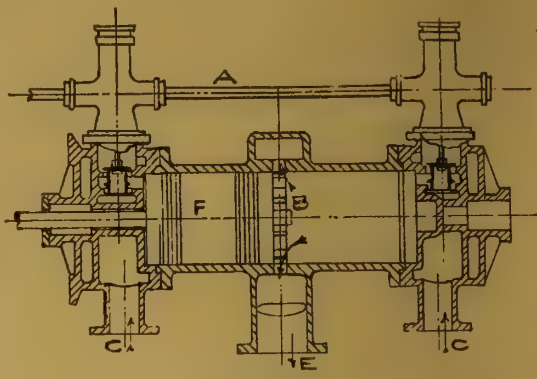

Fig. 165.

One of the greatest advances in the steam engine has been the development of the "locomobile," and a most interesting engine by Messrs. Garrett and Sons, of Leiston, was illustrated on page 643. Referring to this drawing, it will be seen that the cylinders are placed directly over the boiler, which is of the smoke-tube type, the hot gases from which pass around the coils of a superheater on their way to the chimney. Just below the cylinder, a jet condenser can be seen, and the air pump (worked from the crankshaft) sucks from this and delivers to the hot well (to the right of the pump). The feed pump is carried on a bracket from the air pump, and its suction and delivery pipes can be seen. If it is preferred to run non-condensing, a feed heater can be fitted. From a consideration of the steam cycle, it will be seen that the design is thermodynamically correct; there are no condensation or radiation losses; all is in one unit, and these engines can be obtained in sizes up to 1,000 H.P. The engine may be either simple or compound; all parts are remarkably accessible—the whole of the furnace and smoke tubes can be withdrawn in one. The furnace can be arranged to burn any kind of fuel, and so compact and economical is the whole machine that the claim of the gas engine as the best for isolated plants may be seriously disputed.

(To be continued.)

Flexilis Crucible Steel Castings.—The new Flexilis crucible steel castings are used by the German navy. They have less weight and greater strength than malleable cast iron, and are used for large steam fittings where thin walls must be combined with great strength. The steel having a high melting point, a special sand has to be obtained. The processes have not been fully described as yet. As an example, a fitting consisting of a T-shaped flange of 15 in. inner diameter for a pressure of 20 atmospheres, Flexilis casting, had an elasticity modulus of 35,000 lbs. per square inch and needs a thickness of only ·2 in. with a weight of 440 lbs., as compared with a steel casting at 660 lbs., and one of cast iron at 1,100 lbs.

HUMPHREY PUMPS AND COMPRESSORS.[*]

(Continued from page 652.)

FIG. 7 is a sectional view of the Humphrey pump exhibited in operation at the Brussels International Exhibition, and which obtained two "highest possible" awards, namely, a Grand Prix in the class for gas engines, and a Grand Prix in the class for pumps. Its construction can be seen at a glance, and explanation is not needed till we come to the valve gear shown in figs. 8 and 9. It will be observed that a bolt B sliding horizontally must lock either the admission valve A or the exhaust valve E by engaging under collars *a* or *e*, which are fixed on the stems of their respective valves. Now the bolt is urged right or left, according to whether spring s_1 or s_2 is pulling the hardest, and this again depends on whether the link *l* to which the springs are attached has been shifted to the right or left. Suppose the exhaust valve opened last, then its washer *m* engaging against cam arm *p* moved the system *p l q* so that it leans to the right, in which position it is retained by the tension of spring s_3. This puts tension on spring s_1 and loosens spring s_2, bolt B, therefore, tries to move to the right, but until the exhaust valve shuts it can only press upon collar *e*. However, when valve E comes on its seat the bolt instantly locks under *e*, and the same motion which holds valve E shut has released valve A, so that next time a suction occurs in the combustion chamber A only can open. Precisely the same kind of action occurs when A shuts and is locked and E is released again. Thus valves A and E are automatically allowed to act alternately, the difference between them being that while E remains open till shut by the rising water, A shuts under the action of its supporting spring so soon as the suction in the chamber permits the spring to lift the valve to its seat.

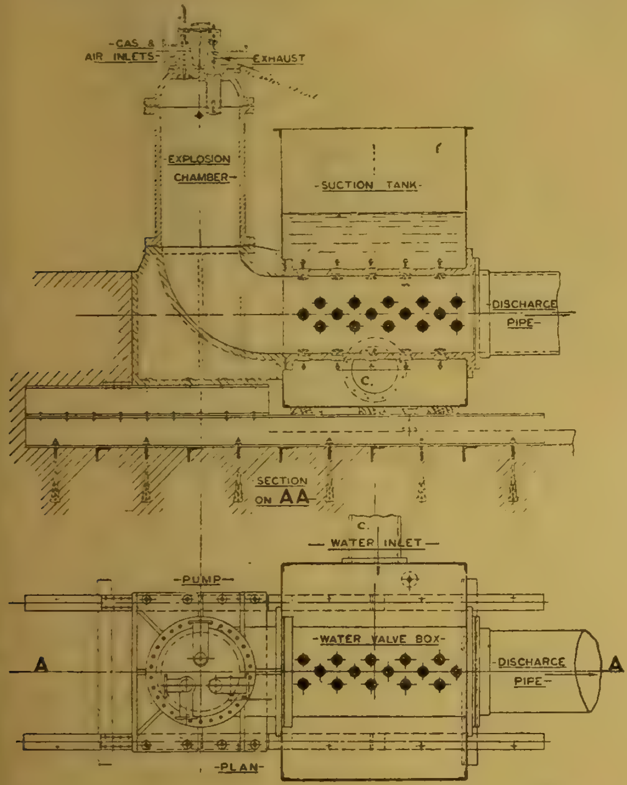

FIG. 7.

The scavenging valve V is shown in the plan of the combustion head (fig. 9), and as it operates at the end of each expansion stroke its locking and release periods correspond with those of the exhaust valve, and are made simultaneously by a lever pivoted at K, and operated by a pin on the bolt B. If the water could rush in fast enough when the pressure falls to atmosphere there would be no scavenging action, but the incoming water has to be accelerated, and that just gives rise to a sufficient suction to effect the desired scavenging. In the exhaust outlet there is a light non-return valve, to prevent burnt products being drawn back into the chamber.

When an internal bell is to be used to provide a separate cushion of burnt products a slight modification of the gear is required to control the three valves. Instead of a scavenging valve we have a valve S opening into the top of the internal bell, as shown in fig. 10, and on its spindle is a loose non-return valve Q. The valve S is released to fall at the same time as the admission valve opens, but the valve Q prevents any inlet into the top of the bell. The action is as follows. When explosion occurs the bell is full of water and all valves are shut. Expansion below the open bottom of the bell allows the water to escape from the bell, which becomes filled with burnt products. On the first instroke of the water the exhaust valve E is found open as usual and allows the products to escape, but valve S is shut, so that the burnt products in the bell are trapped and suffer compression by the rising water, which clears away all the other burnt products outside the bell. The compressed cushion in the bell now expands, and the second outstroke occurs, during which the suction opens the admission valve A to let in the fresh charge as usual, and in addition valve S opens.

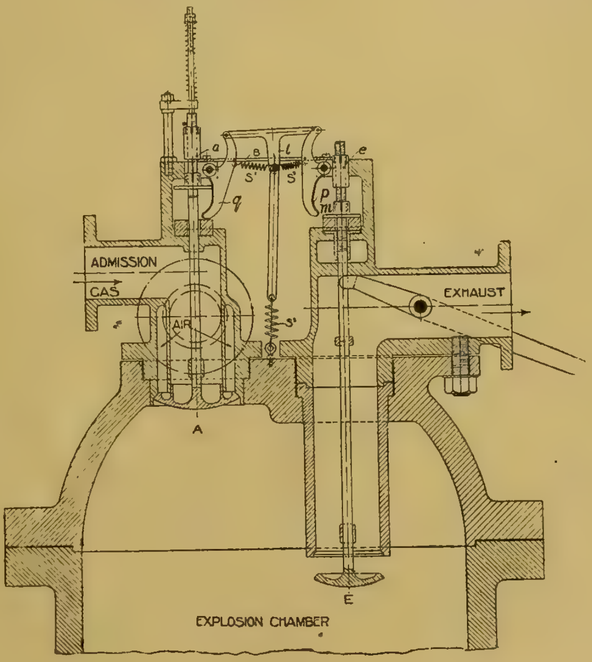

FIG. 8.

The second outstroke, being shorter than the first, does not lower the water to the bottom of the bell, and the pure combustible charge outside the bell does not mix with the products inside. Lastly, the second instroke occurs, and the water rising in the bell forces the exhaust gases out past the non-return valve Q until valve S is reached. The water then shuts valve S, and the return column of water having gained velocity, depending on the volume of gases discharged from the bell, compresses the pure combustible charge outside the bell. Since the volume of the bell is not limited, the water column may attain a high velocity, and so give a high compression pressure, thus ensuring good efficiency.

One other important modification of the single-barrel pump depends for its successful operation upon the fact that in the Humphrey pump the burnt gases are so well cooled at the end of the long expansion stroke that they will not ignite an incoming combustible charge. It therefore becomes possible to have a true two-cycle pump, and the action will be understood by reference to figs. 10a and 10b, which show alternative arrangements of the top of the combustion chamber. Dealing first with fig. 10a, the combustion chamber has to be specially shaped so that the incoming charge, which may be preceded by pure air, displaces the burnt products and mixes as little as possible with them. Thus, in the figure, A is the admission valve at the top of a tall but narrow part of the chamber B, in which the full charge volume extends down to the level *c c*. A number of exhaust valves E lead to a common exhaust outlet O, which may be fitted with a non-return valve, or each exhaust valve may carry a light non-return valve on its spindle as shown. The level at which expansion reaches atmospheric pressures is, say, *f f*, but this level having been reached by the water, its further movement draws in fresh combustible mixture till it occupies the space down to *c c*, and the liquid level has fallen to *g g*. The column of liquid now returns and drives the exhaust products through the valves E (which opened by their own weight) until these valves are shut by the water. The kinetic energy acquired by the column is now spent in compressing the fresh charge, which is ignited to start a new cycle. Thus each outstroke is a working stroke, and no locking gear is required on the valves.

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[*] Paper read by Mr. Herbert A. Humphrey, M.I.C.E., before the Manchester Association of Engineers.

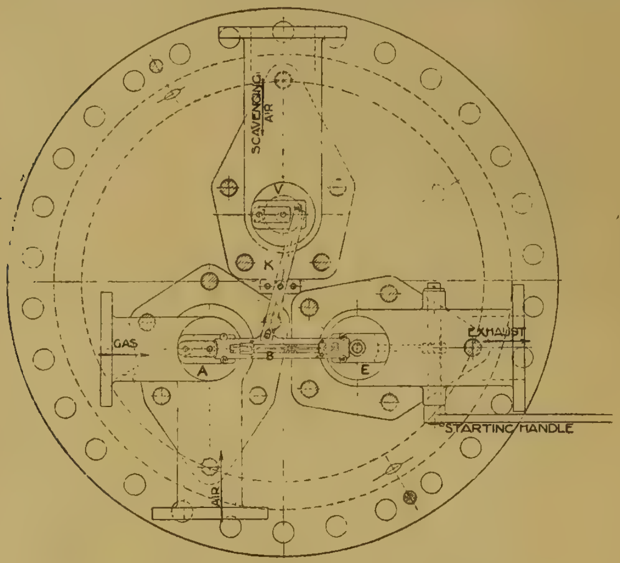


Fig. 9.

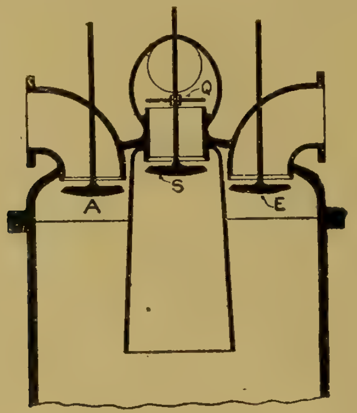


Fig. 10.

The same cycle applies to fig. 10b, but in this case there are a number of admission valves placed in a ring so as to allow the mixture to enter with a low velocity, in order to prevent eddies and mixing with the exhaust products.

The advantages of the cycle will appeal to you at once, as a higher compression pressure is obtained than with the simple pump, and consequently higher efficiencies with the same lift.

Before leaving the simple pump it is necessary to call attention to the fact that if a pump when working is stopped by switching off the ignition current it will continue to complete its cycle up to the point of compressing the new charge, and will pull up, after a few oscillations of the water column, with the fresh charge remaining ready for ignition, to again start the pump when the current is switched on. In starting up from "all cold," a single charge of air is introduced against the head of water by a hand pump or small compressor, and the exhaust valve is opened by a hand lever to allow the air to escape. This starts the oscillation of the column, which automatically shuts the exhaust valve, cushions, draws in a new charge, compresses and fires it, and so the pump gets away under load.

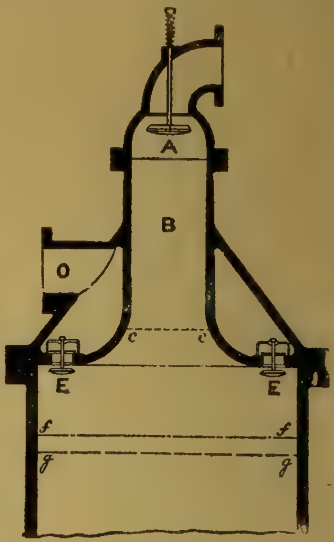


Fig. 10a.

Coming now to the double-barrel pump, diagrammatically illustrated in fig. 11, we have two combustion chambers, A and B, in which explosion occurs alternately. In each chamber we have the usual cycle of compression, explosion, expansion, exhaust, and the taking in of the new charge, thus again involving four strokes of unequal length. In this case, as in that of fig. 10a, the water column has only one outward and one inward movement

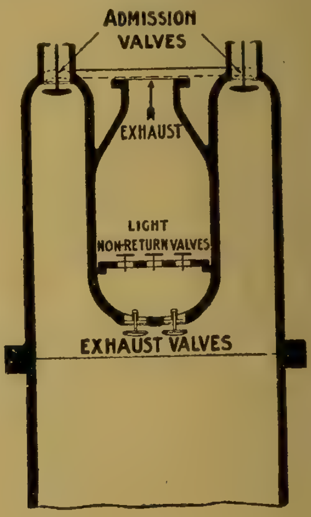


Fig. 10b.

per cycle, but the expression "two-stroke" would here be misleading, unless one remembers that it applies only to the water column, and does not refer to what occurs in the combustion chambers.

Let us follow through the cycle in this case, and we will assume that a compressed combustible charge exists in the top of chamber A, and that B is full of water. Explosion and expansion in A cause the outward propulsion of the water column, and when atmospheric pressure is reached the exhaust valve of A opens, water flows in to follow the column and to rise in A, expelling burnt products, and, there being insufficient pressure to maintain the water in B, the level therein falls, causing an intake into B of a fresh combustible charge. All this takes place during the outward movement of the column of water, and then the column coming to rest commences to return towards the chambers. It finds that the remaining burnt products in A can be readily sent out through the still open exhaust valve, whereas the new charge in B cannot escape, as the admission valve which admitted the charge is now shut under the action of its spring. Consequently the column rises at first in A until the exhaust valve is shut, and then in B compressing the new charge. Ignition in B starts a fresh cycle with the functions of A and B reversed.

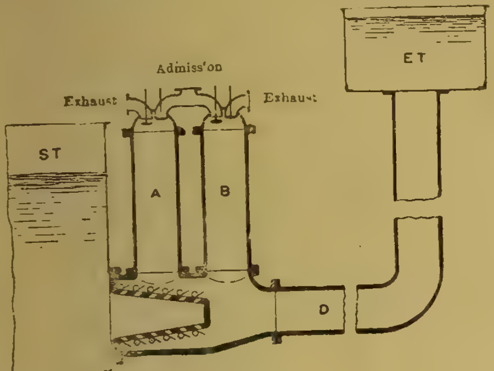


Fig. 11

(*To be continued.*)

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 17th November, 1910.

Barrow.—*First Class :* R. Crumley, R. B. Meares. *Second Class :* F. E. Love.

Cardiff.—*First Class :* C. A. B. Winn. *Second Class :* A. I. Cox, A. B. Davies, A. Fleming, R. W. Gunston, C. A. Payne, D. Smith, A. Walliker, H. Woods.

Glasgow.—*First Class :* O. A. Clement, D. McNaughton. *Second Class :* R. G. H. Kahlcke, A. Ryrie, J. Crichton, J. Munro, H. S. Alexander, A. Lochhead, H. McL. Martin.

Leith.—*First Class :* J. M. Bonar, H. Linton, R. Hutton, D. Innes.

Liverpool.—*Second Class :* C. Moir.

London.—*Steam :* A. M. King. *First class :* F. W. Tims. *Second class :* C. O. Thompson.

North Shields.—*First class :* T. M. Reay, H. Digman, E. R. Walker, J. P. Thompson, M. B. Stokoe, W. J. Chappel. *Second class :* F. E. Gregory, W. S. McGhie.

Plymouth.—*First class :* T. C. Cleave.

Southampton.—*First class :* H. Date, L. C. Prior, R. R. Campbell. *Second class :* C. C. A. Ratcliffe, L. A. Newnam.

West Hartlepool.—*First class :* E. H. Holdforth, T. West, M. P. Crofton, W. H. Hope, J. W. Goding. *Second class :* W. R. Mitchess, J. B. Smithson, J. H. Spawls.

Personal communications for Mr. Philip E. Hodgkin, of the Pulsometer Engineering Co., should now be addressed to him, c/o the Pulsometer Engineering Co. Ltd., 50, Central House, New Street, Birmingham.

AN IMPROVED HAMMER OPERATED BY ELASTIC FLUID.

The improvement relates to an elastic fluid operated hammer of the type in which the supply of working fluid to the working cylinder is interrupted at a predetermined point in the down stroke of the tup piston, so as to prevent any unnecessary wire-drawing effect of the working fluid owing to the velocity of the falling tup exceeding that of the incoming fluid, and the object is to provide improved means operable by the falling tup to cause the supply of working fluid to be interrupted at any predetermined point during the down stroke of the tup.

The improvement consists in a fluid-operated hammer of the above type in which the movement of the valve interrupting the supply of working fluid to the working cylinder is effected by means of a pivoted lever attached to the valve and having at one end thereof a roller adapted to follow a change in contour of the side of the tup during its reciprocation.

The improvement is the invention of Messrs. G. W. Grimshaw and W. Norris, of Messrs. Peter Pilkington Limited, pneumatic engineers, Bamber Bridge, Preston, Lancs., and our illustrations show in fig. 1 the hammer head or tup in its highest position, in fig. 2 and 3 the tup in its lowest position after an ordinary blow and after a dead blow respectively have been struck, and in fig. 4 the position of the valves and gear when the tup is being held down under pressure.

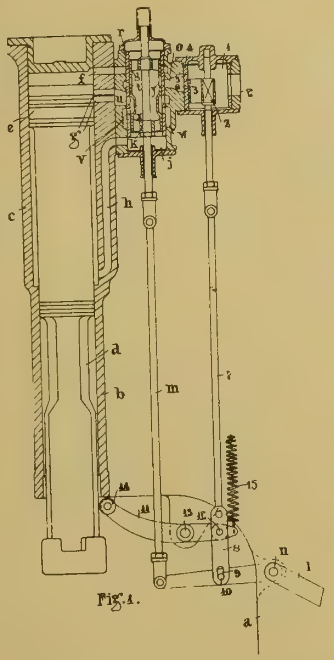


Fig. 1.

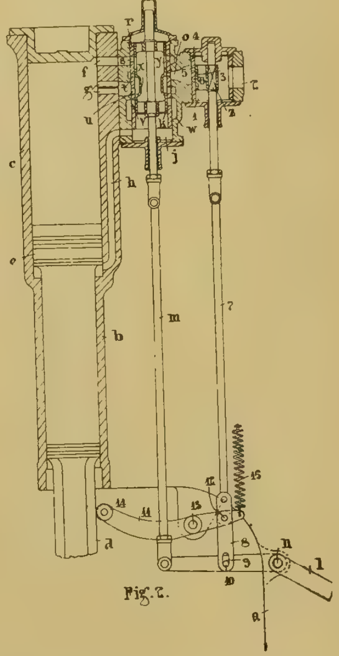


Fig. 2.

The hammer shown is preferably operated by compressed air, and comprises a frame *a* of the general form, having a working cylinder *c* bolted to the frame and cast along with guides *b* for the hammer head or tup *d*. Integral with the tup *d* is a piston *e*, moving within the working cylinder *c*, an annular space being provided on the underside of the piston *e* for the purpose of raising the tup *d* in the manner hereinafter described.

The working fluid, such as compressed air, is admitted to the working cylinder *c* by passages *f*, *g*, and *h*, formed within the cylinder casting and leading to a valve chamber *j*, in which there moves a piston valve *k* controlling the supply of air to and from the working cylinder. The movement of the valve *k* is effected by means of a handled lever *l*, connected thereto by a rod *m*, the lever *l* being pivoted to the main frame *a* at *n*.

Compressed air is conducted to the valve chamber *j* by a passage *o* surrounding a liner *r* placed between the piston *k* and the walls of the valve chamber, the liner *r* being provided with ports *s*, *t*, and *u*, for admitting the air to the working cylinder *c*, and a port *v* for allowing the air exhausted from the working cylinder to pass to an exhaust passage *w* formed in the walls of the chamber *j*.

The valve *k* is mounted on a valve rod, and consists of a hollow cylindrical part open at both ends and having a contracted part or waist *x* and ports *y*.

The stop valve *z*, which controls the admission of air to the passage *o*, is preferably placed in a separate chamber 1, though this, of course, is not essential, air being admitted to the chamber 1 through the passage 2. The valve *z* is mounted on a suitably guided valve rod, and has a port 3 therein, the purpose of which will be seen later. Between the valve *z* and the containing chamber 1 is a cylinder liner 4, having ports 5 and 6 therein leading to the passage *o*, and opened by the movement of the valve *z*. These movements are given to the valve *z* by means of a connecting rod 7, having at its other end a link 8 having a slot 9 therein, in which there moves a projection or peg 10, carried by the handled lever *l*, the link 8 being also attached by a peg 12 to another pivoted lever 11.

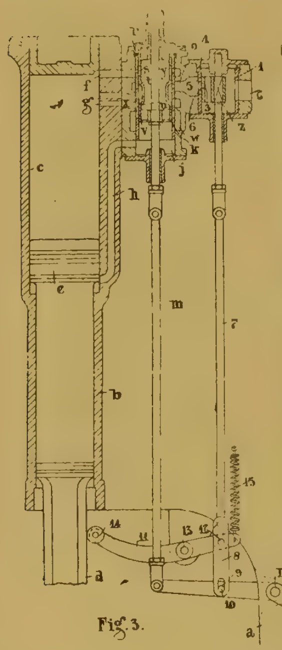


Fig. 3.

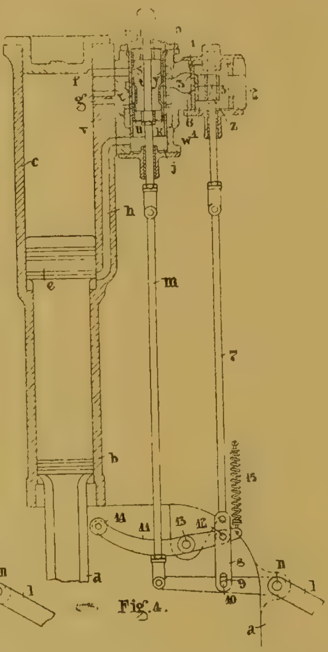


Fig. 4.

The lever 11 is pivoted to the frame *a* at 13, and has a roller 14 which is kept in contact with the side of the tup *d* by a tensioned spring 15, placed at the opposite end of the lever *l* and suitably attached to the frame *a*.

If the surface of the tup *d* with which the roller 14 is in contact is straight, then no change in the position of the stop valve *z* will be effected by a downward movement of the tup *d*. By suitably forming the surface, however, such as by reducing the diameter of the tup at certain points, as shown in fig. 1, it can be arranged that when the tup has travelled down a predetermined part of its stroke, the spring-pressed roller 14 will cause the lever 11 to impart a movement to the rod 7 and stop valve *z*, thus causing the latter to cut off the supply of working air.

The operation of the hammer is as follows:—Assuming the piston *e* to be at the lowest part of its stroke, and the valves *k* and *z* to be in the position shown in fig. 1, compressed air is then admitted to the underside of the tup piston *e* by the passage 2, valve *z*, passage *o*, and port *t*, to the space within the valve *k*, from which the air then passes to the lower end of the working cylinder by the passage *h*. The piston *e* is then raised and drives the air in front of it out through the passage *g*, through the ports *u* and *v*, which are now connected by the space surrounding the waist *x* of the valve *k*, thence to the exhaust port *w*. The exhaust ports *g* are placed at some distance from the upper end of the cylinder *c* in order that they may be covered by the piston before it reaches the end of its stroke and an air-cushioning effect thereby obtained, since the ports *s* are closed by the valve *k*. The position of the hammer tup and valves is now as shown in fig. 1.

In order to obtain an ordinary blow of the hammer, the valve *k* is moved upwards by means of the handled lever *l* into the position shown in fig. 2, the valve *z* being closed. Compressed air then flows in from the space under the piston *e*, through the passage *h*, interior of valve *k*, ports *y* and *s*, and passage *f*, thus causing the piston to descend and give an ordinary blow, no air from the outside having been used.

If a dead blow of the hammer is required, the piston *e* is brought to its uppermost position, and the valve *k* moved to the extreme uppermost end of its stroke, and the valve *z* opened. As before, air enters from the space below the piston *e* and flows to the other or upper side thereof by way of the passage *h*, ports *y* and *s*, and passage *f*, but on the piston *e* descending it uncovers the port *g*, and since the stop valve *z* is now open, more compressed air flows in from the passage *o* and the ports *t* and *u*, which latter ports are connected by the annular space around the waist *x* of the valve *k*. A further descent of the piston *e* and tup *d* causes the part of the latter at which a change of diameter takes place to come into contact with the spring-pressed roller 14, and thus to close the stop valve *z*, which prevents further admission of air to the working cylinder *c* during the remainder of the stroke of the piston *e*, the position of the valves being now that shown in fig. 3, and the valve *k* being unaffected on account of the idle movement 9.

If it is desired, however, to hold the tup *d* on the anvil for any length of time so as to exert pressure on the material being forged, it is only necessary to allow more air to flow into the working cylinder. This is effected by moving the lever *l* upwards, thus causing the valve *z* to move downwards and to open and allow more air to pass into the cylinder *c* by the ports *t* and *u* and passage *g*, thereby maintaining the desired pressure.

MANCHESTER STEAM USERS' ASSOCIATION.—This year's memorandum of the above association has just been issued, and the chief engineer of the association, Mr. Stromeyer, comments on the association's revised "instructions to boiler attendants," and also makes some interesting remarks on smoke nuisance. The view he takes is that the chief trouble from which our large towns suffer is the sulphuric acid that is produced by the burning of ordinary coal. He also points out that efforts at smoke prevention by diluting the smoke with an excessive amount of air, and by reducing the heights and sizes of the chimneys, are expensive and likely to intensify the evil by causing more coal to be burnt. It is far more easy to establish the fact that a large and high chimney has smoked continuously than that a dozen small ones have done so, and yet the latter are infinitely more objectionable than the former. The conclusion of the memorandum recapitulates the results of recent experiments by Mr. Stromeyer, which were undertaken with a view to discovering a test which would discriminate between reliable and unreliable steel. Until recently the position with regard to boiler steel was that only open-hearth steel, which has certain properties, might be used for boilers. The new position is that even open-hearth steel, if it contains more than a certain very small percentage of nitrogen (0·006 per cent), is unsuitable for boilers, and the suitability of this material is therefore still a chemical and not a mechanical question. Attention is also drawn in the memorandum to a danger which cannot as yet be explained, but of which chemical works are doubtless fully aware, viz., that if mild steel subjected to tension stresses is brought in contact with caustic soda it becomes quite brittle. Whether other salts, and especially whether those impurities met with in boiler waters, have a similar effect is not yet known.

PACKING FOR HYDRAULIC PRESSES.

The present status of the hydraulic press is largely indebted to the development of packings for high pressures. The problem of retaining a high liquid pressure within the working chamber without leakage and excessive friction has resulted in perfecting two classes of packings—namely, the self-acting leather and rubber packings that are so commonly found on hydraulic machines, and the hemp or fibrous packings mechanically compressed in a stuffing box. This article, by Mr. A. L. Jenkins, appeared in the *American Machinist*, and we think may be of interest to our readers.

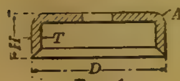


Fig. 1

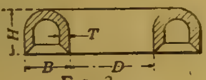


Fig. 2

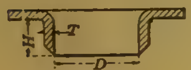


Fig. 3

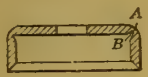


Fig. 4.

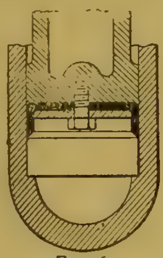


Fig. 5

Fig. 1.—Cup packing.
Fig. 2.—U-packing.
Fig. 3.—Hat or flange packing.
Fig. 4.—Localised wear on packing.
Fig. 5.—Simplest method of using up packing.

Self-acting Packings.—The most perfect packings for rams, plungers, and pistons operating against high liquid pressures, are the cup, U, and hat-leather packings shown in figs. 1, 2, and 3.

The self-acting property of a leather packing is due to the pressure of the liquid acting against the internal surface, causing it to expand against the cylinder or ram with sufficient force to prevent leakage.

At first thought it may appear that the whole depth of a cup leather packing is useful in making the joint, but it is easy to imagine a very long cup made of pliable material with its rim hanging perfectly free, and only a short portion near the point A in fig. 1 forming the joint. To effect a tight joint the pressure of the cup against the cylinder wall must be at least equal to the pressure of the liquid. At the point A (fig. 1) opposite the clearance space between the ram and cylinder, there is no reaction against the packing, and the difference in pressure on the inner and outer surfaces is equal to the pressure of the liquid. Hence, the pressure of the liquid multiplied by the area of the clearance is equal to the total pressure of the packing against the ram and cylinder.

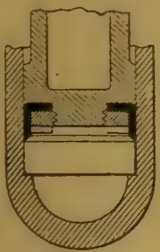


Fig 6

Simple method of attaching packing to ram.

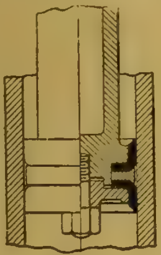


Fig. 7

Double-acting ram fitted with cup packing.

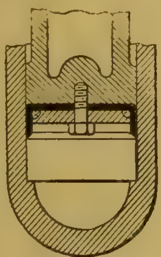


Fig. 8

Application of flax ring to increase pressure of packing against cylinder.

The distribution of the pressure of the leather against the cylinder wall or ram depends upon the pliability of the packing, and is an important factor in determining the dimension H in figs. 1, 2, and 3. Packings made of soft leather or indiarubber have bearing over a very small area on each side of the clearance space, and form very effective joints for high pressures, but are objectionable on account of localised wear, as shown in fig. 4. The wear takes place at A, due to the friction of the cylinder, and the leather is forced out by the pressure, giving an indentation at B. To prevent localised wear a hard-finished leather is used, which distributes the pressure over a greater area. This relieves the wear at the expense of tightness, and it is often necessary to use additional means of pressing the cup against the cylinder. This may be done as shown in figs. 9 and 10, which will be described later.

Leather packings should be made of sound oak-tanned leather, selected from the best part of the butt. If the packing is not subjected to much wear, and is liable to become dry, indiarubber may be used.

The manufacture of leather packings is very simple. The leather is made pliable by soaking in water, heated to about 130 deg. Fah., then pressed into the desired shape with a set of cast-iron dies forced together by a screw or hydraulic press, the mould clamped and placed in a steam-heated oven to dry. When the leather becomes hard and dry it is trimmed to an angle of 45 deg. In joining these packings, considerable stress occurs at the point A (fig. 1), and as this stress increases with the depth of the cup, it is inconsistent to make it much deeper than tightness demands.

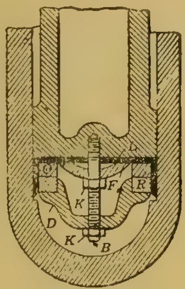


Fig. 9

Details of adjustable packing.

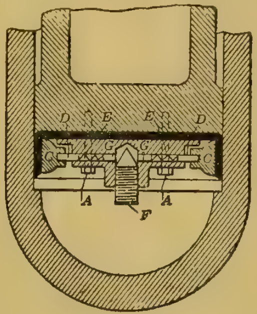


Fig. 10

Details of an adjustable packing.

Cup Packings.—The simplest application of the cup packing to hydraulic presses is shown in fig. 5, it being secured to the end of the ram by a large washer and cap screw. This is only satisfactory for very small cylinders and comparatively low pressures. Another method very similar to this is shown in fig. 6, there being very little essential difference. Fig. 7 shows an arrangement that is sometimes used on horizontal and inverted presses for returning the ram.

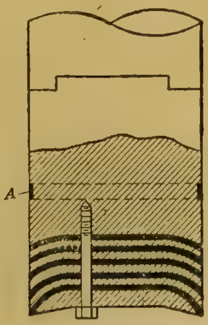


Fig. 11

Packing used for 105,000 lbs. pressure per square inch.

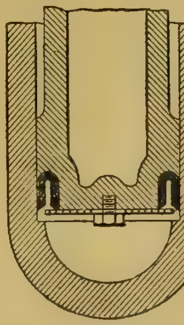


Fig. 12

U-packing on end of ram.

For high pressure it is necessary to use some mechanical means of expanding the cap against the cylinder wall, and this may be very simply done by compressing a piece of hemp packing against the inside of the cup by a washer, as shown in fig. 8. Fig. 9 shows a method used for expanding the packing on rams less than 8 in. in diameter. It consists of a rubber or braided flax ring R, compressed between the iron ring O and the cap D by tightening the lower nut K on the stud B. This causes the ring R to expand the lower portion of the cup against the cylinder, and thereby effects even wear of the packing. The washer F is forced against the leather by the upper nut K, and compresses the hemp packing in the space L to prevent leakage around the stud. Rams 8 in. in diameter and over are provided with a long stud, which extends from the lower nut K to the top of the ram, thereby providing a means of tightening the packing without removing the ram.

Another method of expanding the packing is shown in fig. 10. The screws A clamp the packing to the bottom of the ram with the plate B. The expanding ring C is made in six segments, each of which is provided with a rod D, which is forced outwardly by the action of the spring E. The thrust of the springs is regulated by the conical-pointed pins G. Large cylinders are provided with a tee-fitting at the bottom, which permits the insertion of a special wrench for adjusting the screw F.

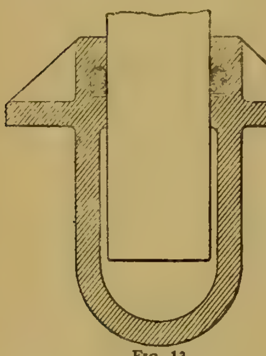


FIG. 13

U-packing in wall or neck of cylinder.

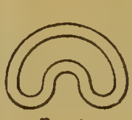


FIG. 14

U-packing bend for insertion in cylinder.

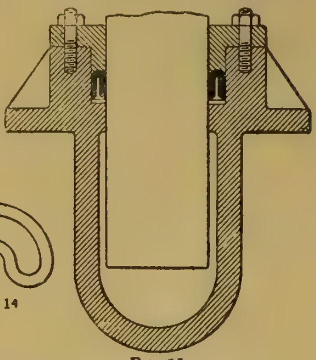


FIG. 15

U-packing in neck of cylinder with gland.

Fig. 11 shows the lower end of a ram used on the Huber forming press, built at the Krupp works. The ring A is of copper, and packing consists of alternate layers of brass and leather so arranged as to be self-acting. This packing has met the requirements for high pressure by operating successfully against a pressure of 105,000 lbs. per square inch.

U-Packings.—The U, or double-cup, packing, was invented by Benjamin Hick, and was used by Bramah on the first hydraulic press. Fig. 12 shows the application of this packing to the end of the ram, in which case the cylinder is lined or finished the same as for cup packing. In fig. 13 the packing is placed in a cavity near the top of the cylinder by bending it as shown in fig. 14. This construction is not expensive, but there is some difficulty in getting the top of the cavity bored to fit the packing, and it is also difficult to replace the packing. A better practice is to use a gland in the neck of the cylinder, as shown in fig. 15. For all U-packings there should be $^1/_{16}$in. to $^3/_{16}$in. clearance in the bottom of the cavity to allow the liquid free access to the interior, and the annular space between the inner walls should be filled with hemp or other material to keep the packing in shape and force it against the ram when the pressure is off. A wood or brass ring is sometimes placed within the packing to prevent it from striking the bottom of the cavity when the ram returns. Large packings are sometimes provided with an internal brass ring, as shown in fig. 16. A brass guard ring A (fig. 16) was introduced by Tweddell to prevent wear, but is seldom used. A pad of fibrous packing inserted above the leather is considered good practice when the gland does not fit the top of the packing.

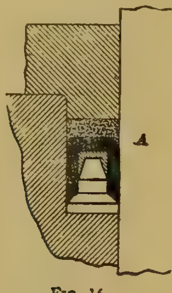


FIG. 16

U-packing with internal guard and flax pad.

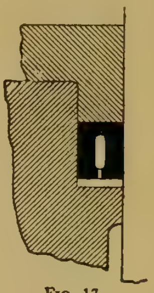


FIG. 17

Indiarubber U-packing.

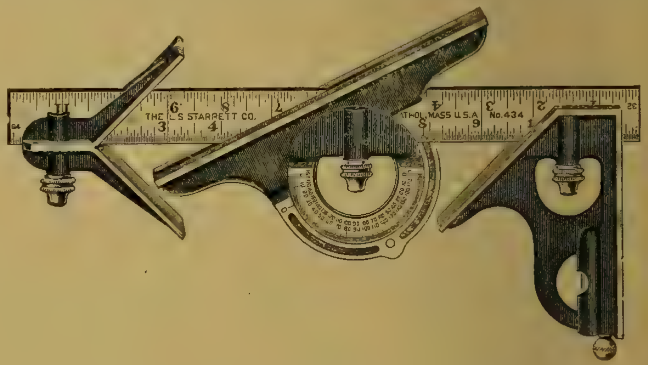
Fig. 17 shows an indiarubber packing that consists of a hollow ring, rectangular in cross-section, provided with holes in the bottom permitting the liquid to enter the interior. U-packing made of rubber and cloth, having about the same composition as rubber belting, is satisfactory for moderate pressures of water. It is difficult to secure a piece of suitable leather that is large enough to make packing over 30 in. diameter. In such cases the leather is cut in strips about 2 in. wide, and spliced with chamfered joints about 5 in. long. The laps are then stretched across one edge, forming a belt-like ring, equal in diameter to the recess in the cylinder. The edges are tapered, the leather soaked in water, then bent by hand into the U form and inserted in place.

(*To be continued.*)

A NEW COMBINATION SET.

A VERY handy little combination tool, as shown in our illustration, has been lately brought out, which should be greatly appreciated by mechanics. The combination set has been designed by Messrs. L. S. Starrett and Co., of 36-37, Upper Thames Street, London, E.C. The scale of the set is case hardened and graduated with heavy figures reading both ways, and the heads are of drop forge steel hardened.

It will be noticed that the protractor head extends both sides of the blade. This greatly improves the usefulness of the tool, as the same angles may be transferred from either side of the frame without re-setting. Another improvement is that the turret is graduated to read both ways, from 0 deg. to 180 deg. This latter feature is one of considerable importance to mechanics, as direct readings may be had from the turret, indicating the supplement of the angle, as well as the angle required. The fact that there is but one zero line on the frame, moreover, eliminates all possible chance of confusion as to whether acute or obtuse angles are obtained. The head of the protractor is 7 in. long, and is supplied with an accurate level attached to one side of the frame.



JAPANESE UNITS.—Japan has been a metric country for several years, but the new tariff uses kilograms and "kins" with impartiality, "kin" being the native unit and weighing about 1·32 lbs. The difficulty in upsetting units which have been the standard for many years will readily be seen.

PRACTICAL NOTES ON MAKING AND DRIVING REINFORCED CONCRETE PILES.

By Vere Sussex Hyde.

Owing to the fact that reinforced concrete piles are immune from the attacks of seaworms (*linmonia terebraus*) and other destructive agencies, and that they may be moulded in any length and any section, and can be jointed up by an absolute monolithic joint, and thus driven to almost any depth, they have many advantages over the timber pile.

The writer proposes in this article to deal with the practical side only of making and driving ferro-concrete piles, and he trusts this may be of a little assistance to those who have the supervision of this work while in progress.

The first thing to be done is to make the steel skeleton framework. For this purpose it is necessary to take the rods, which have already been sorted out on the works, and have any bends, curves, or twists taken out, but no heating is to be used for this purpose. When this is done the wire workers should be set to frame up the skeleton, adhering strictly to the engineer's drawings detailing the manner of the reinforcement. While this is in progress the joiners should be set off to prepare the necessary number of moulds, which may be laid down side by side to facilitate the concreting. The moulds should be constructed of good, dry, straight timber, not less than 1½ in. to 2 in. in thickness, wrought on the inside face, and properly and securely braced where necessary.

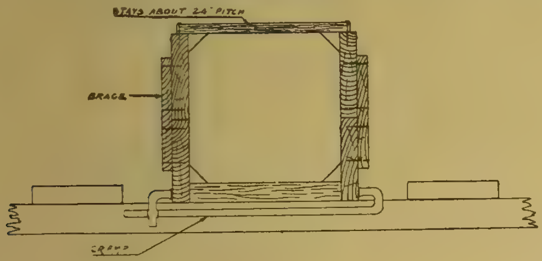


Fig. 1.

Moulds.—Some systems advocate the use of a square pile, and others a round. The mould required for a square pile is a very simple matter, constructed with three sides, the uppermost side being left open for placing in the steel skeleton and concreting. It is essential, however, that the mould should lie perfectly level, and that the skeleton be securely suspended in the correct position and dead level, so that it may be entirely surrounded by concrete. The ends of the rods must be properly placed in the cast-iron shoe at the end of the mould (fig. 1).

For a round pile a mould is constructed with two circular sides or cheeks, made with narrow battens after the fashion of a barrel, bound with iron straps, with two flat sides, so that when the pile is complete it has two flat surfaces, wide enough to lay flat up against the leaders of the piling frame to facilitate the driving (see fig. 2).

In forming this mould a straight plank is used, through which bolts are passed about 2 ft. apart for the purpose of holding down the straps which bind the circular sides. This plank is laid down dead level on sleepers. The skeleton frame is next laid on this plank, and then the circular sides or cheeks are attached and bolted through the straps at the top, as shown in the sketch. The open space at the top is the same width as the bottom flat plank. The opening is left for the concreting.

The same shape mould can also be made without iron straps by using semi-circular wood template, to which the narrow battens are fixed; the two sides are held together in the same manner as in the case of square piles, by nailing short stays on the top side, as shown in fig. 3.

As in the case of the square pile, the skeleton framework is suspended by hooks to the top bolts to keep it in the correct position. The hooks are removed when the concrete is half-way up the mould, so that there is no chance of the steel framework getting disturbed from its correct position.

Concreting.—For the concreting of piles it is advisable to use a suitable rammer with rounded shoulders, about 1½ in. to 1¾ in. breadth at the base, and not in the form of a golf club, as with the latter there is a tendency to frequently catch the reinforcement, which is generally of a close form in ferro-concrete piles. The ramming or punning must be very thoroughly performed, and keen supervision should be exercised, so that when the concreting is completed the whole is a compact monolithic and non-porous mass. Under ordinary circumstances the moulds may be removed in four or five days after concreting. In hot weather it is a good practice to daily water the piles with an ordinary watering pot and rose for about a week or 10 days, say 10 hours after completing concreting. A well-made pile may be safely driven seven weeks after making, but the longer it is permitted to remain undisturbed the better, the reason being obvious. In practice, the following specification for concrete to be used for pile making will be found a good one:—27 cube feet of good Thames or river ballast, entirely free from all loam or blue clay, and in no case larger than that which will pass ⅜ in. mesh; 13½ cube feet of clean sharp sand, free from salt and other impurities, the grains to be of various sizes; 7½ cwts. of high-grade cement of the British standard specification. "Ferrocrete" of the A.P.C.M. may be considered one of the best and most reliable. The concrete mixture, if properly mixed and rammed, will make up a volume of 31 cube feet.

However, the writer has found that in cases where a wooden dolly alone is used without a cast-iron helmet for pile driving, it is advisable to strengthen further the head of a pile for about 2 ft. down with a stronger mixture than before mentioned, the aggregate for this purpose to be composed of two parts of granite chippings, free from all granite dust and washed, and not larger than that which will pass ½ in. ring; one part of clean sand as before, and one of cement, making a concrete of two to one, and one otherwise three to one concrete. Concrete thus proportioned sets like a rock, and will not be damaged by driving when no helmet and cushion is used.

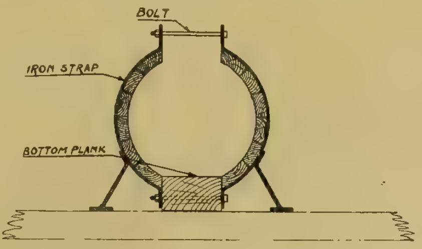


Fig. 2.

Ferro-concrete piles are driven with a special pile-driving machine or engine, among the best known being the Lecours, Sykes, and Lingerwood. These drivers are generally fitted with a two-ton monkey or ram, which is hoisted by a steam winch. The ram can be driven at various speeds up to 30 blows a minute, and may be regulated and pulled up in its fall if necessary. Care and judgment must be taken in driving with steady, uniform blows, with a short drop, otherwise damage may be done by splintering or cracking the pile head, however good or hard the concrete may be; but with a reliable ganger driver, who will exercise care, piles may be driven without a crack.

Owing to the great weight of a long pile, say 35 ft. to 45 ft. in length, special arrangements should be made for careful handling, hoisting, and placing in position for driving.

When a pile has been hoisted to its position, it must be plumbed up, then bolted on, or rather through, the two leaders of the piling frame, and then plumbed up again before any blows are given.

In the case where a cast-iron helmet is used, it is necessary to make a strong cushion of sawdust in sackcloth, and to pack it inside the helmet, to relieve the head of the pile from the severe impact caused by the fall of the ram, thus saving the head of the pile from shattering, or being otherwise severely punished. When a helmet is not specified for driving, an elm block or dolly about 3 ft. high should be placed on the head of the pile for the same reason for which the helmet is used.

When everything is ready, the pile driver proceeds with the driving, which may be regulated as the case necessitates, and drives until the specified set is reached; the set or test to be as stated in the engineer's or architect's specification.

The usual test is that the pile does not sink more than $\frac{1}{2}$ in. or $\frac{1}{4}$ in. under 10 blows of a two-ton monkey at a drop of 3 ft. The test is, of course, always regulated according to the conditions of the soil and strata through which the pile has to penetrate.

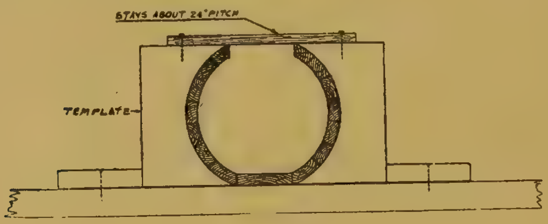


Fig. 3.

The testing of a ferro-concrete pile is obviously one of the most important points to be considered during the excution of works on which piles are being driven, and one which is open to much abuse. The writer desires to take the opportunity of pointing out a few necessary precautions when taking the set of a pile, and thus illustrating how a set or test can be "faked" and generally juggled with.

For measuring the test, it is necessary that the distance should be determined for the drop of the monkey or ram to the head of the pile. This should be clearly marked on the driving frame, so that it can be seen that the ram is hoisted to the right height for each blow. For marking the pile a gauge rod is hung from the leaders of the piling frame so that it may swing; a line is drawn with a pencil on the pile at the level reached by the bottom of the gauge. The specified number of blows is then given, and the pile is again marked with a pencil with the aid of the gauge. The space between the two lines thus marked on the pile determines its going after receiving the blows.

It is necessary for the clerk of works or inspector to observe very minutely the following points when called upon to witness and pass a test:—

(*a*) To note that when a helmet is used for capping a pile, the sawdust cushion is the same one which has been used in the driving, and that it has not been replaced by a new one, or that a new one has been packed into the helmet and the old one placed under it, so that on looking up into the helmet he sees the old cushion apparently undisturbed. This little ruse has come under the writer's notice on several occasion; it is quite obvious that under these conditions a pile does not get the full benefit of the blow.

(*b*) To see that the ram is raised each time to the height marked on the piling frame, and that the men holding the ropes do not regulate the fall of the ram, so that it loses its force just before striking the head of the pile. He should take the precaution of putting the ordinary measuring rule over the gauge rod used for marking the fall of the ram. I have known this gauge to have been shortened an inch or two unobserved after being passed as correct, with the hope that having once been passed, it would not be measured again.

(*c*) Another very cute device that has also come under the writer's notice is that when drawing the lines on the pile with the aid of the gauge, the pencil is held at an angle from the latter instead of at right angles, thus drawing the lines closer together; the only remedy is for the clerk of works or inspector to insist on marking the piles himself.

(*d*) When pile driving is being carried on at night, a very keen look out must be kept to see that the pile shoes are not tampered with or knocked off preparatory to lowering them into position for driving.

Piles are as a rule placed in groups of two, four, or six at the points where the weight has to be supported. It will occasionally be found that in driving, the first pile of a group may be driven right into the ground, and then will not take the set, going always, say, $^{1}/_{16}$in. to $\frac{1}{4}$ in. more than allowed. In such an instance, the following method may be employed to get it to pass the test. That is to stop driving the pile and drive the one next to it, then return to the former pile next day and give it 120 blows with a 3 ft. drop before applying the test.

In the majority of cases the pile will not, under these circumstances, go more than $^{1}/_{16}$in., and probably not that. This would, I think, satisfy most engineers.

AN IMPROVED STEAM ENGINE VALVE CHAMBER.

The inlet and exhaust valve chambers for steam engines described in this article are of an improved construction whereby the valve chamber and valve seat will be of symmetrical construction and subject to uniform conditions of temperature and pressure, thereby obviating any distortion of the valve chamber or of the valve seat. With this object the chamber within which the valve seat is fitted is formed with two concentric cylindrical walls separated by a cylindrical space, to which the steam has free access, so that the inner cylindrical wall, which is of uniform circular section, is entirely surrounded by steam, so that all external points are subject to the same temperature and pressure, and also all internal points for all working conditions are exposed to the same temperature and pressure, which, however, will obviously in general be different from those existing externally. In order that the free end of the inner wall carrying the valve seating can expand and contract symmetrically and independently of the expansion or contraction of the outer wall, there is no direct connection by ribs or the like between this free end of the inner wall and the outer wall.

In previous constructions, in which the valve seat casings have been entirely surrounded with steam, such casings have not been made of uniform section throughout their length, but have changed from the circular to the oval or rectangular, or other forms or ribs have been provided, in all which cases distortion occurs on change of temperature causing the valve to stick or to leak. The present construction obviates these drawbacks, and is of more special importance when piston valves either of the drop or positive control types are used, since a very small change of shape in the valve seating will cause valves to stick, but the improvement is also applicable to double-beat equilibrium valves.

The improvement is the invention of Messrs. Galloways Ltd., Knott Mill Ironworks, Manchester, in conjunction with Mr. H. Pilling, and is shown in our illustration in fig. 1 in transverse section through the valve chamber, and in fig. 2 in part side elevation, partly in section, through the centre of the valve chambers at one end of the cylinder.

As shown, the inlet valve chambers (and this may also apply to the exhaust valves) are cast integral with the sides of the cylinder at the two ends thereof, and are double-walled, the inner wall *a* forming the enclosure for the removable valve seating *b*, which may be fixed in place in any usual and suitable manner so as to fit snugly within the inwardly turned edge a^1 of the inner wall *a*.

Between the inner wall *a* and the outer wall *d*, which is surmounted by the cover *c*, is a cylindrical annular chamber *e* of uniform circular section throughout its length, opening into the space above the piston valve *f*, and thence communicating by steam duct *g* along the top of the cylinder and side belt *h* (fig. 1) with the steam inlet *i*. It will be apparent that the symmetrical construction of the wall and symmetrical distribution of steam on each side of the inner wall *a* which is obtained by this construction ensures that the pressure and temperature conditions are similar at all points of the external surface, and also at all points of the internal surface of the inner wall, that expansion and contraction of the symmetrical inner wall acts uniformly, and that consequently any distortion of the wall *a* and valve seat *b* is obviated. The valve, valve gear, and dashpot are of known construction, and need not be described.

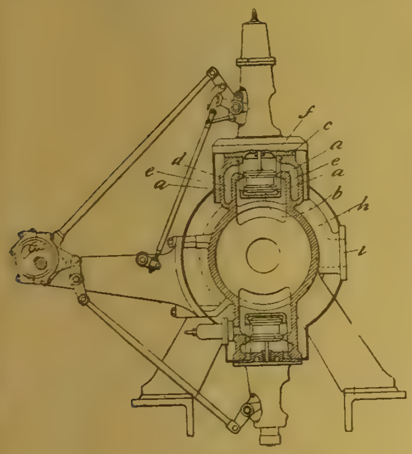


FIG. 1.

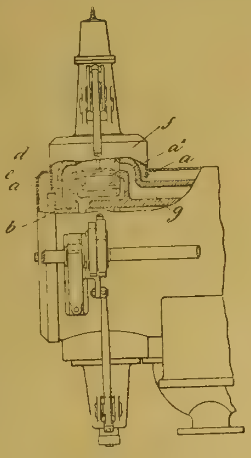


FIG. 2.

It will be seen that the improvement consists essentially in a valve chamber for steam engines having a double wall enclosing a cylindrical space bounded by two concentric cylinders of uniform circular section throughout their length adapted to maintain all points on the same side of the inner wall at uniform pressure and temperature, and to allow the inner wall carrying the valve seating to expand and contract independently of the outer wall, so obviating any distortion of the valve seatings.

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"The Indicator Handbook." A Practical Manual. By C. N. Pickworth. Part I. Fourth Edition, Revised and Enlarged. Manchester: Emmott and Co. Ltd. Price 3s. net.

THIS book has been brought to our readers' notice so many times that it is only necessary to give it a passing notice. Opportunity has been taken in meeting the demand for a further edition to revise it and add new matter. The type has been re-set, and the blocks are well re-produced. Throughout the information is of a practical nature, and the book is well deserving of a place on the engineer's bookshelf.

"The Business Man's Guide." The numbers of matters upon which it is necessary that a business man should be well informed, and, what is more important, should have definite knowledge, is so great that he cannot be expected to retain them in his mind. Thus it is that a compendium of information judiciously collated and clearly explained is indispensable to meet the requirements of everyday transactions. Mr. J. A. Slater has brought together under one cover just those terms and their full meanings which enable office officials to carry on their duties satisfactorily. For instance, everyone knows what an "endorsement" is, but few could describe all it implies; not many are familiar enough with the Factory and Workshop Act to deal with any matters arising out of it without reference; and so with other phrases and terms. The articles are arranged alphabetically, which dispenses with an index, are about 500 in number, and come under the following principal subjects: Banking, bankruptcy, bills of exchange, book-keeping, commerce, companies, financial, geography, insurance, law, shipping, stock exchange.

The edition now before us is the fifth, an indisputable testimony of its value. Besides being a time saver, it is a money saver, and as a ready reference has no equal. The price is 3s. 6d. net.

Closely allied to the above is a new work by the same author, Mr. J. A. Slater, B.A., LL.B. (Lond.). It is intended as a public man's guide, and of interest to all those who are concerned in questions of the day. The book follows on exactly the same lines as its older companion, but is more diversified in its subjects. All terms that are likely to be met with in connection with public matters are explained with a degree of legal accuracy that could only be expected from an experienced author as Mr. Slater. In quoting one or two terms we may mention the following: Abjuration, barratry, dispensing power, statistics of limitation, right of search. These but inadequately indicate the scope of the book. The articles chosen are those mostly related to political, imperial, ecclesiastic, diplomatic, and municipal matters, the whole comprising a dictionary which a public man can ill afford to dispense with. The book covers some 444 pages, and sells at 3s. 6d.

The two volumes are published by Sir Isaac Pitman and Sons Ltd., and each is a complement to the other, the two together constituting an admirable encyclopædia.

BOOKS RECEIVED.

"Mechanical Engineering for Beginners.' By R. S. McLaren. Second Edition, Revised. London: Charles Griffin and Co. Ltd. Price 5s. net.

"Tool Making." A Manual of Practical Instruction. By E. R. Markham. London: Crosby Lockwood and Son. Price 6s. net.

"Official Gazette of the United States Patent Office." Vol. CLX., No. 1. Published by Authority of Congress, Washington.

"Milling Machines and Milling Practice." A Practical Manual. By D. de Vries. London: E. and F. N. Spon. Price 14s. net.

TRADE CATALOGUES.

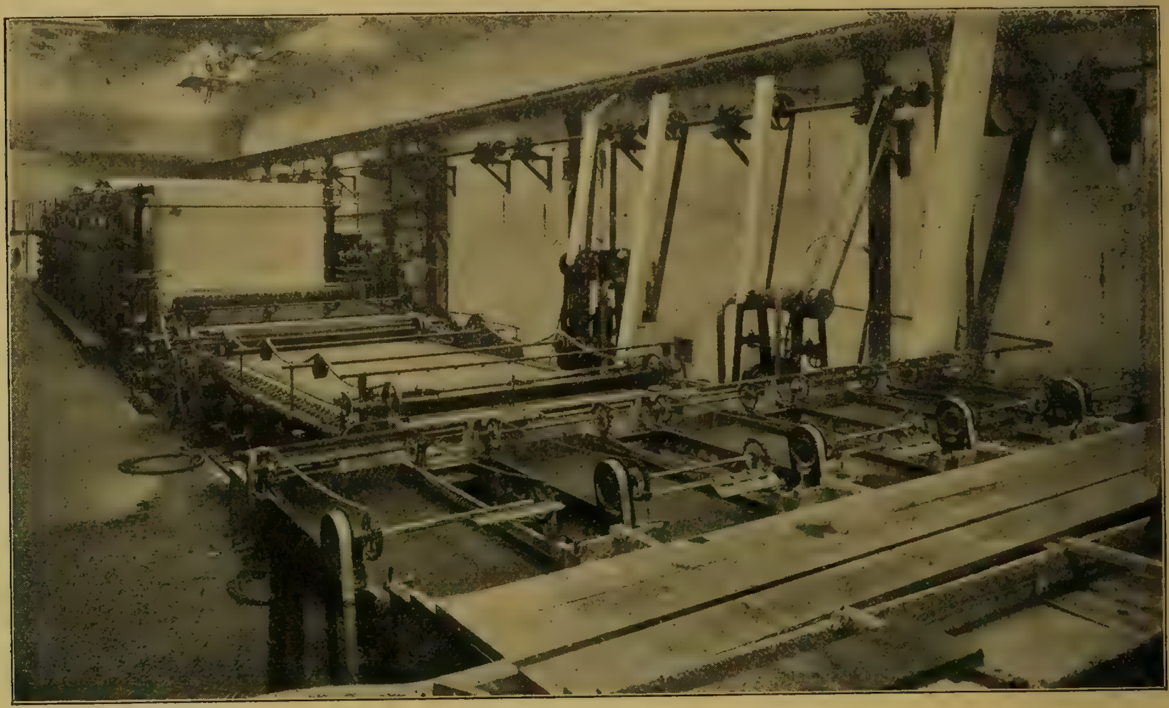
WE have received from **Messrs. W. P. Butterfield Ltd.,** Galvanising Works, Shipley, a copy of their monthly list of riveted galvanised cisterns in stock November 1st.

WE have received from **Messrs. E. G. Appleby and Co.,** 10, Victoria Street, London, S.W., copies of a circular and pamphlet descriptive of the "Kerpely" gas producers, the sale and manufacture of which they control for this country.

Messrs. Siemens Brothers Dynamo Works Ltd., of Caxton House, Westminster, have sent us an interesting catalogue, reprint A 83901-84669, dealing with arc lamps for continuous and alternating currents.

A LARGE PAPER-MAKING MACHINE.

THE illustration below shows a large installation of paper-making machinery which has recently been introduced by the proprietors of the *Daily Telegraph* at their paper mills at Dartford-on-Thames. One of the most interesting features in the design of this plant is the incorporation of a refining engine, making it a component part of the paper-making machine. This refiner is introduced between the high stuff chest and the mixing box, the quantity of pulp being regulated before it enters the mixing box, and is of the "Sciennes" new type, having specially-designed discs arranged to deal with a large quantity of thick pulp. The case is made in halves, so that access can easily be had to the interior. The adjusting gear is of a new type, making adjustment accurate and delicate. The refiner is capable of passing over one ton of dry paper per hour, and is driven from the back shafting engine, the exhaust steam being used for drying the paper. From the mixing box, which is of special design, the pulp passes over the sand tables to five flat strainers, each with brass vats, having specially-designed inlet and outlet channels, which simplify the spouting and ensure cleanliness. Each strainer is also fitted with improved scraper gear for keeping the surface of the plates clean, the refuse removed from the plates being carried along a channel to an ordinary jog auxiliary strainer. The pulp is fed from the strainers to the wire frame through a breast box. The wire frame carries a wire 134 in. wide by 60 ft. long, and is arranged so that the breast roll can be raised to any desired extent, should this be considered necessary, while the breast roll is of special make to ensure lightness and rigidity. The deckle has large pulleys and stiff deep slices. The frames are also arranged with special scrapers to keep the inside of the straps dry and prevent splashing. Constructed of aluminium, carried on strong brass bars, the vacuum boxes are all arranged so that a box can be taken out when the machine is running without difficulty. The couch rolls are of brass, the top roll being carried in special lever arm brackets. The guardboard is of the swivelling type. The press rolls and felt-washing rolls are of brass and iron, and the wet felt rolls of copper. Of a specially neat, open-faced design, the press roll brackets are arranged with levers and weights for giving pressure, and the leading rolls at the wet end are of the "Sciennes" patent type, arranged to relieve the paper of all strain. These rolls run slightly faster than required when the paper breaks, thus running up the slack quickly when the end is put over, and are of great assistance to the attendants leading paper over wide fast-running machines. There are 20 drying cylinders, each of 16 ft. circumference and weighing 5 tons each, which are driven by means of spur wheels and carried in roller bearings. There are four felt-drying cylinders, also carried in roller bearings. The steam and exhaust connections are of the "Sciennes" patent type, fitted at the back of machine, and each cylinder and felt dryer is fitted with special water-lifting buckets and water traps. Each cylinder and felt dryer is also provided with a patent steam trap, which separates each cylinder from its neighbour, and allows only water to escape. Along the front of the cylinders there are two platforms—the under one for leading the paper along the cylinders, and the upper one to enable the attendant to have access to the various rolls and bearings overhead. The calender is fitted with chilled rolls, carried in open-faced frames and ring-oiling bearings, and each roll is fitted with a doctor and a special air-blast arrangement to cool the paper. The reeling-up gear enables heavy reels to be turned round and changed without any exertion on the part of the attendant. The machine is driven by means of two compound high-speed engines, made by Messrs. Ashworth and Parker, the engine for the machine being fitted with a rope flywheel, and driving the various parts by means of an expanding rope pulley gearing with machine-cut wheels. The rope is automatically stretched by means of a carriage and a dead weight, so that the tension is always uniform. The engine and gearing are arranged to run the machine up to a high speed, should this ever be required. The back shafting engine runs at a constant speed, and drives a shaft which extends from end to end of the machine house, driving the

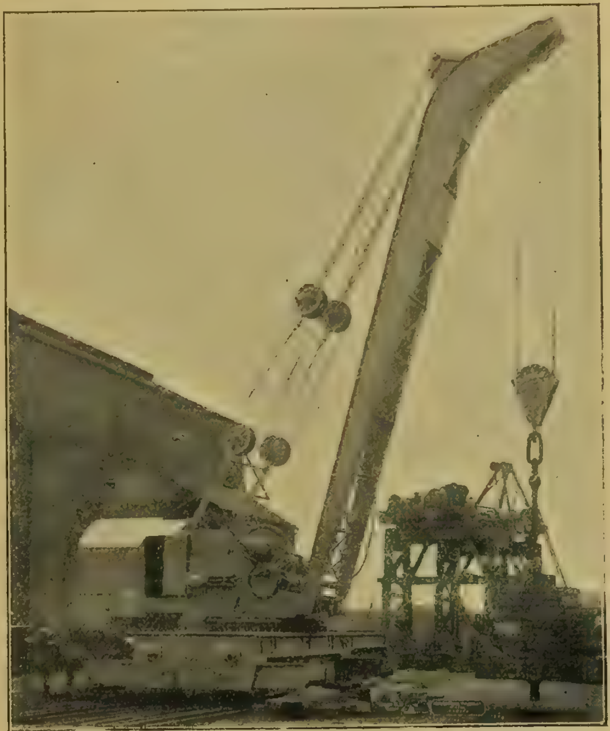


134-INCH PAPER-MAKING MACHINE AT THE DAILY TELEGRAPH PAPER MILLS, DARTFORD.

refiner, stuff chests, pumps, etc., at one end, and the reeling machine at the other end. It also drives the fans for air blast, a dynamo which provides the electric light for the building, the power for travelling crane, fans, and also for some small outlying plant in the mill. The arrangement of taking power from the back shafting engine was introduced on this machine for the first time, and the power available from this source is more than sufficient for the machines named above. The machine, under all circumstances, is able to consume the steam in drying the paper. There is never any waste steam to blow off. The result of this arrangement, combined with the excellent arrangements throughout the mill, has brought the coal consumption down to an exceedingly low figure per ton of paper. The stuff pumps are of the plunger type, of very heavy make, and designed to work under a high head, while the backwater pump is of the "Sciennes" special centrifugal type, all of brass, with copper piping. The vacuum pumps have four plungers, all arranged to be driven by one belt, connected up with copper piping. The excess-water pump is of the centrifugal type, so arranged that it takes all the pulp from below the wire, and delivers it to a specially-constructed tank in the beater house, thus ensuring no waste and no labour in connection with keeping the pit below the wire frame clean. Over the machine is a 7-ton electric crane, which is capable of handling any part of the machine. The re-reeling machine is placed at the dry end of the machine. The reel of paper from the paper-making machine is put in special brackets, the paper being led over a leading roll, which operates an automatic brake. This brake maintains a perfectly uniform tension on the web from start to finish of the reel. It then passes over a measuring roll, attached to a counter; then from the slitting knives and over leading rolls to the winding-up drum. The reeler arms are arranged to discharge the webs on to the bogies, and ample freedom is given to the attendant to get at all the webs without difficulty. The machinery above described was designed, manufactured, and erected by Messrs. Bertrams Ltd., of the St. Katherine's Works, Edinburgh, to the requirements of, and acting in conjunction with, Mr. Greig, the manager of the paper-making department at Dartford.

A BREAKDOWN CRANE FOR THE G.W. RAILWAY.

The Great Western Railway Co. has taken delivery of a 36-ton steam breakdown crane, constructed by Messrs. Ransomes and Rapier Ltd., Ipswich. This crane, as illustrated, has had incorporated in its design several important features. It is mounted upon five pairs of wheels and axles, two pairs being in a bogie. The wheelbase is 21 ft. 3 in., and that of the bogie 5 ft. 6 in. The top part of the crane, which revolves entirely upon the live ring of rollers, is held to the carriage by means of a steel bolt or pin. The absence of a centre post permits of the loads upon the rollers being accurately determined. The main members of the carriage are the box girders, and, being above the springs, the width over them is the full width of the loading gauge, thus enabling a roller path of the maximum diameter being employed. Two sets of propping-up girders only are employed, and these are arranged in pairs, the end of each girder being fitted with a screw-jack for convenience and speed in packing up the crane for heavy lifts. The rollers for the live ring are of wrought steel, and work between a cast-steel path bolted to the carriage and a cast-steel bedplate forming the base of the revolving part. Two of the axles are driven by worm and spur gear. This gear is driven by a shaft passing through the centre pin. Screw-operated clutches are provided for the gear, so that it can be easily disengaged when the crane is to be taken over the line. A screw brake is provided acting on four wheels. This brake is operated from either side of the carriage. The arrangement of the gearing is such that only the train of wheels for any particular motion is in operation when the motion is required. All gearing is of cast steel, the teeth being machine cut. The cylinders are horizontal, 9in. diameter by 14in. stroke, and have link motion reversing gear. The multitubular boiler is 4 ft. 8 in. diameter by 7 ft. 2 in. high, and works at 80 lbs. per square inch. Both donkey pump and injector are fitted for feed. The load is lifted on a four-part extra flexible steel wire rope, one part being wound on a grooved barrel. The jib is derricked by a 10-part extra flexible steel wire rope, two parts being wound on a barrel grooved right and left hand. The two members of the jib are braced together with steel sections and bars, while the height at 20 ft. radius is 45 ft. to centre of pulley. In order to reduce the travelling weight of the crane a portion of the counterbalance weight is detachable. The removal portion is lowered by means of screws on to the back part of the carriage; the crane is then swung round and the weight is lifted by means of the crane's own load gear and hook and special chains hooking into eyes formed on the counterweight. The weight of the crane in travelling order with jib resting on match truck and the propping girders and removable tailweight in trailing truck is about 70 tons, and in working order is 86 tons. The working loads are: 36 tons at 20 ft. radius, 32 tons at 25 ft., 25 tons at 30 ft., 20 tons at 35 ft., and 16 tons at 40 ft., all propped up. The crane can travel with the jib in any position with the following: 14 tons at 20 ft., 10 tons at 25 ft., 7·5 tons at 30 ft., 6 tons at 35 ft., and 4·5 tons at 40 ft.


36-Ton Steam Breakdown Crane, Great Western Railway.

AUTOMATIC LATHE WORK.*

When considering a suitable subject for a lecture before this society, it appeared to be desirable to choose one out of several branches of work on which the author has specialised, and, consequently, he decided to deal with the department of machine tool work, which appeared to be moving along at the quickest rate, and which seemed to be likely to have the greatest effect on the art of cheap productive engineering in the course of the next few years.

Those who have studied the evolution of any highly developed manufacture will have observed that progress in the past has always been in the direction of making productive processes more and more automatic, and of obtaining a continually increasing output from each workman without increasing the manual effort exerted by him.

A pronounced example of the way in which this tendency has operated is offered by the textile industry, in which the number of threads of yarn controlled by one attendant has increased enormously since threads first began to be spun, and in which not only the number of threads spun but also the number of machines operated by one workman has shown a marvellous increase. The direct effect of this development of automatic textile machines has been to increase the output per workman without increasing the hardness of his labour, and the secondary, and perhaps the most important effect to the world, has been that fine textile fabrics have become cheap enough in cost to be purchased by everybody. In this sense the textile industry offers a fine object lesson in the benefits accruing to mankind from the use of automatic machinery, and is a direct reply to those misguided persons who in the past have opposed the introduction of new machinery and of more productive industrial methods.

In machine tool work progress along automatic lines has perhaps been somewhat slow, probably on account of the great variety of products to be dealt with and on account of the lack of the irresistible competitive force which compels the producer to specialise. It has been common in the past for one maker to build, for example, steam engines, gas engines, dynamos, and perhaps even machine tools, and each of these in a number of sizes and types, and naturally, with works of a given size, the quantities of these multitudinous articles, which could be put in hand at once, were very small, and the opening for economical methods and for automatic machinery was consequently non-existent.

The stress of increased competition in various machine-tool using industries within recent years has, however, made it imperative to reduce the cost of machine parts, which has also meant increasing the quantities to be put in hand of each article of production; and, in order that this might be done, successful manufacturers have recognised the necessity for specialisation and for reducing the variety of articles manufactured.

The effect on manufacturing methods has been a steady increasing demand for automatic features on machine tools, and the direction in which this tendency was earliest felt was probably in the production of screws, automatic machines for which have now reached a high state of perfection. The author is not dealing with this class of machine to-night, but only alludes to it incidentally in tracing the origin of the modern automatic turning machine, which, in many ways, is a further development of the automatic screw machine.

By an automatic turning machine is meant an automatic machine for turning, boring, facing, etc., operating on detached pieces of work as distinct from work made from the bar. Such detached pieces may be castings, forgings, stampings, or blanks previously severed from the bar on a cutting-off machine, and it will be agreed that such work exists in much greater variety and in a much greater range of dimensions than in the case with automatic screw machine work.

It is almost obvious that the savings which are admittedly effected by the automatic screw machine should be equally attainable on such detached pieces as described above, if the quantities are sufficiently large, and the reasons why automatic turning machines have not developed in the past equally with automatic screw machines have been the absence of specialisation by individual manufacturers, and the fact that the quantities to be made in many cases were only small.

In the case of automatic turning machines for dealing with large articles, economies can frequently be effected on comparatively small numbers where the time required to machine each article is relatively long, as, although the quantities may be small, yet the time for which the machine can be run without changing over from one job to another may be as long as in the case of an automatic screw machine, owing to the greater amount of work to be done on the larger article, and the longer time required to do it, so that when considering the question of installing such machines it is always necessary to attach due importance to the length of run which is possible. The author has known cases where as few as 24 articles have been very profitably machined on an automatic turning machine when the time required for each article has been in the neighbourhood of one hour. Although this is true, it does not appear to have had practical recognition to any great extent in the past, as the early development of automatic lathes or turning was with machines for small work, following very closely on the lines of automatic screw machine practice, perhaps because the machines were first used in establishments such as textile and sewing machine factories, making small articles in immense numbers, where automatic methods were already in daily use on bar work, and where the economies effected by their use were already fully appreciated.

As might have been expected, the earliest machines for this work were simple converted automatic screw machines, the work, which was generally made from castings, being fed automatically into the chuck from a magazine. Many types of magazines were used with success.

As the advantages of the automatic turning machine began to be felt, a demand naturally arose to use the machines on larger articles, but experiments with magazines for large work were not very successful, owing firstly to the cost and difficulties of construction and of operation of the magazines, and secondly, owing to the fact that the quantities to be dealt with were only moderate; also owing to the difficulty of obtaining rough castings sufficiently uniform in size to be chucked automatically from a magazine.

The question of the cost and of the difficulties of operation of the magazines was dealt with in some cases by abandoning the magazine altogether, and using what is known as a transfer chuck, which consists of a spring holder mounted in the turret of the machine, into which the work is placed by hand. At the proper point in the cycle of the machine this transfer chuck places the article in the automatic chuck on the spindle of the machine, the operations then proceeding in the same way as if a magazine had been used. The duty of the attendant with this method was to go round from one machine to another feeding the transfer chucks, the machines of course running continuously.

The difficulty of holding rough castings varying so much in size was overcome in some cases by the use of spring chucks, in others by the use of chucks operated by compressed air, and in a design which has recently been put into successful operation in which the irregularities in the castings are automatically compensated for by the chuck without any spring grip or equivalent device by a system of automatic spring-operated wedges. Such devices have been successful on work of moderate size, but no one would now attempt to hold, say, an 18 in. diameter casting in an automatic chuck, and on such large work hand chucking is universal.

It must be remembered that in the case of large pieces of work, the machining of which takes a considerable time, the actual time required to do the chucking is only a small fraction of the time required to do the whole job, so that there is not much to be saved by chucking automatically, even if the whole of the time required for chucking could be eliminated, and for this reason the hand-operated chuck is now used almost universally on large automatic turning machines

The important question to consider when determining what methods are to be used for any given work is the relative costs of different methods, and it may be well at this stage to inquire into the cost of machining the same piece of work, say, on an engine lathe, on a modern turret lathe, and on an automatic turning machine. And, in the first place, some general considerations as to the time required to do the work on the three classes of machines may not be out of place.

We will imagine a piece of work which might take four hours on an engine lathe, and we certainly shall not be far wrong in saying that, in many cases, the same piece of work could be easily produced in one and a half hours on a turret lathe in which the boring and turning go on at the same time, and in which frequently several tools are in use at once. The question now arises as to whether an automatic turning machine would do the work any quicker than a turret lathe, and the reply to this question is that in a carefully arranged test in which the turret lathe and the automatic turning machine were both set up in the best way, the time for doing the job would be approximately the same on both machines, but in the ordinary every day practical running of the workshop there is no doubt that the output of the automatic turning machine per day or per week would materially exceed that of the turret lathe. The reasons for this are twofold, the first being that the automatic turning machine, when once set up, works at the same rate all day without getting tired, and without suffering from any of the numerous casual interruptions which interfere with the output of a hand-operated machine; and the second reason is that in actual practice the turret lathe is very seldom set up as efficiently as it might be, and as it undoubtedly would be in a specially arranged test, whereas the automatic turning machine must be set up more or less decently to do its work at all, and, therefore, in itself exercises a kind of automatic discipline on the operator, which is absent with the hand-operated turret lathe, so that the author is quite safe in saying that in many cases, speaking from the point of view of average output, the job which took four hours on an engine lathe and one and a half hours on a turret lathe could be produced in one hour on the automatic turning machine.

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* Paper read by Mr. P. V. Vernon, at Coventry, November 9th, 1910.

Having dealt with the time required to do the job, we now come to the question of costs, which may be divided into three heads, viz.: (1) Labour; (2) interest and depreciation; and (3) running expenses.

Dealing first with the question of labour, we will assume that in each case the prices are set in such a way that the workman can make good wages of one shilling an hour, and for a basis we will assume him to be on piecework.

In the case of the lathe taking four hours to do the job, the piecework price would be 4s.

In the case of the turret lathe doing the work in one and a half hours, the piecework price would be 1s. 6d.

In the case of the automatic turning machine, we will assume that one operator attends to four machines, which is a reasonable number, the cost per machine per hour to enable him to make 1s. per hour being 3d., so that the piecework price of the work on the automatic turning machine doing the work in one hour would be 3d., as against 1s. 6d. on the turret lathe and 4s. on the engine lathe.

These savings seem enormous, but are not by any means exceptional on automatic turning machine work, as I will prove later by actual examples.

On the question of interest and depreciation we will assume that in each case an allowance of 15 per cent per annum on the cost of the machine is made, and we will assume that the engine lathe costs £100, the turret lathe £300 plus £50 for standard tools, and the automatic turning machine £400 plus £50 for standard tools. We have assumed, perhaps, an excessive difference in cost between the engine lathe and the automatic, in order to avoid any charge of unduly favouring the automatic in this respect.

The interest and depreciation on the engine lathe for one year would be £15, for the turret lathe, with its standard tools, £52 10s., and for the automatic turning machine, with its standard tools, £67 10s.

(To be continued.)

THE UTILISATION OF ELECTRIC POWER IN THE IRON AND STEEL INDUSTRY.*

Utilisation of Waste Gases.

For some time serious attention has been given to the most economical manner of utilising blast-furnace gases for all processes in the manufacture of steel which require mechanical energy. Economical utilisation necessitates centralisation of the power, for which electricity furnishes the most efficient and convenient means.

At the present time steam turbines or gas engines are used for driving the electrical generators. Gas engines are more economical from a thermo-dynamic standpoint, especially as the efficiency of steam boilers, using blast-furnace gases for fuel, is very low. For the production of one kilowatt hour by a gas engine about 4,500 calories (17,850 B.Th.U.), equal to about 180 cubic feet of gas, are needed, whereas in the case of steam turbines about 9,000 calories (35,700 B.Th.U.), or about 360 cubic feet of gas, are necessary for the production of the same amount of energy. Against the better heat economy of the gas engines must be put the lower first cost of steam turbine installations, amounting to approximately 25 per cent. The latter allow, moreover, of installing considerably larger units, the entire operation of the plant becoming much simpler and capable of being easily superintended. Also the room occupied by steam turbine sets, attendance necessary, and oil consumption are reduced. Further, steam turbines stand the shocks occasioned by sudden changes of the load much better than gas engines, which can be overloaded only to a small extent, and their parallel working is more efficient. It consequently depends on circumstances which drive is to be preferred, and a combined drive is often suitable. In Germany, for instance, several steel works have gas-power stations, in which are installed one or more steam turbines. The latter, by taking up the overloads, lessen the danger of the gas engines falling out of step.

By the centralisation of the power production in an electrical central station it is possible to deliver superfluous quantities of gas, for which there is no use in the plant itself, to outside consumers, in the form of electrical energy. This may prove a means of increasing the income of the steel works. There already exist several steel works which supply neighbouring towns with light and power from this source.

It is also possible to connect the power station of the steel works with some long-distance distributing station. Ordinarily the latter will supply energy from the steel plant. In cases of emergency, however, as, for instance, through interruption of the working of the blast furnaces, the long-distance distributing station will supply the missing energy.

In steel works where there are no blast furnaces in the immediate vicinity, steam turbines have nearly entirely been adopted for the generation of energy.

System of Supply.

With regard to the choice of system of current supply, most of the older steel works installed continuous current. Only the smaller equipments were driven electrically, and the distance over which the current had to be supplied was not great. For this purpose continuous current was very suitable, especially as continuous-current motors have the advantage of being easy to regulate.

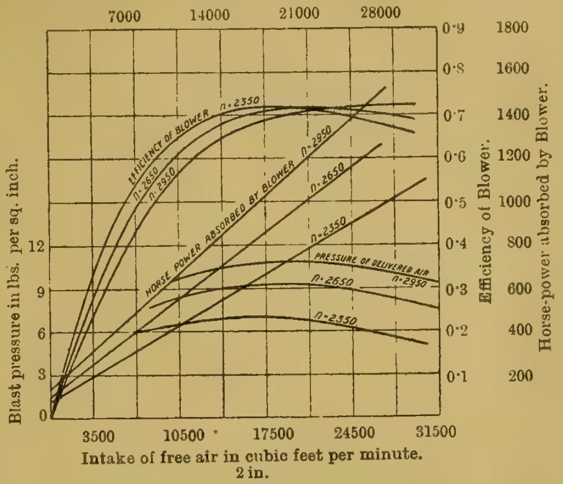

Fig. 1.—Characteristic curves of a high-speed rotary blower for a normal output of 23 000 cubic feet of free air per minute at a pressure of 10 lbs. per square inch.

With the extension of electrical installations the distance over which electrical power was used increased. Also the electrical drive came into use for the larger consumers, for instance, in rolling mills, so that the distribution with continuous current became more and more uneconomical.

At the present time, owing to the extensive installations of modern steel works, alternate current is usually adopted, it being possible with alternate current to conduct large quantities of energy over long distances with comparatively small loss. Its only disadvantage, until recently, lay in the fact of the impossibility of regulating the speed of alternating-current motors in an economical manner. This disadvantage has since been overcome in several ways, which will be described later. First, the problem of speed regulation, which is of the greatest importance in the operation of steel works, will be more closely described.

Speed Regulation of the Motors.

In regulation of speed a distinction must be made between speed reversal and speed regulation in one direction of rotation. The reversal problem, as applied in the case of reversing rolling mills, has already been so often discussed that it need not be dealt with here. In speed regulation in a definite direction of rotation a distinction must be made between the adjustment of different no-load speeds with a slight drop of speed between no load and full load, the adjustment of different no-load speeds which drop to a certain adjustable extent between no load and full load, and a regulation which causes a large drop of speed when the load is applied, but does not permit of adjusting at various no-load speeds.

Furthermore, it is often required that the output should remain constant at all speeds. However, a constant torque over the entire range of speed regulation is generally sufficient.

How do these forms of regulation come into consideration for the different operations in iron and steel works?

Rolling Mills.—For the driving of rolling mills it is often necessary to obtain different no-load speeds, depending upon the rolling programme.

The sort of mill used will determine whether these speeds should remain constant from no load to full load, or whether a drop of speed is required. The latter will be the case for blooming or similar mills, with which considerable peak loads are experienced, which must be taken up by the use of rotating masses. For wire mills and the like, where the load remains fairly constant, a drop of speed is not necessary.

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* Paper read by Mr. J. J. Elink Schuurman at the Iron and Steel Institute.

A constant output for all speeds is often required for mill operation—that is to say, an increase of torque at decreasing speed, which may lead to an increased production.

Blowers.—The drive of blast-furnace blowers and, still more, of steel works blowers, presents an interesting phase of the speed regulation problem. Up to the persent time reciprocating blowers, driven by reciprocating steam engines, or often by gas engines, have generally been used. Recently, however, high-speed rotary blowers, which have certain advantages when compared with reciprocating blowers, have more and more been adopted. In comparing the respective usefulness of the two types of blowers, reliability of operation first comes into consideration. In this respect, absence of all mechanism liable to wear, less attendance required, continuous and steady delivery of air, give the rotary blower a considerable superiority over the reciprocating. Further, it occupies much less room, and its first cost is smaller.

The opinion often expressed that the efficiency of the reciprocating blower is higher than that of the high-speed rotary blower has arisen from the incorrectness of the methods used for determining the efficiency of the former type. When the comparison is properly made, and identical methods of testing are employed for both types of blowers, it will be found that the efficiency of the high-speed rotary blower is by no means inferior to that of the reciprocating.

When the speed is constant the high-speed rotary blower produces a pressure which is practically independent of the volume of air delivered, the volume depending only upon the suction of the tuyeres. A change of pressure can be obtained by varying the speed, and as the pressure increases approximately with the square of the velocity, comparatively small alterations in the speed will suffice to produce the pressure variations necessary for the operation. Thus the pressure curves of high-speed rotary blowers can be brought to higher or lower levels by an increase or decrease of the speed, while the efficiency curves remain practically the same. (See fig. 1.)

Rotary blowers require high speeds, consequently for driving them the steam turbine receives first consideration, especially as it meets the requirements of regulation to a great extent. The exhaust steam turbine is particularly favourable for this purpose, as it is capable in a much higher degree than the reciprocating steam engine of making use of the energy of the steam down to the lowest possible vacuum. When it is considered that the exhaust steam of rolling engines, which in many cases escapes to the atmosphere, can be utilised in exhaust turbines, and the heat it contains converted into mechanical energy as far as technically possible, the economy of such a drive will become self-evident.

In the case where a large gas engine power station exists, it may prove to be more suitable, on account of the better centralisation obtained, to drive the blowers electrically. Also for reserve blowers, which are necessary where the main blowers are driven by gas engines, the electrical drive will be of advantage, on account of its low cost.

As driving motor only a high-speed motor can come into question, which, except in special cases, should meet the requirements of an easy and economical speed regulation. The needs of the blast-furnace blowers are comparatively easy to meet. Steel works blowers, however, require to supply pressures from 5 lbs. to 35 lbs. per square inch, as well as a widely varying volume of air. The driving motor should consequently in this case permit of a wide range of speed regulation, and preference must be given to that form of speed regulation for which the once-adjusted speed does not vary between no load and full load.

Minor Operations.—Besides the principal operations above mentioned, viz., rolling mills and blowers, various small drives requiring regulation of speed come into account. Mention should be made of live roller-beds, cranes, transporting apparatus of all sorts, hoists, hydraulic pressure pumps, etc. Most of these drives must also be reversible.

(*To be continued.*)

TRACKLESS TROLLEY SYSTEM.—In a paper read before the Institution of Mechanical Engineers on Friday, November 18th, Mr. A. Legros suggested that the limit of extension of electric tramways on the present system was in sight. The cost and cost of working were about the same in an electric tram and a motor 'bus, so that the cost of the track was an outstanding handicap on the tram system. The attention of municipal corporations had already turned to the trackless trolley system, and it was probable that that would be the only competitor against the motor 'bus in districts where the traffic was not very dense. Mr. Legros was of opinion that tramcars propelled by engines using compressed gas carried on the car could be operated more cheaply than those on the present system.

LAUNCHES AND TRIAL TRIPS.

Tinto.—The Dundee Shipbuilding Co. have launched a steamer of about 800 tons, named Tinto, for the coasting trade between Newcastle and Hull. The vessel has been built to the order of Messrs. Thomas Wilson, Sons, and Co., Hull.

Watermouth.—Messrs. Richardson, Duck, and Co. have launched from their yard at Stockton a steel screw steamer of the following dimensions: Length, overall, 393 ft. 6 in.; breadth extreme, 50 ft.; depth moulded, 28 ft. 11 in.; with a dead-weight carrying capacity of 7,500 tons. The vessel, which has been built to the order of Messrs. Anning Brothers, of Cardiff, will class 100 A1 in Lloyd's Register, and has been built under special survey. She is a single-deck steamer, with wide-spaced channel frames. The steel centre division is fitted in holds in which there are no beams or quarter pillars. The engines, by Messrs. Blair and Co. Ltd., have cylinders of 25 in., 42 in., and 68 in., with a 45 in. stroke, steam being supplied by two extra large single-ended boilers, having a working pressure of 180 lbs., and fitted with Howden's forced draught.

NAVAL NOTES.

Cameleon.—The acceptance trials of the new destroyer Cameleon, built by the Fairfield Shipbuilding Co., which will commence on the 30th inst., will be carired out by the nucleus crew of the Electra. On arrival at Devonport the Cameleon will be commissioned with the nucleus crew of the Electra and a balance crew drawn from the Devonport depot for service in the second flotilla, completing the numbers of that flotilla to 24 vessels. The Electra will be recommissioned with a new nucleus crew for further service in the fifth (Devonport) Destroyer flotilla.

Avon.—The propelling and other machinery of the destroyer Avon, which has just completed a "thorough repair" refit, underwent a basin trial on Tuesday, November 15th, with satisfactory results. The attempt to carry out the recommissioning trial on Friday, however, proved a failure. The feed pumps gave out before the three hours run at three-fourths power had been completed, and it was found impossible to keep water in the boilers. The trial had therefore to be abandoned.

Indefatigable.—The new cruiser Indefatigable, with her odd-looking funnels, cannot be called beautiful, although she is daily becoming more presentable. To-day she leaves the Hamoaze for the first time, and will proceed on Saturday to sea for the first trial of her propelling machinery. If all goes well she will have got through her eight hours' full-power trial on December 7th, and before Christmas her gunnery, torpedo, and subsidiary trials will have been completed. By February 23rd she is to be completed and ready for sea, in which event she will be in commission within two years of the date of her commencement. Aloft her equipment is apparently perfect.

Neptune.—The Neptune, whose acceptance trials took place last week, is to be completed for sea in all respects by the end of December, when she will be commissioned for service with the first division of the home fleet. As she was laid down on January 19th, 1909, this means that she has been well under two years in building, and as her construction has been proceeding almost at a leisurely pace of late, this may be regarded as very creditable.

Weymouth.—On the 18th November there was launched from the Elswick Shipyard of Sir W. G. Armstrong, Whitworth, and Co. Ltd., the cruiser Weymouth, for the British Navy. She is one of the protected deck cruisers of the City class, her sister ships at present in course of construction being the Dartmouth, the builders being Messrs. Vickers, Sons, and Maxim, Barrow; the Falmouth, Messrs. Beardmore and Co., Glasgow; and the Yarmouth, the London and Glasgow Shipbuilding Co., Glasgow. The Weymouth is slightly larger than the five similar vessels of the City class, one of which, the Newcastle, left the Elswick Works in September. The vessls now being built, like their predecessors, were designed by Sir Philip Watts, the director of naval construction to the Admiralty. The Weymouth will be fitted with machinery of the turbine type supplied by Messrs. Parsons, of Wallsend.

Wearbridge.—The Northumberland Shipbuilding Co. Ltd. launched from their yard at Howdon-on-Tyne a finely-moulded steamer, built to the order of Messrs. Crosby, Magee, and Co., of West Hartlepool, for the North of England Steamship Co. Ltd. The vessel is 371 ft. long by 49 ft. beam by 29 ft. 4½ in. deep, and has been built under special survey to the highest class at Lloyd's. She is fitted with long bridge, long poop, top-gallant forecastle, the accommodation being placed in steel houses on bridge deck. Special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes arranged for, consisting of eight steam winches by Messrs. Clarke, Chapman, and Co. Ltd., Gateshead-on-Tyne, a large number of cargo derricks, and steam windlass by Messrs. Emerson, Walker, and Thompson Bros., and she is fitted with the usual water ballast arrangements for light passages. The machinery will be supplied by Messrs. Richardson, Westgarth, and Co. Ltd., Sunderland, consisting of engines with cylinders 25 in., 41 in., and 69 in., and 48 in. stroke; three boilers with 180 lbs. pressure. The vessel will carry about 7,200 tons on a light draught and steam about 10 knots, loaded, at sea.

Japanese Dreadnought.—The Imperial Japanese Government have recently signed a contract with Messrs. Vickers, Sons, and Maxim, of Barrow-in-Furness, for the building of a new Dreadnought battleship cruiser. The new vessel will, when completed, have a displacement of between 27,000 and 28,000 tons, and is to cost about two and a half millions sterling.

NOTICES OF MEETINGS, &c.

November 25th.—North-East Coast Institution of Engineers and Shipbuilders.—General Meeting to be held in the Lecture Theatre of the Literary and Philosophical Society, Westgate Road, Newcastle-on-Tyne, at 7-30 p.m. A paper on "The Economical Working of Reciprocating Marine Engines and their Auxiliaries," by Mr. D. B. Morrison, will be read.

Coventry Engineering Society. Paper on "Electricity Applied to Mining," by Mr. C. F. Jackson.

November 26th.—The British Foundrymen's Association: Birmingham Branch. Meeting to be held in the Technical School, Suffolk Street, Birmingham, at 7 p.m. "Blowers and Fans for Cupola Purposes." (*a*) "Blowers," by Mr. Arthur D. Ellis; (*b*) "Fans," by Mr. Cleworth.

Association of Engineers-in-Charge. Social and Dance.

The Institution of Civil Engineers (Association of the Birmingham Students). Visit and Demonstration, Engineering Department, Birmingham University.

The Manchester Association of Engineers. A paper will be read by Mr. S. H. Rowley, on "Involute Cut-gearing, and Methods of Producing Same."

Glasgow Technical College Scientific Society.—A paper will be read on "The Fixed Stars," by Mr. J. D. McDougal.

Junior Institution of Engineers.—Visit to Messrs. David Kirkaldy and Son's Testing and Experimental Works, 99, Southwark Street, London, S.E., at 2-30 p.m.

November 28th.—Institute of Marine Engineers. Meeting at 58, Romford Road, Stratford, London, E. Discussion on Mr. Durtnall's paper on "The Internal-combustion Engine."

Bradford Engineering Society.—Meeting to be held at the City of Bradford Technical College, Great Horton Road, at 7-45. A paper will be read by Levi Lumb, Esq., A.M.I.Mech.E., on "The Governing of Prime Movers."

November 29th.—The Institution of Civil Engineers. Ordinary Meeting at 8 p.m., at Great George Street, Westminster, S.W.

Manchester Students' Section of the Institution of Electrical Engineers. Meeting at the Municipal School of Technology, Sackville Street, Manchester, at 7-30 p.m. A paper by Mr. H. A. Carney, will be read on "What's wrong with the Electrical Industry, and how to put it right—on paper."

November 30th.—Liverpool Engineering Society. Meeting at the Royal Institution, Colquitt Street. A paper will be read on "The Control of Fuel Supplies," by Mr. J. B. C. Kershaw, F.I.C.

December 3rd.—The British Foundrymen's Association: Lancashire Branch. Meeting to be held in the Municipal School of Technology, Manchester, at 4 p.m. A paper will be read on "Imperfect Castings," by Mr. S. G. Smith.

Leicester Association of Engineers. A paper will be read on "Modern Aeroplane Practice," by Mr. J. P. Chittenden, A.M.I.Mech.E.

The Birmingham Association of Mechanical Engineers. Annual Meeting at Grand Hotel, Colmore Road. Election of Officers, and Social.

Big Timber Deal.—We understand that an American syndicate has just purchased 180 square miles of timber on Masset Inlet, Queen Charlotte Island, opposite Prince Rupert, for the sum of 1,750,000 dollars. This is the fourth large tract of timber sold in that locality within the last 60 days to American purchasers.

TRADE NOTES.

The Port of London authority have ordered two dredgers from Messrs. Fleming and Ferguson, Paisley, and eight hopper barges from Messrs. Ferguson Brothers, Port Glasgow. The other work of this kind which the authority have to place is deferred indefinitely.

Messrs. Brown, Boveri, and Co. are said to be about to place on the market a gas turbine, and that they have already constructed, and had running for some time, a 300 H.P. turbine. They are reported to be now experimenting with a 1,000 H.P. machine, the invention of Messrs. Holzwarth and Junghaus.

Messrs. Moncrieff P. Ford & Co. have opened offices at 57, Colmore Row, Birmingham, from which they will conduct the business of machinists, tool makers, and specialists in hardening shop equipment and supplies. In addition to their own specialities in engineers' small tools and hardening furnaces, they have made very favourable arrangements with manufacturers of highest repute to handle such lines as gauges of all kinds—standard limit screw, etc.—micrometers, measuring machines, etc., and also pyrometers and temperature indicators and recorders, including such well-known instruments as the Fery, and Fery spiral pyrometers.

Messrs. Glenfield and Kennedy Ltd., of Kilmarnock, are reported to have recently received an order for three vertical three-throw single plunger pumps, with capacity of 12,000 gallons an hour against a total head of 800 ft., for the Randfontein Mines. The company are supplying in all to these mines nine similar sets of three-throw pumps, together with one set for a head of 1,000 ft., and also supplying to the Buenos Ayres and Pacific Railway Co. a pumping installation, comprising one set of Ashley's patent three-throw deep well pumps to raise 15,000 gallons of water an hour against a head of 230 ft., together with a vertical engine and boiler and 7 in. rising main.

Reported Shipbuilding Orders.—According to *The Shipping World* Mr. Alfred E. Mathews, of the Mathews Steamship Co. Ltd., Toronto, has placed an order with the Sunderland Shipbuilding Co., Sunderland, for a steamer for the Canadian Lakes. Mr. Alfred Lotinga, London, on behalf of the Societa Nazionale Reo Servizi Marittimi, Rome, is reported to have placed a contract with Messrs. Mackie and Thompson Ltd., Govan, to build four mail and passenger steamers. They are to carry 400 tons on 10 ft. draught, and to have accommodation for 24 first-class and 40 second-class passengers. It is also stated that Messrs. Prentice, Service, and Henderson, Glasgow, have placed an order for a steamer of 10,000 tons carrying capacity with Messrs. Russell and Co., Port Glasgow, and the same builders have also contracted with Messrs. Gow, Harrison, and Co., Glasgow, to build a steamer of about 9,000 tons dead-weight capacity; and Messrs. Marshall and Dobbie, Glasgow, have ordered a steamer of 7,600 tons carrying capacity from them. These orders, it is added, are practically placed, although the contracts may not yet be actually signed.

Railway Material.—The *Boletin Oficial* (Argentina) publishes a decree approving the plans submitted by the Argentine Central Railway ("Ferrocarril Central Argentino") for the construction of the last section of the Rosario to Cruz line, viz., between the 310th kilometre and Cordoba station; and also of a section to run from the 366th kilometre to Los Molinos and San José, including branches to connect with the Alta Gracia and Malagueño lines. The same journal also publishes a decree allocating a sum of 50,000 pesos (about £4,400) for surveying operations relative to the construction of a line of railway from Copacabana, on the Mazán and Tinogasta section of the Argentine Northern Railway, to Chilecito, *via* Pituil, Santa Cruz, Campanes, Famatina, San Nicolás, and Sarmiento. The *Diario Oficial* (Brazil) publishes a decree approving the plans submitted on behalf of the Sao Paulo-Rio Grande Railway Co ("Companhia Estrada de Ferro Sao Paulo-Rio Grande") for the construction of a section of line to connect the Paraná Railway with the Sao Francisco line at the town of Rio Negro. The cost of construction is put at 445,000 milreis (about £31,500). The *Gaceta* (Spain) notifies that a concession has been granted to the Sociedad Minera Guipuzcoana" for the construction and working of a strategic railway from Pamplona to Plazaola, and the *Feuille Fédérale Suisse* contains a decree granting to Messrs. Chavannes, Choquard, and Maillat, of Porrentruy, an 80 years' concession for the construction and working of a narrow gauge railway from Alle to Courgenay, *via* Miécourt, Charmoille, Fregiécourt, and Cornol. Work must begin within six months after approval of the plans, and completed within two years thereafter. The line will be eight miles long, and the cost of the work is estimated at 415,000 francs (£16,600).—*Board of Trade Journal.*

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2290. **Diesel Engines for Power Stations and Ships.**—Will one of your readers please consider the advantages and disadvantages of engines of the Diesel type; state the sizes in which these can be made, and give results of tests on same; in particular, deal with the use of such engines for generating electrical energy? Is there any probability of such engines being used for marine propulsion, and, if so, on what kind of ship?—COALER.

Answer.—The Diesel engine has been used with some success for marine propulsion. For instance, a vessel on Lake Zurich has been recently advantageously fitted with a Diesel engine of 150 H.P. (see *The Practical Engineer*, October 21st, 1910), and an oil-carrying vessel of 1,800 tons with "Mirrlees" Diesel vertical direct-acting engines, each having four cylinders and capable of developing 160 B.H.P. (200 I.H.P.) continuously when running at 400 revolutions per minute. Data relating to the Diesel engine will be found in "*The Practical Engineer* Pocket Book" for 1911, and information could also be obtained from a paper on "The Internal-combustion Engine for Marine Use," by Mr. W. R. Cummings, published in "The Transactions of the Marine Engineers" for November. No doubt the Diesel Engine Company, Queen Victoria Street, would also be pleased to forward catalogues and other publications giving full particulars on application.—W. T.

2286. **Conical Steel Tubes.**—Could any reader inform me where I could obtain conical-shaped steel pipes as follows: Inside from 6 in. to 14 in. diameter, ⅝ in. thick, with flanges 12 in. and 18 in. diameter; length of pipe, flange to flange, 12 in.?—A READER OF YOUR PAPER.

2287. **Balance Ring Slide Valves.**—I should be glad if some reader would explain the nature, object, and applications of balance ring slide valves; what are the advantages and disadvantages of same, and how far are they used?—M. T.

2288. **Ornamental Hammer Work.**—Information is wanted as to the best sort of material to use when making ornamental scrolls, names, letterings, etc., for what is called ornamental hammer work—that is, the best substance or composition to hammer upon.—PERTH.

2289. **Heating Steam Tank.**—Will some reader give me a rule by which I can determine the final temperature assumed by a steam heated water tank (naked steam) into which I feed steam, and from which I draw water at a uniform rate? Express general result in terms of steam used.—TANK.

2291. **High-pressure Water.**—Will some experienced reader give me detailed information concerning the cost of high-pressure water and its value as a source of power? What are the average efficiencies and plant factors of various hydraulic engines?—HYDRIC.

2292. **Wastage for Steel Plates and Bars.**—Would some reader kindly give me the wastage for steel plates and bars to cover rolling heats and scrap.—E. F.

MISCELLANEA.

THE new steamer Szent Istvan, built by the Clyde Shipbuilding and Engineering Co., Port Glasgow, for the Royal Hungarian Sea Navigation Co., left Glasgow recently on her maiden voyage to Malta, Venice, Trieste, and Fiume. The vessel has a large cargo.

THE square of a number ending in a half may be obtained in the following simple way: Multiply the whole number by the next larger whole number and add a ¼ to the product. For example, the square of 4½ is (4 × 5) + ¼ = 20¼; the square of 6½ is (6 ×7) + ¼ = 42¼; the square of 12½ is (12 × 13) + ¼ = 156¼.

CLYDE DOCK.—The Clyde trust has decided to apply to Parliament for powers to construct the largest tidal and graving docks in Britain at a cost exceeding £1,000,000 sterling. The tidal dock will cover 32 acres, and the graving dock will be over 1,000 ft. long and 110 ft. broad, to take the largest naval and mercantile vessels.

IN an article on aeroplane propellers in the *Revue de Mécanique*, the author shows how the metacentric section of an aeroplane with plane surfaces may be constructed for the various inclinations in a symmetrical plane. He also indicates for an aeroplane with or without a screw propeller what conditions ought to ensure manœuvring without oscillations.

NEW ALUMINIUM ALLOY.—*La Metallurgie* states that a new aluminium alloy casting material has been placed on the German market which is easily cast and gives a perfect casting of great strength. The new alloy is not hard to machine or work, and it possesses a beautiful glistening colour. It is composed of 87 per cent aluminium, 8 per cent copper, and 5 per cent tin, though the copper may vary between 7 and 8½ per cent and the tin between 4½ and 5½ per cent.

A RECENT bulletin, published by the *Bureau of Mines*, calls attention to the many mine accidents caused by the explosibility of coal dust rather than firedamp, the usual attributed cause of such accidents. The bulletin states that only within comparatively few years has the dry dust of bituminous and lignitic coal been generally recognised as an explosive agent more insidious and deadly to the miner than firedamp.

THE IRON AND STEEL INSTITUTE.—A research scholarship or scholarships, of such value as may appear expedient to the council of the Iron and Steel Institute from time to time, has been founded by Mr. Andrew Carnegie (past president), who has presented to the Iron and Steel Institute one hundred thousand dollars for the purpose. The award will be made annually, irrespective of sex or nationality, on the recommendation of the council of the institute. Candidates, who must be under 35 years of age, must apply on a special form before the end of February to the secretary of the institute.

NEW CUNARD LINER.—The Cunard Line has invited Messrs. John Brown Ltd., Clydebank, and Messrs. Swan, Hunter, and Wigham Richardson, Wallsend-on-Tyne, to specify for the largest passenger vessel in the world. She is for the Liverpool-New York trade, and will be 885 ft. long by 95 ft. broad. She will have a total displacement of 50,000 tons, thereby exceeding the White Star liner Olympic by 5,000 tons, and will have a speed of 23 knots against the Olympic's 21. She will be propelled by turbines, and her furnaces will be adapted to burn oil fuel.

EXPERIMENTS WITH NEW STEELS.—Since 1908 Messrs. Krupp, Essen, have been experimenting with new steels to supplant the old nickel-chrome combination used for armour plate, and their new nickel-tungsten steel has now been proved, it is claimed, to have more than 11 per cent penetration resistance over all other varieties, resisting projectiles of 2,250 foot-seconds velocity. Fully equal in surface hardness to the old type, the new plate is said to be tougher and more resistant, to be free from any tendency to brittleness, and not to be liable to crack under repeated impact of heavy high velocity projectiles.

RAILWAYS IN CHINA.—Ten years ago there were not five miles of railway in operation throughout the entire length and breadth of the vast empire of China; to-day something like 5,000 miles of railway are open to traffic or in course of construction. No longer are the people of China hostile to railway projects in any part of the country; their eagerness to have them, indeed, is only bounded by want of capital to construct them, and, here and there, by an intense reluctance to borrow foreign capital on the terms capitalists consider will adequately guarantee the safety of their funds.

LARGE GAS ENGINES.—An illustrated pamphlet has been published by the Maschinenfabrik Augsburg-Nürnberg dealing with the large gas engines manufactured by them. After an introduction, in which it is stated that the gas engine units exceeding 1,000 B.H.P. now in service or in course of construction have a combined output exceeding 1,000,000 B.H.P., 46·5 per cent of which is in Germany and 32·5 per cent in America, a section is devoted to the economy of the large gas engine in various applications. The third section deals with the different methods of producing combustible gas, while the fourth more particularly describes the Nuremberg gas engine, which operates on the four-cycle principle and is double-acting, both ends of the cylinder being closed and both sides of the piston arranged to receive power impulses. In the fifth section an account is given of gas-blowing engines, while the sixth, and last, contains particulars of the working of Nuremberg gas engines, the results of various tests, and statements of fuel, oil, and water consumption.

OSRAM·LAMPS

PATENTEES' CHRONICLE

OF

Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

NOVEMBER 14th, 1910.

26360 Valveless engine. Pring.
26361 Roofs. Broussas.
26362 Aeroplane. Gregory.
26363 Shaping straps. Hackett.
26364 Padlocks. Harrison.
26365 Pinafore. Ashton.
26366 Draught excluder. Warden.
26367 Fire extinguisher. Billings.
26368 Fertilising device. Hichon.
26369 Hook liberator. Walters.
26370 *Ships' side lights. Booth.
26371 Pile bar. Lister.
26372 *Mops. Brown.
26373 Feed water heaters. Vincez.
26374 Furs. Elms.
26375 Switch points. Salter.
26376 Music cabinets, etc. Casten.
26377 Window blind holder. Herbert.
26378 Photo device. O'Neill.
26379 Linen collars. Dalton.
26380 Starting, etc., belt drives. Whiteley
26381 Wraping mill. Whiteley.
26382 Milling machine. Whiteley.
26383 Sewing device. Gilchrist.
26384 *Castings. Muirhead.
26385 Bottle stoppering. Rishworth.
26386 Seat covering. Badman.
26387 Picture frame. Lineham.
26388 Game. Charlesworth.
26389 Cabinet. Beadle.
26390 Electrical device. Taylor.
26391 Barrow axles. Exley.
26392 Card dealing machine. Mitchell.
26393 Dynamos. Freeman.
26394 Gulley lid. Hutton.
26395 Time saving device. Hyatt.
26396 Boots. Sabin.
26397 Steam generator. Whitehall.
26398 *Land treatment. Madalinski.
26399 Electric lamps. Lanchester.
26400 Clutch. Balsillie.
26401 Electric current generating. Frost.
26402 Furnace pan plate. Smith.
26403 Separation of silver and gold. Durant.
26404 Electric lighting. Fearns.
26405 Tumbling barrels. Stevens.
26406 Window cleaner. Balaisdell.
26407 Traps. Millington.
26408 *Embroidering machine. Gahlert.
26409 Internal combustion engine. Merryweather.
26410 Globe, etc., holders. Jones.
26411 Valves. Whitaker.
26412 *Chain links. Hartmann.
26413 Stencilling machine. Schulkoff.
26414 *Wheels. Mills.
26415 *Cleaning tinplate waste. Linde.
26416 Valve gear. Roots.
26417 Boots, etc. Lynn.
26418 Slate cleaner. Breider.
26419 Door fastener. Layton.
26420 *Electric motors. Adams.
26421 Flying machine. Galvâo.
26422 Tyre inflating. Grisley.
26423 Side flues. Hannan.
26424 *Rock drills. Dalrymple.
26425 Feed water heaters. Marks.
26425 Feedwater heaters. Marks.
26426 Wheels. Headley.
26427 Hinged stays. Headley.
26428 *Musical instrument. Marks.
26429 *Lathes. Millington.
26430 *Screw propellers. Halvorsen.
26431 *Grinding device. Troske.
26432 Acid manf. Johnson.
26433 Lock nuts, etc. Hunwicke.
26434 *Lamps. Washington.
26435 Corsets. Harvey.
26436 Cycle control lever. Larkin.
26437 *Coiling wires. Caddy.
26438 *Pump. Berrenberg.
26439 *Electric motor control. Adams.
26440 *Telephone system. Bowman.
26441 Airships. Monge.
26442 Dredging plants. Carey.
26443 *Hook and eye. McComb.
26444 *Pipe joint packing. Raimonds.
26445 *Tumbling barrels. Abbott.
26446 Flaying knives. Tasker.
26447 Hand iron. Thomas.
26448 Tyres. Maxwell.
26449 Colour photography. Dawson.
26450 Envelope. Brown.
26451 Telephone instruments. Sowerby.
26452 Door lock. Blackburn.
26453 *Door fastening. Schoenfeldt.

NOVEMBER 15th, 1910.

26454 Tool holder. Gladman.
26455 Elevator. Mitchell.
26456 *Sifting vessel. Coates.
26457 Kilns. Kent.
26458 Turbine. Haworth.
26459 Smoke consumption. Altridge.
26460 Chalk holder. Bergholtz.
26461 Gas burner cleaning. Jones.
26462 Electric trolley wires. Dudgeon.
26463 Screw propellers. Denvy.
26464 Wheel spindle cap. Masters.
26465 Ovens. Thomas.
26466 Adding machine. Booth.
26467 Tyres Reid.
26468 Tyres. Reid.
26469 Oats, etc., cutting. Higgins.
26470 Carburetter. Binks.
26471 Chimney pots. Downing.
26472 Coal cutter. Eckersley.
26473 Speed controlling. McIntosh.
26474 Looms. Kirkham.
26475 Friction clutch. Bates.
26476 Governors. Bateman.
26477 Gas regulator. Crawshaw.
26478 Electric welding. Bucher.
26479 Metallic lattice work. Walduck.
26480 Filters. Wollaston.
26481 Tobacco pipes. Graves.
26482 Water filtering. Morison.
26483 Wheels. James.
26484 *Lamp securing. Jones.
26485 Manicure board case. Glover.
26486 Advertising device. Marshall.
26487 Bedsteads. Whitefield.
26488 *Corsets. Kops.
26489 *Corsets. Kops.
26490 Treatment of cloth. Farnworth.
26491 Hair restorer. Hawkes.
26492 Push car Baker.
26393 Elevator. Marshall.
26494 Spark arrester. Cooper.
26495 Steam generator. Morison.
26496 Pumps. Morison.
26497 *Nut manf. Smith.
26498 *Drilling machine. Smith.
26499 Relating to flags. Peyton.
26500 Internal-combustion engine. Lorne.
26501 Indicator. Dix.
26502 Candle extinguisher. Butler.
26503 *Theatre scenery. Bailey.
26504 *Typecasting machine. Bailey.
26505 Lubricator. Trier.
26505 Valves. Hipwell.
26507 Pianos. Hipwell.
26508 Gas burners. Ransome.
26509 Fluid controlling device. Driscoll.
26510 Leather, etc., cutting. Bull.
26511 *Corrugated sheet-iron. Knutson.
26512 Artificial fuel. Shedlock.
26513 *Affixing capsules to bottles. Lowman.
26514 Toy gun. Gilmore.
26515 Hats. Aylott.
26516 Refining paraffin wax. Steel.
26517 Tyres. Anns.
26518 Draught excluder. Axten.
26519 Screens. Whitehouse.
26520 Bat manf. Muckle.
26521 Bed springs. Ryan.
26522 Depericarping apparatus. Fairfax.
26523 Tyre lever. Shelley.
26524 Mudguards. Birt.
26525 Internal-combustion engine. James.
26526 *Heating apparatus. Smidth.
26527 *Trial box for oculists. Guilbert.
26528 *Bands for trousers. Finke.
26529 Carburetter. Newson.
26530 Tyres. Birrell.
26531 Tyres. Crosby.
26532 *Organ player. Mills.
26533 Automobile speed indicator. Wimperis.
26534 Miners' safety lamps. Oldham.
26535 *Grate shakers. Burwell.
26536 *Power transmitting. Radcliffe.
26537 *Postcard coin freed machine. Gosch.
26540 Direction indicator. McPherson.
26541 Ice manf. Lightfoot.
26542 Retorts. Cloudsley.
26543 Dumb-bells. Wiatt.
26544 Train lighting. Clark.
26545 *Lighting apparatus. Hofman.
26546 *Valve plugs. Lentz.
26547 *Fly trap. Kleiter.
26548 Acid manf. Johnson.
26549 Heating apparatus. Coffin.
26550 Brakes. Pettigrew.
26551 Airship garages. Booth.
26552 Boiler furnace. Platts.
26553 Hat trimming. Rushton.
26554 *Reinforced structures. Rings.
26555 *Musical instruments. Kastner.
26556 *Boot, etc., lacing. Clark.
26557 Advertising device. Czerniewsky.
26556 Fishing rods. Whistler.
26557 Pumps. Carey.
26558 *Piano keyboard note guides. Nesbitt.
26559 Wire ropes. Leschen.
26560 Fishing reels. Whistler.
26561 *Fire hydrants. Lofton.
26562 *Pendulum manf. Ocaubert.
26563 *Rain gauge. Casella.
26564 *Non-refillable bottle. Gregory.
26565 *Bottle sealing. Wetmore.
26566 *Higienic soles. Chabry.
26567 *Paper manf. Hubers.
26568 *Electrolytic cells. Wildermann.
26569 Fountain pens. Weyde.
26570 *Flying machine. Goldberger.

NOVEMBER 16th, 1910.

26571 Beverages. Smart.
26572 Ships. Linkleter.
26573 Carburetter. Hearne.
26574 Cement testing. Nicol.
26575 Relating to billiards. Williamson.
26576 Valve gear. Martin.
26577 Dye manf. Levinstein.
26578 Weighing machine. Noesch.
26579 Lamp burners Morrie.
26580 Cycle guards. Clark.
26581 Gimlets. Branscombe.
26582 Files, etc. Denley.
26583 Wagons. Hartley.
26584 Rifle range. Thompson.
26585 Pen nibs. Munro.
26586 Looms. Hollingworth.
26587 Looms. Hollingworth.
26588 Looms. Hollingworth.
26589 Match stand. Wiscon.
26590 Printer's furniture. Stockal.
26591 Electric wires. Bayliss.
26592 Advertisements. Baines.
26593 Mine cages. Rayner.
26594 Railings. Webb.
26595 Cycle driving gear. Ormsby.
26596 Yarn twisting. Houston.
26597 *Garment suspenders. Rond.
26598 Step ladders. Leadley.
26599 Rolling mills. Lamberton.
26600 *Combination for smokers. Wilcox.
26602 Water taps. Berry.
26603 Coat collars. Simpson.
26504 Advertising device. Powis.
26605 Music roller. Walter.
26606 Tobacco pipe. Toogood.
26607 Driving axles. West.
26608 *Cholo-photography. Pfenninger.
26609 *Reflector filter. Pfenninger.
26610 Photo mounting. Gieve.
26611 Gas burners. Colbran.
26612 Rotary engine. Harper.
26613 Bedstead. Hamlyn.
26614 *Pump. Pfleiderer.
26615 Reservoir pens. Munro.
26616 Talking machine. Fischer.
26617 Corsets. Warren.
26618 Advertising device. Hawker.

26619 Advertising device. Hawker.
26620 *Signalling device. Justice.
26621 *Transmitting device. Becker.
26622 Valve, etc. Hampson.
26623 *Cycle side car. Fulford.
26624 *Heating device. Usban.
26625 Cask washing. Reichenberger.
26626 *Torpedo torches. Hyra.
26627 Electric switch. Dickson.
26628 Boot protector. Mackay.
26629 Reversing device. Lewendon.
26630 Carburetter. Brown.
26631 Motor cycle. Nehan.
26632 Wheels. Keegan.
26633 Printing presses. Lake.
26634 Friction clutch. Pountney.
26635 Carburetter. Pugh.
26636 Internal-combustion engine.
Huntingdon.
26637 *Use of ozone. Casas.
26638 *Feather manf. Marks.
26639 Power transmission. Lamplough.
26640 Wheels. Keegan.
26641 Printing press. Lake.
26642 Electricity generator, etc. Dekker.
26643 Wearing apparel. Wilkinson.
26644 Aeroplanes. Graham.
26645 *Dye manf.
26646 *Peroxide of hydrogen manf.
Löwenstein.
26647 *Semaphores. Ferraeri.
26648 *Steam boiler. Fraissient.
26649 Hay rake. Blackstone.
26650 Treatment of ores. M'Call.
26651 *Pneumatic cash, etc., conveyors.
Reid.
26652 Wheels. Keegan.
26653 Aeroplane. Neale.
26654 Glove stretcher. Hurst.
26655 *Tyres. Niel.
26656 Gas burners. Cannon.
26657 Signalling apparatus. Davison.
26658 *Flying machine. Vlaicu.
26659 Cash tills. Hudson.
26660 Petrol gas apparatus. Flower.
26661 Stamp mills. Dunn.
26662 Showcards. Léveeque.
26663 Furniture screws. Newhouse.
26664 Skirts. Walker.
26665 Speed gear. Loveday.
26666 *Punches. Pecinka.
26667 Lamps. Grate.
26668 Pistons, etc. Allen.
26669 Shoeware. Deelen.
26670 *Blotters. Schmidt.
26671 Lighting device. M'Care.
26672 *Printing presses. Chishire.
26673 *Bunsen burner. Lange.
26674 Piston rods, etc. Allen.
26675 Washing machine. Bartlet.
26676 Dye manf. Newton.
26677 Dye manf. Newton.
26678 Nailing machine. King.
26679 Stools. Robinson.
26680 Speed pulleys. Hinton.
26681 Key rings. Billinghurst.
26682 *Razor wipe. Godard.
26683 Lamps. Warne.
26684 *Purifying substances. Liebich.
26685 *Dynamo. Allgemeine.

NOVEMBER 17th, 1910.

26686 Windows. Shuttleworth.
26687 Church bells. Fulwood.
26688 Flooring cramps. Salisbury.
26689 Non-refillable bottle. Pugh.
26690 Shaping pottery. Hancock.
26691 Lace manf. Creassey.
26692 Dye manf. Crook.
26693 Heat transference. Bennett.
26694 Tubes. Bennett.
26695 Relating to coal trams. Monaghan.
26696 Accumulators. Cochrane.
26697 Cycle lights. Mearington.
26698 Hairpins. Page.
26699 Feed water heater. Smith.
26700 Boilers. Niblock.
26701 Boiler. Niblock.
26702 Electric motors. Neachell.
26703 Mat manf. Schwarz.
26704 Cuff protector. Proffitt.
26705 Washing apparatus. Baxter.
26706 Tyre repairing. Marles.
26707 *Cabstand calls. Drost.
26708 Compressors. Carter.
26709 Speed gear. Hill.
26710 Wood saw. Livsey.
26711 Hatpin. Mitchell.
26712 Sock. Mitchell.
26713 *Steam traps. Horne.
26714 Steam engine. Eastwood.
26715 Gas burner. Sutton.
26716 *Liquid medicine. Kippax.
26717 Sole. Terry.
62718 Cape cart hoods. Lunn.
26719 Valves. Sinclair.
26720 Aeroplane. Booth.
26721 Roller skate. Jacobsohn.
26722 Wheel. Crook.
26723 Carding engine. Hulme.
26724 Sash window. Burrell.
26725 Chimney pot. Aldridge.
26726 *Paper bag manf. Nichols.
26727 Valves. Bates.
26728 Tobacco pipe. Burn.
26729 Magneto ignition. Lodge.
26730 Bedsteads. Carter.
26731 Soap holder. Carter.
26732 Wheels. Ure.
26733 Pencil holder. Clews.
26734 Potato digger. Jack.
26735 Wooden box. Ostle.
26736 Motor cars. Crudgington.
26737 *Electric switch. Denny.
26738 Small arms. Ashton.
26739 *Producing polychrome relief. Voit.
26740 *Burying manure. Joring.
26741 *Shackle. Joust.
26742 Screw. Weinbacher.
26743 Pump. Alan.
26744 Briquettes. Coles.
26745 Stamp mills. Nissen.
26746 Wheels. Kindscheif.
26747 *Electrodes. Hartmann.
26748 *Turbine. Kienast.
26749 Wheels. Grossmann.
26750 Aeroplane, etc. Westaway.
26751 Casting machines. Everett.
26752 Display device. Brook.
26753 Buffing gear. Watson.
26754 Lamp shades. Biheller.
26755 Pumps. Dover.
26756 Saddles. Jefferies.
26757 Tongs. Evered.
26758 Mining cages. Sivel.
26759 Treatment of lac. Johannes.
26760 *Motor cars. Pagliano.
26761 Treating minerals. Roberts.
26762 *Guns. Bloxam.
26763 *Humidifying apparatus. Nobbs.
26764 *Flexible tubing. Berryman.
26765 Chemical manf. Ellis.
26766 Carburetter. Smith.
26767 Vermin trap. Woolf.
26768 *Capsules. Schmidt.
26769 Carburetters. Davy.
26770 Sewing machine. Timewell.
26771 *Condensers. Megeuet.
26772 *Gas retorts. Paterson.
26773 *Yeasts. Cohendy.
26774 Sound device. Hodgkinson.
26775 *Engines. Baarslag.
26776 Plaster manf. Oswald.
26777 *Extraction of metals. Perret.
26778 Manicure. Burnet.
26779 Tyres. Dunn.
26780 Liquid measuring. Wilson.
26781 Internal-combustion engines. Bowen.
26782 Heat utilisation. Joh.
26783 *Sterilising. Nogier.
26784 *Buttons. Joran.
26785 *Coats. Barker.
26786 Sewing machines. Raney.
26787 *Chocolate manf. Savy.
26788 Zinc distillation. Moulden.
26789 Waterproof solution. Muskett.
26790 *Agglomerating apparatus.
Debauche.
26791 Mash tuns. Robinson.
26792 Tyres. Bromley.

NOVEMBER 18th, 1910.

26793 Packing rings. Deighton.
26794 Crates. Beale.
26795 Transporting rubber. Rowat.
26796 Mouse trap. Boonzaier.
26797 Gauge. Jones.
26798 Roller bearing. King.
26799 Carding engines. Hargreaves.
26800 Fibre drying machines. Sowden.
26891 Guns. B.S.A. Co. Ltd.
26802 Fabrics. Wright.
26803 *Advertising. Seyd.
26804 Carding machines. Pagson.
26805 Driving chains. Renold.
26806 Ovens. Somerville.
26807 *Soap stick. Dye.
26808 Belts. Tower.
26809 Casting. Whitehouse.
26810 *Reproducing machine. Bigelow.
26811 Type bars. Leonard.
26812 Stapling machine. Wildey.
26813 Air pistol. B.S.A. Co. Ltd.
26814 Wagons. Nelson.
26815 Skewer. Carter.
26816 Calendar. Pagan.
26817 Hairpins. Butler.
26818 Ball for cisterns. Hodgson.
26819 Manf. of valves. Crombie.
26820 Gassing machines. Gray.
26821 Pumps. G. and J. Weir.
26822 Securing caps. Gardner.
26823 Bearings. Howells.
26824 Draught excluder. Walker.
26825 Condensers. Morison.
26826 Bags. Martin.
26828 Syringes. Purser.
26829 Toe clips. Hill.
26830 Casement stays. Crowther.
26831 *Flying machine. Bellusis.
26832 Cycles. Bullock.
26833 Cycles. Bullock.
26834 Advertising. Huckle.
26835 *Converting lead into lead oxide.
Bergman.
26836 *Electric heaters. Ferranti Ltd.
26837 Manf. of wheels. Brindley.
26838 Photography. Lee.
26839 Clocks. Cook.
26840 Rims for tyres. Wade.
26841 Railway signalling. Orme.
26842 Chaff cutting machine. Maynard.
26843 Hopper wagons. Wigley.
26844 Pens. Lycett.
26845 Umbrellas. Izbicki.
26846 Pumps. Bedell.
26847 Furnaces. King.
26848 *Bolts. Labourdette.
26849 Inhaler. Hall.
26850 Fans. Mackley.
26851 *Wheels. Frost.
26852 Wheels. Frost.
26853 Blotters. Kenna.
26854 Telephones. Burney.
26855 Wheels. Symes.
26856 *Transmitter. Habermann.
26857 Corsets. Bate.
26858 *Calculating machines. Walker.
26859 Machines for inserting fasteners.
Boult.
26860 Furnaces. Kennard.
26861 *Sewing machines. Schütze.
26862 Periscopes. Hasselkus.
26863 Saddles. Lowenthal.
26864 Sight testing apparatus. Gowlland.
26865 *Dried fruit. Cruikshank.
26866 Tyres. Immisch.
26867 Internal-combustion engines. Smith.
26868 Speed gear. Smith.
26869 *Treatment of air. Franck.
26870 Treatment of rubber. Shaw.
26871 Skates. Princess Anne of Löwenstein-Wertheim.
26872 Guns. Vickers.

NOVEMBER 19th, 1910.

26873 Sprinkler. Dixon.
26874 Lock. Mayfield.
26875 Drain ventilators, etc. Wood.
26876 Cycle pedals. Wood.
26877 Treatment of water. Evans.
26878 Treatment of water. Evans.
26879 Tyres. Bradwell.
26880 Dynamo. Holt.
26881 Fire-lighters. Glover.
26882 Razor. Morgan.
26883 Lace manf. Creassey.
26884 Motor cars, etc. Satchwell.
26885 Carburetters. Satchwell.
26886 Feed water heaters. Morison.
26887 Carburetters. Poppe.
26888 Vaporisers. Griesbath.
26889 Cotton opener. Crossley.
26890 Briquettes. Farraday.
26891 Brushes. Hodge.
26892 *Lamps. Prestwich.
26893 *Geysers. Hudd.
26894 Riding breeches. Baxter.
26895 Foot cleaner. Nicholson.
26896 Power transmission. Smith.
26897 Clutch, etc. Smith.
26898 Wheel. Goodyear.
26899 Vulcanising plant. Hill.
26900 Advertising sign. Hook.
26901 *Type casting machine. Stockall.
26902 Aerial navigation. Hutchinson.
26903 Evaporating apparatus. Woore.
26904 Roasting wheat, etc. Makin.
26905 Sweeping device. Robertshaw.
26906 Copper refining. Cowper-Coles.
26907 Electro-deposition of copper.
Cowper-Coles.
26908 Tobacco pipes. Walker.
26909 Angle grip. Chapman.
26910 Pen nib. Beam.
26911 *Motors. Mossmeyer.
26912 *War vessels. Jenney.
26913 Pumps, etc. Parsons.
26914 Boiler. Lees.
26915 Partition slabs. Hill.
26916 Locking nuts. Hughes.
26917 Food. Stein.
26918 *Card shuffler. Smeets.
26919 *Metallic packing. Meyer.
26920 Gas burners. Hamer.
26921 *Wearing apparel. Harting.
26922 Target. Owen.
26923 Saddles. Holaway.
26924 *Carburetter. Schafmayer.
26925 Pulleys, etc. Louis.
26926 *Fibre preparing. Prieto.
26927 Animated pictures. Greene.
26928 New coating product. Lilienfeld.
26929 Garden, etc., rollers. Macpherson.
26930 Brooch pins. Müller.
26931 Railway coupling. Woodhouse.
26932 *Rubber manf. Dogny.
26933 *Tyres. Rosdorff.
26934 *Feed mechanism control. Dietrich.
26935 *Card punching machine. Dietrich.
26936 *Embroidering machine. Dietrich.
26937 *Embroidering machine. Dietrich.
26938 *Embroidering machine. Dietrich.
26939 *Embroidering machine. Dietrich.
26940 Roller mills. Johnston.
26941 Plant support. Jones.
26942 Coin-freed mechanism. Higgins.
26943 *Cinematographs.
26944 *Motor transmission. Dietrich.
26945 *Motion transmission. Dietrich.

26946 Amusement device. Harris.
26947 Ladders. Brookes.
26948 *Liquid delivery. Reichhardt.
26949 *Lathes. Bourel.
26950 Treatment of ore. Justice.
26951 *Printing apparatus. Beadle.
26952 Shaving soap receptacles. Williams.
26953 Valves. Halliday.
26954 *Furnaces. Marihaye.
26955 Nightlights, etc. Calderwood.
26956 Treatment of liquids. Johnston.
26957 Acetylene generator. Haywood.
26958 *Device for uprooting beets, etc. Benson.
26959 *Galvanic cells. Hesseln.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

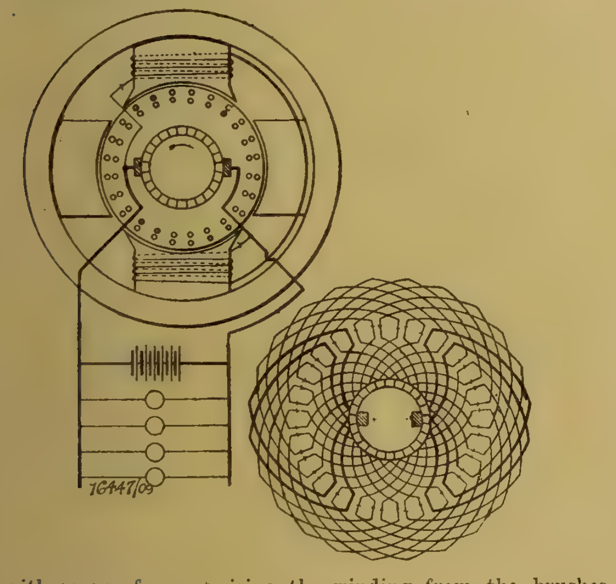
The following Accepted Applications for Patents are open to Opposition up to December 26th, 1910, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

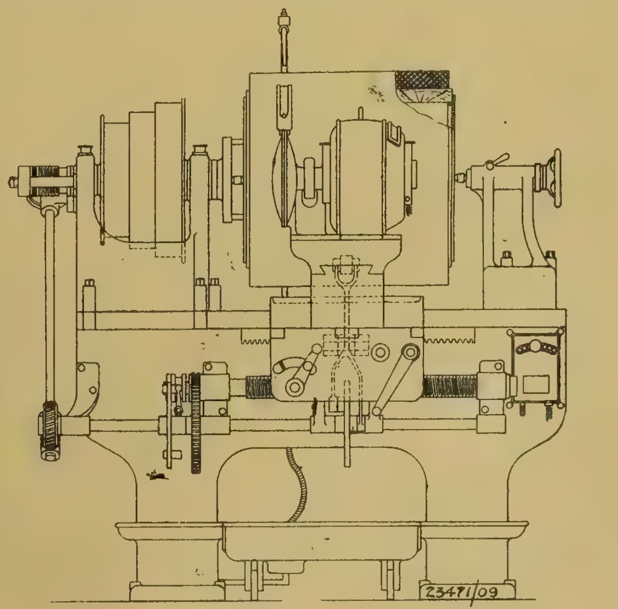
9447 Laybourne and McKaig: Railway crossings. [Post-dated October 19th, 1909.] 16347 Plant: Lasting machines.

16447 Midgley and Vandervell: Dynamo electric machinery. This invention relates to dynamo electric machinery, particularly of that class in the case of a generator in which the rate of revolution is variable and is especially applicable to dynamos used for train lighting in conjunction with a battery of accumulators. The invention consists essentially in winding the armature on the chord principle and to the commutator of the armature providing one set of brushes only. Each brush is made broad enough to short circuit several armature coils, but instead of having one wide brush two or more brushes placed close together, covering the same range as the wide brush, may be used. The magnets with subsidiary poles disposed mid-way between the main poles are provided, these subsidiary poles being provided with a shunt winding in conjunction with means for energising the winding from the brushes of the generator or equivalently the poles may be separately excited. The main poles themselves are not provided with any winding at all, but as the subsidiary poles are separately excited, the magnetic field produced through these poles will always have one direction, and the brushes are so placed that the short-circuited coils pass through this magnetic field, and the current generated thereby in the short-circuited coils will be reversed if the direction of rotation is reversed. The current produced in the short-circuited coils sets up a magnetic field approximately at right angles to the subsidiary field, which thus generates current in the armature and thereby constitutes the main magnetic field. As this field is produced by the short-circuited coils, the magnetic flux will alter in direction according to the armature, and in this way the current taken from the brushes will always be in one direction.



16559 Milch: Control of induction motors. 18644 Foden: Means for securing spare pneumatic tyres to the wheels of road vehicles. 18872 Law: Driving the feed rollers of machines for manufacturing engine waste. [Post-dated February 17th, 1910.] 18988 Duncan: Chain armour for wheel tyres. [Post-dated February 18th, 1910.] 19335 Brown: Breech mechanisms for automatic recoil-operated guns and the like. [Date applied for under Rule 13, July 19th, 1909.] 20661 Challis: Suction apparatus for collecting dust and the like. [Post-dated March 8th, 1910.] 20867 Taylor: Methods of and means for obtaining continuous currents from alternating-current circuits and *vice versa*, and for transforming direct currents. [Cognate Applications: 21157, 1909, 21622, 1909, 22791, 1909, 24444, 1909, 1182, 1910, and 5896, 1910.] 20989 Schonfeldt: Device for locking cash receptacles to coin-freed gas apparatus. 21157. *See* 20867, 1909. 21622. *See* 20867, 1909. 21970 Robinson: Bands or supports for catamenial bandages. [Post-dated March 29th, 1910.] 22586 Martin: Means for weighing the loads lifted by cranes, derricks, and the like. [Post-dated April 4th, 1910.] 22791. *See* 20867, 1909. 23409 Harrison and Melmore: Apparatus for compressing air or gas. [Cognate Application. 8474, 1910.] 23410 Schlumpf: Apparatus for changing the positions of hanks of yarn on dyeing sticks. 23437 Malard: Treatment by liquid processes of textile and other materials. [Application for Patent of Addition to 759, 1908.]

23471 Hill: Apparatus for cutting or slicing rubber or rubber substitute. This invention relates to the general arrangement of a self-acting machine for cutting built-up or solid rubber drums or cylinders into washers, annular discs, or threads, such machine being automatic in its several movements, namely, for cutting into the rubber to the proper depth, withdrawing the cutter, and in its longitudinal traverse and arrest to produce a pre-arranged thickness of washer,

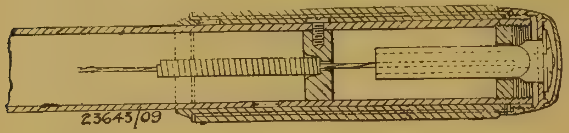


The device consists essentially of a machine for cutting or slicing cylinders of rubber or like material by means of a revolving circular knife adapted during an arrest of the saddle to be moved automatically towards and from the cylinder, and to traverse longitudinally a pre-arranged distance between the cuts.

23495 Taylor and Colegate: Machines for setting fasteners in paper, envelopes, or the like. 23519 Holmstrom and Redpath: Loading gear of ordnance. 23525 Marks (Adler): Devices for locking bolts or nuts in position. 23537 De Carlshausen: Spring tyres for use in the wheels of automobiles, bicycles, and other vehicles. [Application for Patent of Addition to 13102, 1908.] 23551 Hibberd: Gas meters. 23555 Graigola Merthyr Co., Yeo, and Goskar: Manf. of artificial or patent fuel and apparatus therefor. 23570 Shaw: Mathematical compasses. 23599 Bell: Pneumatic anti-vibration deviesc for automobiles. 23624 Williams: Method of treating coal and like gas for the removal of cyanogen therefrom. 23631 Schobert: Flexible hose, piping, or tubing and the manf. of the same. 23632 Wittkowsky: Process for wood filling.

23643 Larkin, and E. M. Bowden's Patents Syndicate Ltd.: Devices for control purposes in connection with cycles, motor cycles, motor cars, and motor-propelled means of transport generally.

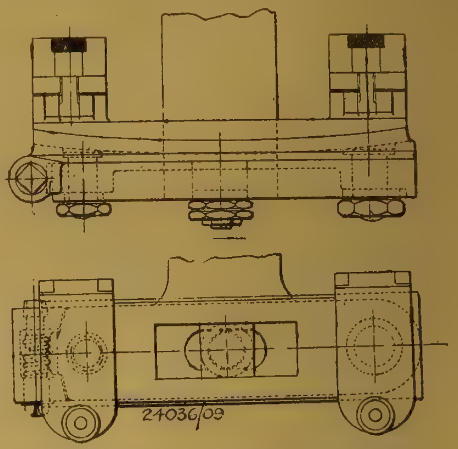
This invention relates to improvements in twist handles such as are used for control purposes in connection with Bowden wire or other flexible transmission mechanism on cycles, motor cycles, motor vehicles, or the like, and it refers more particularly to that type in which the handle is caried by a rotating sleeve that is spirally slotted or otherwise helically formed for engagement with a fixed member or pin on the handle bar in such a manner that its rotation upon the handle bar imparts a longitudinal movement to the carrying block or other member engaging the nipple on the inner operating wire, and consists in providing in a device of the type in which the handle and its sleeve are mounted to rotate upon and simultaneously travel axially or longitudinally on the handle bar of a fixed pin on the handle bar that may either hold, or itself form, the stop block for the outer Bowden member and which serves at the same time to engage the helical slot in the handle sleeve.


23643/09

23668 Turcat and Nuth: Processes for the preparation of elastic products and substitutes for natural lacquers or varnishes and products obtained thereby. [Date applied for under International Convention, October 16th, 1908. Samples furnished under Section 2 of the Act.] 23689 Pedley: Stand or support for a cycle. 23749 Shepherd: Steam-driven road vehicles. 23770 Taylor and Stephenson: Taps or plugs for stoneware jars or the like. [Request under Section 19 of the Act not granted.] 23858 Hunter: Adding and calculating machines. 23881 Madsen: Water-heating device. 23885 Rotherham: Internal-combustion engines. 23887 Gleason: Manf. of hollow rubber articles. [Date applied for under International Convention, October 29th, 1908.] 23891 Varty: Lever mechanism. [Request under Section 19 of the Act not granted.] 23894 Veesey: Stays for casement windows. 23896 Pointon: Charging air with the vapour of medicaments and other volatile substances and apparatus therefor. 23904 Fleming: "Keeping" and drawing of fermented liquids. 23917 Drake: Hot-water conserving tank or cistern. 23923 Radcliffe: Device for holding the blades of so-called safety razors for the purpose of sharpening. 23948 Schmidt: Cariers or moving platforms. [Date applied for under International Convention, October 28th, 1908.] 23977 Phillips and Bulteel: Production of light oils from heavier minerals oils. 23992 Levinstein and Levinstein Ltd.: Manf. of new azo dye-stuffs. [Samples furnished under Section 2 of the Act.] 23998 Callow: Moulding, shaping, and compressing dough and like plastic material. [Cognate Application. 12247, 1910.] 24002 Pavia and Casalis: Automatic couplings for railway vehicles and the like. [Date applied for under International Convention, April 5th, 1909.] 24021 Child: Expansible or adjustable busts or bodies of lay figures. 24023 Scott: Direct-current electric motors.

24036 William Beardmore and Co., and Bremberg: Sight-adjusting devices for ordnance.

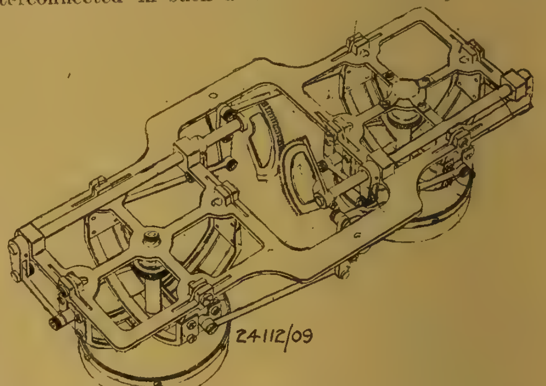
The invention has for its object to provide simple, effective, and accurate devices for adjusting telescope, or it may be other sights, upon sight-bar platforms or equivalent parts of the mounting, the adjustment being that practically permanent one mainly required when the gun and its mounting are first assembled for proving and for those slight irregularities of workmanship which render the sight not exactly correlative with the gun axis when the former is directly mounted upon its platform. The adjustment device may also be used in case of wear. In a device made according to the invention, separate adjustments are provided in a horizontal and in a vertical plane. The method applied for horizontal adjustment, while particularly applicable for that adjustment, is also applicable for vertical adjustment, and similarly that applied for vertical adjustment is also applicable for horizontal.


24036/09

24039 Harris: Apparatus for delivering predetermined quantities of liquid into bottles or similar vessels. 24041 Laserson: Flexible drive and variable-speed mechanism for motor-propelled vehicles, velocipedes, and the like. 24060 Dronsfield: Strap-splicing machines. 24074 Morison: Apparatus for heating and evaporating liquids by means of steam.

24112 De Ferranti: Methods of and means for imparting stability to bodies by use of gyroscopes.

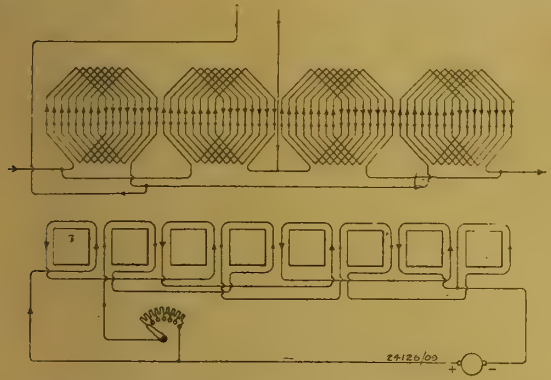
This invention relates broadly to the gyroscopic steadying of bodies, and is applicable either to a case in which additional stability is imparted to an initially stable body or to a case in which stability is to be imparted to an initially unstable body or to a case in which stability is neutral. Specifically the present invention consists in a system of the type indicated of a pair of gyroscopic units interconnected in such a manner as directly to impart stability to the body to which they are applied in all directions. The invention also consists of a pair of gyroscopic units so interconnected with each other and the body to which they are applied that forces tending to incline the gyroscopes in the same sense in any the same direction lock them positively to the body in that direction while allowing equal and opposite precessions in directions at right angles thereto.


24112/09

24123 Livingston: Crank mechanism for engines.

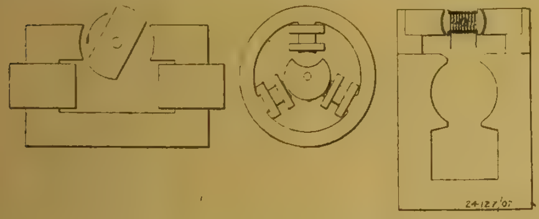
24126 British Thomson-Houston Co. (General Electric Co.): Dynamo electric machines.

Our invention relates to synchronous alternating-current machines, and its object is to devise a novel machine of this type adapted for use either as a double-current generator or as a frequency changer in which the two voltages may be independently varied. In accordance with this invention the machine has only a single armature and single field magnet. The field coils which mechanically form only a single winding are electrically connected in a plurality of circuits so as to produce two component magneto motive forces of different pole numbers, the relative strengths of which may be varied by varying the relative currents in the circuits in which the field coils are connected. The coils of the armature winding also are preferably arranged to form mechanically only a single winding, but are connected in a plurality of circuits so as to form electrically two windings of different pole numbers corresponding to the pole numbers of the magneto motive forces produced in the field magnet. If the pole numbers are so chosen as to be non-inductive with respect to each other, each component magneto motive force of the field magnet induces a voltage in its own armature winding, and does not affect the other armature winding. By varying the relative strengths of the two magneto motive forces the relative amounts of the induced armature voltages are varied. Thus the machine may be operated as a frequency changer with a constant voltage on the motor side, while the voltage on the generator side is varied through any desired range, or, if the machine is operated as a double-current generator, the voltage of both currents delivered may be varied, the variation of each being independent of the other. While the armature coils are preferably arranged to form mechanically a single winding, the invention in its broader aspect is not limited to this arrangement of armature winding.



24127 Parsons and Law: Regulation of the voltage of alternating-current machines.

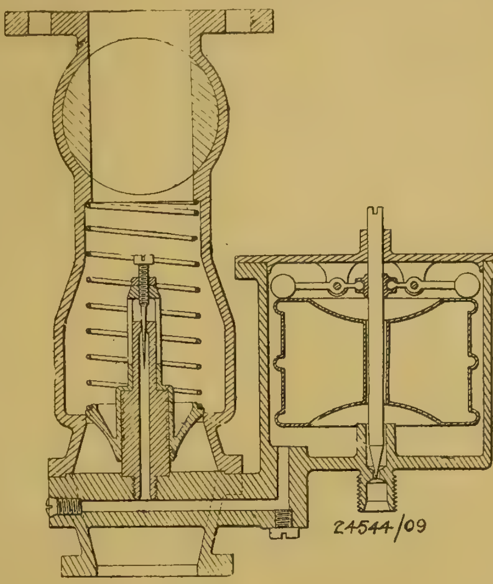
This invention relates to the regulation of the voltage of alternators for the purpose of keeping the voltage constant, and particularly to apparatus for this purpose in which the voltage is regulated by varying the current passing round a leakage path of magnetic material placed across the poles of the alternator or of the exciting machine. The invention consists in causing the current in the winding of the leakage path to be greater when the load is inductive than when it is non-inductive by means of a synchronously rotating inductor adapted to vary the reluctance of a magnetic circuit. The invention also consists in automatically varying the reluctance of the magnetic circuit of the static transformer which supplies current to the winding of the leakage path in such a manner that the current in the winding is greater when the load is inductive than when it is non-inductive. Furthermore, in providing an inductor rotating in synchronism with the alternator and in inductive relation with the magnetic circuit of the transformer which supplies current to the winding of the leakage path, the inductor being so arranged that the current in the secondary of the transformer and consequently in the winding of the leakage path is greater when the current lags behind the voltage causing the power factor to be less than when the current is in phase with the voltage, and in means for causing the current in the leakage path to be greater when the load is inductive than when it is non-inductive.



24135 Wishart: Tobacco pipes, cigar holders, cigarette holders, and the like. 24143 Longsdon: Driving mechanism for wringing, mangling, and like machines. 24174 Braun: Stoppering bottles and the like. 24176 Walker (Mergenthaler Setzmaschinen-Fabrik Ges.): Distribution in typographical composing machines of multiple face lines and their spacers. 24193 Lake (Grand Rapids Veneer Works): Method of drying lumber. 24209 Wilke, Gollner, and Kohlhase: Process of and apparatus for providing bread and the like with a protective covering. 24210 Breh: Washing machines. 24213 J. Osman and Co., and Fidler: Continuous kilns for burning bricks, tiles, pipes, terra-cotta goods, lime, and the like. 24310 Preston and Sedgfield: Fall-over stanchions for doors of railway wagons and like vehicles. 24314 Parks and Wardwell: Braiding, weaving, and like machines. 24346 Poate, Poate, and Fawcett, Preston, and Co.: Hydraulic presses. 24376 Sharp: Apparatus for indicating the number of words written by a typewriting machine. 24392 Cote: Level indicator for liquids. 24407 Parshall: Sluice gates and like devices. 24409 Wingfield: Frames for motor cars and other vehicles. 24434 Carter: Dynamo electric machines. 24444. *See* 20867, 1909. 24452 Fraser: Wire mattresses.

24544 Hamilton: Carburetters for internal-combustion engines.

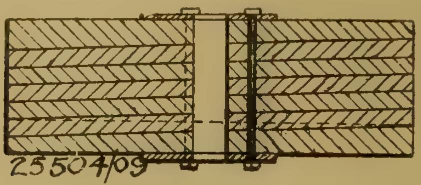
This invention relates to carburetters for internal-combustion engines, and more particularly to carburetters of the suction spray type, and has for its object to automatically vary the area of air inlet and the area of fuel inlet according to the demand of the engine in such manner that the quantity of fuel and the quantity of air constituting the explosive mixture are maintained at a predetermined ratio, whatever may be the extent of opening of the valves. The invention consists of a carburetter for internal-combustion engines wherein the fuel-controlling valve and the air inlet valve are operated to simultaneously control the passage of fuel and air to the mixing chamber giving to the body of the air inlet valve with regard to the adjacent walls by which the passage of air is confined or *vice versa*, a conoidal curvature whereby a predetermined ratio of air opening to fuel opening is maintained for any position of the valves.



24562 Walker, Maddy, and Holbourns: Space bar magazines of typographical composing machines. 24590 Lentheric and Habert-Dys: Method of decorating vessels of glass and other substances capable of being vitrified and vessels thereby produced. 24617 Ireland: Dust and lubricant shields or guards for the axle boxes or bearings of railway, tramway, and other vehicles, shaft bearings, and the like. 24663 Stevens: Automatic photographic detective cameras and apparatus. 24700 James Dawson and Son., and Dawson: Conveyer belts. 24730 Lelievre: Internal-combustion engines. [Date applied for under International Convention, October 31st, 1908.] 24742 Brightmore: Method of and means for preventing the ignition of coal dust in mines during blasting operations. 24879 Bright and Howard: Hinges for doors, gates, and the like. 24882 Tidcombe: Pudding basins. 24888 Lister: Aerial machines. 24957 Sunderland and Thorn: Door checks. 24958 Jevons: Electric welding. 25039 Vorwerk: Sheaths for stiffening supports for articles of clothing and processes for manufacturing the same. 25042 Mabon: Variable-speed gear for motor cycles and the like. [Post-dated April 26th, 1910.] 25209 Barnes: Detachable plate tread for wheel tyres. 25232 Dobson: Propellers. 25305 Butterworth: Device for attaching feeding bottles to children. 25369 Schmidt: Devices for opening, closing, fixing double windows and the like. 25391 Cleaver: Mattresses. 25397 Auster and Auster: Hoods for motor cars or other vehicles. 25430 Ferguson: Machine belt fasteners. 25453 Ure: Aerial vessels and the like.

25504 Chillington Tool Co., and Chapman: Wheels for grinding and polishing metal surfaces.

This invention has for its object to construct wheels for the combined purposes of grinding and polishing metal surfaces. The wheels are made up of layers or sections of felt or other suitable soft fibrous material between which are interposed layers of adhesive material, such, for instance, as printer's roller composition (a mixture of glue and treacle or glue and glycerine) and an abrasive material, such, for instance, as carborundum or emery, the thicknesses of the felt or other fibrous material affording polishing surfaces between the grinding surfaces, and in use the layers of adhesive and abrasive material have a grinding action upon a metallic surface presented against the wheel, while the surfaces of the felt or corresponding material which come against the metallic surface under treatment have a polishing effect thereupon. In forming up the wheels the sections of soft material, having the adhesive and abrasive material between, are pressed together in a mould for a few hours under a temperature of about 200 deg. Fah., the pressure varying according to the degree of hardness required in the wheel, and in the case of the smaller sizes of wheel may be, at the same time, compressed around a bush which forms the nave.



25527 Schoenfeld: Embroidery machines. 2592 Fairbank: Buckets, pails, and like utensils. 25616 Pierpont, and Lanston Monotype Corporation: Machines for stamping or punching matrices or like bodies. 25665 Paul: Method of hardening abnormally soft water. 25699 Payton: Weft forks. 25718 Kelvin and James White Ltd., Clark and Chetwynd: Magnetic compasses. 25734 Siemens Bros. Dynamo Works, and Kloss: Electrical propulsion of ships. 25794 Wombwell: Apparatus for use when teaching drill to soldiers and for similar purposes. 25862 Grigsby: Inverted incandescent gas burners and lamps. [Post-dated May 5th, 1910.] 25909 Lowendahl: Process of manufacturing porous metal blocks. 25928 Croft and Bouts: Liquid level indicators. 25938 Wineberg: Covers for the saddles and parcel carriers of cycles, motor cycles, and the like. 25998 Ruth: Colour photography. [Date applied for under International Convention, November 12th, 1908.] 26076 Wydes-Roberts and Sleight: Roller bearings for sheaves, wheels, fairleads, and the like. [Post-dated May 11th, 1910.] 26522 Oakes: Resilient wheel for motor cars and the like. 26559 Pearson and Seward: Counters. 26616 James (Compagnie Generale de Phonographes, Cinematographes, et Appareils de Precision): Gramophonic recordings on discs or on cylinders. 26665 Summers: Furnaces for use in the "close annealing" of sheets of iron and steel and other analogous purposes. 26723 Pulzer: Watch holder for use in connection with bracelets, wrist straps, or the like. 26790 Doig and Doig: Plough shares. 26890 Banbury: Mechanically-operated revolving building. 26947 Cameron and Coats: Valve gear and valves of internal-combustion engines. 27162 Whiteway, and Chas Macintosh and Co.: Pneumatic tyres for motor and other vehicles. 27181 Kelvin and James White Ltd., and Clark: Mariners' compasses. [Application for Patent of Addition to 10200, 1907.] 27185 Jones and Lupane: Adjustable fitting and detachable appliance for pots and saucepans adaptable to all sizes serving as a self-attendant in the boiling of vegetables and the like to prevent boiling over and at the same time ensuring thorough boiling and cooking. 27216 Cox: Printing blocks. [Post-dated May 23rd, 1910.] 27317 Ogden: Means or apparatus for external cleaning of fuel economisers and air heaters. 27395 British Radio Telegraph and Telephone Co., and Balsillie: Transmission of messages by wireless telegraphy. 27496 Easlea: Manf. of domestic stoves. 27573 Greaves: Process of and apparatus for tanning hides or skins. 27608 Latour: Covers for pneumatic tyres. [Date applied for under International Convention, January 27th, 1909.] 27643 Bates and Shepherd: Friction clutches. 27754 Cowper-Coles: Construction of lamps. 27785 Bell and Graham: Throttle valves for steam engines. 27847 Thomas Bessant Ltd., Ward and Norris: Manf. of door knobs and other knobs and terminal ornaments for bedsteads and for other uses. 27988 Seddon: Manf. of wings or planes as used in aeroplanes. [Cognate Application. 7508, 1910.] 27989 Greenwood: Gear-cutting machines. [Application for Patent of Addition to 17028, 1906.] 27992 Dawson: Ornamental handkerchiefs and the process of manf. 27998 Jackson: Apparatus for partly exhausting syphons for testing and other purposes. 28183 Brandes: Blowpipes for the autogeneous welding and cutting of metals. [Date applied for under International Convention, December 2nd. 1908.] 28222 Nield and Melland: Splicing or joining the end of ropes and means therefor. 28285 Matthews: Blocks for the manf. of leggings. 28408 Morgan: Pulleys and driving drums. [Cognate Applications. 1683, 1910, 9311, 1910, and 11766, 1910.] 28527 Thomas Holcroft and Sons, and Bate: Frypans. 28640 Droitcour: Paper or papier mache matrices to be used in forming printing plates, and paste used in the formation of such matrices. 28658 Furnival, Furnival, and Furnival: Sheet delivery apparatus for printing machines. 28709 Muntz: Turf plough or implement for cutting turf. 28891 Smith: Kneading and like knives of dough-mixing and like machines. 29117 Moorhouse: Kinematographs and like apparatus. [Cognate Application. 10696, 1910.] 29196 Smith: Domestic washing machines. 29242 Cowlishaw: Fluid-pressure engines. 29597 Girod: Hardening of projectiles and other articles of steel. [Date applied for under International Convention, January 23rd, 1909.] 29668 Wikschtrom: Machines for use in the manf. of wire nails. 29678 Usher: Air-sterilising apparatus. 29703 Goedecke and Cie. Ges.: Safety razors. [Date applied for under International Convention, December 19th, 1908.] 29773 Middleditch: Means for preventing corrosion of electrical terminals. 29812 Zur Nedden: Printing, blocking, and embossing presses. 29993 Allen: Post cards, show cards, electioneering cards, and the like for purposes of amusement and advertising. 30009 Cousans: Centrifugal fans. 30025 Goodall: Centrifugal dressing machines such as are used in milling flour or the like. 30189 Bellerby: Device for loading ships and the like. 30196 Raschen, Imison, and United Alkali Co.: Purification of arsenical sulphuric acid. 30241 Brooks: Braces or suspenders for personal wear. 30379 Johnson (Badische Anilin and Soda Fabrik): Manf. of stable anhydrous hydrosulphites. 30404 Hildebrandt: Conduits for temperature exchanging apparatus. 30580 Webb: Distributing valves for elastic-fluid motors.

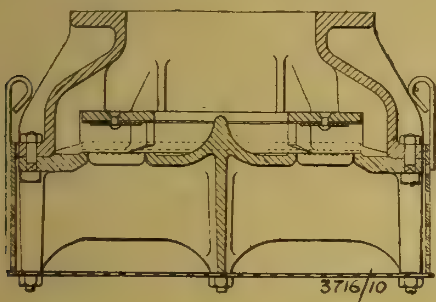
1910.

54 Bridgewater: Pyjamas. 142 Phillips: Side delivery rakes and tedders. 152 Goodby, and Goodby: Expansion joint. 213 Bartelt: Method of and means for introducing detergent into a washing machine. 233 Bachle and Krebs: Internal-combustion engines. 279 Novak: Turbines and the like. 285 Collins: Hand tool for bending pipes, rods, and the like. 352 Blood: Tea kettles or utensils for boiling milk or other liquids. [Post-dated May 26th, 1910.] 370 Newton (Farbenfabriken vorm. Friedrich Bayer and Co.): Manf. and production of a new azo dyestuff. [Application for Patent of Addition to 29459, 1909.] 517 Forrest: Shuttles used in looms for weaving. 554 Grimshaw and Norris: Hammers operated by elastic fluid. 571 Hume: Grips for use in connection with blind and other cords. 638 Liebe-Harkort: Elastic tyres for motor road vehicle wheels or the like. [Date applied for under International Convention, July 28th, 1909.] 645 Akt.-Ges. Brown, Boveri, and Cie.: Connection of single-phase motors to polyphase systems. [Date applied for under International Convention, April 5th, 1909.] 699 Wiedemann and Templin: Method of pumping air or other fluids. 837 Schramm: Curtain-suspending devices. 846 Schumm and Luithle: Drawers. 902 Wallwork: Tobacco-pipe charging devices. [Cognate Application. 1668, 1910.] 919 Maasch and Wollf: Apparatus for playing games. 1010 Richards and Bergin: Root-cutting machines. 1072 Burley, and Howes and Burley Ltd.: Hinges for wind or like screens or covers for motor and other vehicles. 1117 Piestrak: Apparatus for the sterilisation of water or any other liquid by means of ozonisation. 1182. *See* 20867, 1909. 1194 Siemens Bros. and Co., and Dieselhorst: Electric cables. 1305 Smalley: Furnaces and furnace doors. [Cognate Application. 9066, 1910.] 1332 Liebscher: Machines for cleaning waste fibrous material. 1449 Barth: Toy flying machine. 1502 Hughes: Cases for the display of jewellery and the like. 1503 Dutordoir: Speed annunciator for vehicles. [Date applied for under International Convention, December 21st, 1909. Application for Patent of Addition to 30543, 1909.] 1554 Redfern: Construction of steel storage bins. 1625 Lucas and Norton: Friction clutches. 1668. *See* 902, 1910. 1683. *See* 24808, 1909. 1777 Baulino and Pecoraro: Speed-indicating apparatus. 1872 Seelenfreund: Receptacles or supply devices for string, thread, wire, and the like. 1915 Stewart: Magnetic speedometers. 1961 Etrich: Driving apparatus for the spindles of spinning machines. [Date applied for under International Convention, February 15th, 1909.] 2071 Entwistle and Kenyon Ltd. Kenyon, Kenyon, Shorrock, and Taylor: Carpet sweepers. [Application for Patent of Addition to 12816, 1909.] 2079 France: "Beetling" machine for fabrics and the like. 2120 Winter, Furber, and United Shoe Machinery Co.: Machines for operating upon soles of boots and shoes. [Application for Patent of Addition to 21898, 1909.] 2284 Beange: Plows. [Application for Patent of Addition to 14894, 1908.] 2394 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new mordant dyestuffs dyeing from an acid bath. 2505 Hearson (Ridd Milking Machine Co.): Milking

machines. 2600 Sydenham: Carrier for gramophone and other talking machine records. 2750 Carlson: Change-speed and reversing gearing. 2876 Beck: Pyrophoric metal alloys. [Date applied for under International Convention, February 5th, 1909.] 2883 Etablissements de Dion-Bouton (Soc. Anon): High-tension magneto machines for internal-combustion motors. [Date applied for under International Convention, February 6th, 1909.] 2910 Nystrom: Apparatus for reproducing music in keyed musical instruments. 3067 Woolnough: Window and the like opening and closing apparatus. 3125 Parsons: Driving gear for ignition magnetos and similar devices. 3295 Jones: Use of coach screws and the like which engage the edges of rail and other flanges. 3585 Carraher and Hager: Car fenders. 3604 Mosnier: Process and means used therein for the preservation of maize, rice, and the like during storage or transportation. 3611 Junk: Hot-water heating systems. 3618 Rose, and Rose Bros. (Gainsborough) Ltd.: Apparatus for applying bands, wrappers, or labels to boxes, blocks, or packages. [Application for Patent of Addition to 16740, 1909.]

3716 Pulsometer Engineering Co., and Bjornstad: Foot valves and strainers for suction pipes of pumps.

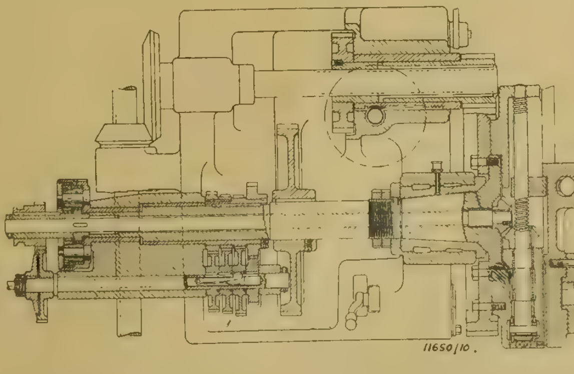
> This invention relates to valves and strainers such as are generally fitted to the lower ends of the suction pipes of pumps for the purpose respectively of retaining the water or other liquid in the suction pipe and preventing solid matter of large size from entering the pipe. Objects of the invention are to provide a valve in which resistance to flow of liquid therethrough is reduced by providing a large area for liquid flow with a valve proper of small weight, working with a comparatively small lift, to simplify the construction of such a valve and reduce its liability to wear and tear and risk of failure to a minimum, and to provide a strainer that is readily accessible for cleaning, since the strainer is always placed below the water level and is often very troublesome to keep clear of weeds or other floating or suspended matter in the water, and consists of a foot valve for the suction pipe of a pump in which the valve proper consists of a loose ring confined between a valve body or chamber and a valve plate removably connected together.



3809 Latham: Painting and like brushes. 3818 Siemens Bros. and Co., and Dieselhorst: Electric cables. 3827 Jackson: Means for tipping the bodies of motor wagons, trailers, lurries, and the like. 3905 Ebhardt: Gum pencils. 3973 Holton: Self-adjusting fuses. 3975 Thompson (Walker): Fire bridges of boiler furnaces. 4285 Willis (Stark and Lowry): Railway rail joints. 4312 Textile Appliances Ltd., and Carver: Jacquards. 4343 Morton and Anderson: Carburetters for internal-combustion engines. 4930 Vicars, Vicars, and Vicars: Dough rollers. 4947 Taylor: Apparatus for measuring dry goods into bags or the like. [Application for Patent of Addition to 13718, 1908.] 5015 Dougherty: Ventilated ports. [Date applied for under International Convention, April 15th, 1909.] 5343 Danielli: Dust bins or boxes. 5515 Freedman: Method of mounting photographs and similar articles upon wood panels. 5667 Niedringhaus: Finishing galvanised sheet metal. [Date applied for under International Convention, March 11th, 1909.] 5668 Niedringhaus: Galvanising apparatus. [Date applied for under International Convention, March 11th, 1909.] 5713 Szperkowski: Elastic-fluid pressure regulator. 5748 Thomas Reeder Ltd., Reeder and Horrocks: Warp beams or rollers employed in textile or other machinery. 5823 Fanning and Nellis: Means for operating track points on electric tramways or the like. 5896. *See* 20867, 1909. 6067 West and Glover: Vertical retort discharging apparatus. [Request under Section 19 of the Act not granted.] 6142 Hansen: Apparatus for shuffling playing cards. 6427 Lynes: Gas and other taps and cocks. 6600 Drury: Mechanism for lifting, hauling, and other analogous purposes. 6653 Firm Robert Bosch: Magneto electric ignition machines. [Date applied for under International Convention, May 10th, 1909.] 6993 Duncan: Automatic oiling device for journals loaded on the upper side such as are used in railway vehicles, tramcars, and the like. 7020 Wiickens: Airship. 7031 Struck: Hat holder with gripping devces moving towards each other. 7155 Cecchi: Manf. of artificial stone or plates and other similar cement agglomerates. 7197 Russell: Thrust bearings. 7295 Twombly: Vehicles. 7485 George Wragge Ltd., Ermen and Ermen: Casement window stays. 7508. *See* 27988, 1909. 7510 Hilliard: Folding wardrobes. 8017 Eckford: Purification or treatment of red or orange lead. [Application for Patent of Addition to 12480, 1909.] 8416 Hellberg: Apparatus for the manf. of threads or twine composed wholly or partly of paper. 8474. *See* 23409, 1909. 8504 Arnold: Tooth cutters for veterinary purposes. 8554 Mazzolini: Means for protecting doors, hatchways, and the like in ships. 8568 Metcalfe: Puncture-resisting material and process for manufacturing the same. 8719 Frederick Sage and Co., and Atkinson: Struts for swing lids and the like. 8737 Lindenthal: Machines for moulding artificial stones, concrete blocks, bricks, and the like. 8754 Puthod: Ironing boards. 8864 Wiegel: Game. [Date applied for under International Convention, August 6th, 1909.] 8895 George Howe Ltd., Howe, Brierley, and Knight: Underpick pickers for looms. 8960 Stock: Motor ploughs. [Date applied for under International Convention, April 29th, 1909.] 9066. *See* 1305, 1910. 9177 Bueb and Deutsche-Continental Gas-Ges.: Manf. of ammonium carbonate. 9200 Geisler: Manf. of shuttlecocks. 9271 Wickel: Process for the manf. of metal foil substitutes for hot embossing purposes. [Date applied for under International Convention, April 17th, 1909.] 9285 Fusa: Automatic safety seal for parcels and the like. [Date applied for under International Convention, April 17th, 1909.] 9286 Galloways Ltd., and Pilling: Steam engine valve chambers. 9311. *See* 28408, 1909. 9471 Siegel: Hat or head coverings for ladies' use in motoring. 9493 Foster: Composition for attaching insulation to steam boilers and other appliances. 9698 Suddell and Lee: Wringing machines for laundry purposes. 9705 Davie and Sturrocks: Puzzle. 9771 Denier: Ventilated head dress. 9906 Bluck: Bucket ladder dredgers. 9963 Firm of P. Paul Laucks: Penholder. [Date applied for under International Convention, August 27th, 1909.] 10036 Witzenmann: Apparatus for armouring cables or the like with metal tubing. [Application for Patent of Addition to 4957, 1909.] 10181 Stevenson: Nut locks. [Date applied for under International Convention, April 29th, 1909.] 10208 Meynier: Dynamo electric machine. [Date applied for under International Convention, April 26th, 1909.] 10539 Baring-Gould: Machine for filling collapsible tubes with creams, pastes, paints, and the like. 10696. *See* 29117, 1909. 10825 Pelzer: Appliance for spreading shaving soap, shaving cream, or the like on the skin for shaving purposes. [Date applied for under International Convention, May 3rd, 1909.] 11087 Van Oorde: Automatic liquid-measuring apparatus. 11291 Isaac: Apparatus for bronzing. 11355 Schmitt: Aeroplanes. [Date applied for under International Convention, May 7th, 1909.] 11600 Firm Robert Bosch: Terminals for electric cables. [Date applied for under International Convention, July 23rd, 1909.]

11650 Laidlar, and George Richards and Co.: Boring and facing machine.

> This invention relates to improvements in boring and facing machines of that type in which a rotary main spindle carries a face plate or boring head on which the tool holder is mounted in such a manner that it can move across such boring head at right angles to the axis of the main spindle. Such movement of the tool holder across the boring head may be automatically effected at varying speeds as a result of the rotation of the main spindle or be manually effected by the operation of a hand wheel. In a machine as commonly constructed such hand wheel is constantly in rotary gear with the main spindle of the machine and therefore constantly rotates as the main spindle rotates. Consequently fine adjustments or move-

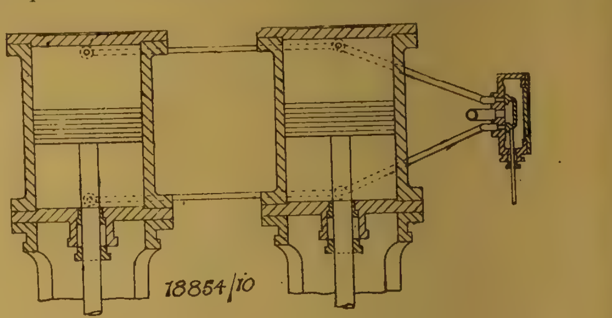


ments of the tool holder across the boring head as a result of hand operation of the constantly rotating hand wheel during the rotation of the main spindle are very difficult. Our invention consists in so constructing or arranging the transmission gear by which the motion of the main spindle is transmitted to the tool holder that one element of it is stationary during such transmission and with this stationary element the hand adjusting wheel is geared and is also stationary until it is moved and moves with it the hitherto stationary element to effect the required adjusment of the tool holder. The "stationary" element is of such a nature that when it is rotated by the hand wheel it operates the inter-geared components to move the tool holder as desired.

11664 St. Helens Cable and Rubber Co., Taylor and Brooking: Manf. of composite plates or articles of hard rubber or the like and metal. 11704 Furst: Filing cabinet for letters, post cards, and the like for use in hotels and the like. [Date applied for under International Convention, May 15th, 1909.] 11715 Wiegleb: Cylinders for internal-combusion engines. 11766. *See* 28408, 1909. 11949 Warwick Machinery Co. (1908), and Halliwell: Systems for utilising steam for prime movers and other purposes. 12116 Hayden: Printing frames. 12130 Farbwerke Vorm. Meister, Lucius, and Bruning: Manf. of violet to blue dyestuffs of the triphenylmethane series. [Date applied for under International Convention, May 25th, 1909. Samples furnisheed under Section 2 of the Act.] 12177 Siegmann: Composition for building, manufacturing, and the like purposes. 12187 Blackburn: Screw propellers. [Dated May 18th, 1910.] 12247. *See* 23998, 1909. 12292 Bowker: Grinding or crushing mills. 12652 Bennett: Rudders. 12728 Firm J. G. Fahr: Mowing and reaping machines. [Date applied for under International Convention, March 31st, 1910.] 12848 Falk, Stadelmann and Co. (Barella): Ball and sock joints. 12858 British Thomson-Houston Co. (General Electric Co.): Centrifugal compressors. 13122 Atterbury: Processes and apparatus for moulding or casting hollow blocks. 13174 Turck: Beam weighing machines. 13279 Metcalfe, and Curtis's and Harvey Ltd.: Cartridge for firing under water. 13464 Ashley: Inkstands. 13500 Degener, and General Composing Co. Ges.: Matrix-setting and type line casting machines. [Date applied for under Rule 13, March 10th, 1910.] 13501 Degener, and General Composing Co. Ges.: Matrix-setting and type-line casting machines. [Date applied for under Rule 13, March 10th, 1910.] 13616 Wheway: Horse collars. 13743 Heaton: Wire or like reels or drums. 13754 Brown: Wheels for vehicles. 13800 Heybach: Carton-closing machines. 13937 Seabrook: Differential axles. [Date applied for under International Convention, July 6th, 1909.] 14002 Arnold: Rims and wheels of vehicles for pneumatic or rubber tyres. [Request under Section 19 of the Act not granted.] 14068 Mundorf: Teasling or nap-raising machines. 14070 Schreier: Numbering machines. 14182 Midland Railway Carriage and Wagon Co., and Pedley: Means for securing buffer plungers. [Application for Patent of Addition to 4994, 1910.] 14419 Got: Labels for packages. [Date applied for under International Convention, June 22nd, 1909.] 14572 Ambrock: Devices for connecting hats and sticks to chairs. 14712 Stumpf: Uni-directional flow steam engines. 14813 Goldstein: Dress forms. 14862 Allgemeine Elektricitats Ges.: Windings of dynamo electric machines. [Date applied for under International Convention, June 21st, 1909. Request under Section 19 of the Act not granted.] 15012 Meader: Game. 15375 Kiser: Wrenches. 15385 Caveney: Locks for hand cuffs, desk or table drawers, and similar purposes. 15551 Astor: Securing devices for chairs. [Date applied for under International Convention, October 14th, 1909.] 15856 Van Berkel: Meat-slicing machines. 15889 Stichelen: Tyres for wheels. [Date applied for under International Convention, July 3rd, 1909.] 16193 Collin: Process and apparatus for the manf. of sulphate of ammonia from moist gases. 16383 Stumpf: Uni-directional flow steam engines. [Date applied for under International Convention, June 18th, 1910.] 16634 John Yates and Co., and Yates: Tools for cutting and removing turf or grass. 16889 Howden and Holloway: Means for fixing blades in turbines. 17088 Bloxam (Chemische Fabrik-Griesheim Elektron): Manf. of new substantive disazo-dyestuffs. 17154 Henderson: Mechanical toys. 17276 Stromeyer: Brake shoes. 17474 Allgemeine Elektricitats Ges.: Ejectors and centrifugal compressors or pumps. [Date applied for under International Convention, August 9th, 1909.] 17614 Bloxam (Chemische Fabrik-Griesheim Elektron): Manf. of a new disazo-dyestuff. 17635 Wolf: Cigars. 17698 Levick: Folding lavatories. 17728 Freytag and Baumann: Gas turbines. 17844 De Havilland: Adjustable propellers or screws specially suitable for aerial craft. 17864 Cousans: Casings for centrifugal fans. [Date applied for under Rule 13, December 23rd, 1909.] 17893 Barton: Governing apparatus for motors. [Date applied for under International Convention, September 1st, 1909.] 18055 Tweedale: Kites, aeroplanes, and analogous aerial machines. [Date applied for under Rule 13, October 18th, 1909.] 18270 Hogan: Bed pans. [Date applied for under International Convention, October 16th, 1909.] 18305 Croucher: Support or platform for punching balls. 18379 Firm of Gustav Buchler: Suspender for socks and the like. [Date applied for under International Convention, April 4th, 1910.] 18403 Darling: Means for securing wire to fencing posts. [Date applied for under International Convention, August 4th, 1909.] 18524 Boult (United Shoe Machinery Co.): Lasting or like machines. [Application for Patent of Addition to 19455, 1909. Date applied for under Rule 13, October 22nd, 1909.] 18772 Down: Operation tables for surgical use. [Date applied for under Rule 13, February 15th, 1910.]

18854 Lundbom: Devices for the distribution of the pressure fluid in piston or reciprocating engines. [Date applied for under International Convention, August 11th, 1909.]

> The object of this invention is to provide an improved arrangement for distributing the pressure fluid in piston or reciprocating engines for use more particularly in connection with mechanical stokers. The invention consists in making the valve motion or valve gear independent of the motion of the piston engines or of one of such engines and in connecting each cylinder with common supply and exhaust pipes on the distributing valve, and also in applying check valves for each cylinder, so that the respective piston engines can either be worked simultaneously or stopped alternately (by turning off the pressure fluid) independently of one another, at the same time giving a most simple arrangement for distributing the pressure fluid to the cylinders.



18893 Hall: Bridle for paint brushes. [Application for Patent of Addition to 11552, 1910.] 18921 Akt.-Ges. fur Anilin Fabrikation: Process for dyeing hairs, furs, and the like. [Date applied for under International Convention, June 21st, 1910. Application for Patent of Addition to 5134, 1910.] 19086 Gaara: Steering devices for aeroplanes and similar machines. [Date applied for under International Convention, September 1st, 1909.] 19142 Schwalbe: Process for obtaining cellulose from vegetable fibres. [Date applied for under International Convention, August 14th, 1909.] 19341 Kalle and Co. Akt.-Ges.: Manf. of an oxidation product of acenaphthene. [Date applied for under International Convention, August 17th, 1909.] 19398 Fried. Krupp Akt.-Ges.: Barrel recoil guns. [Date applied for under International Convention, December 31st, 1909.] 19539 Siemens Bros. Dynamo Works (Siemens-Schuckertwerke Ges.): Commutators for dynamo electric machines.

19707 Smith: Setting out and finishing of leather in the manf. of the same.

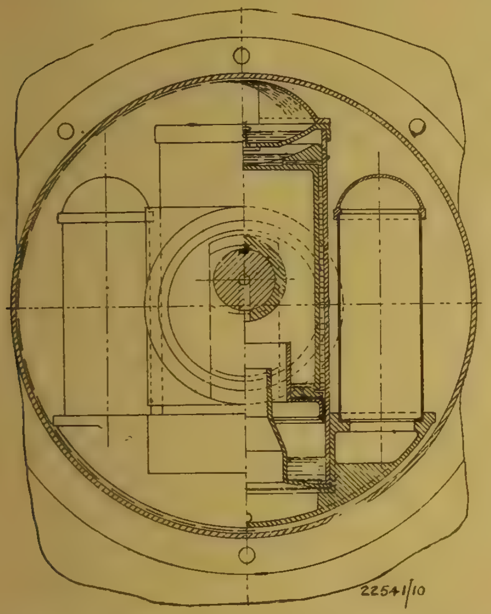
> This invention relates to the setting out and stretching of leather in the course of its manufacture, the setting out consisting in smoothing and setting the leather upon a table or bed while wet by means of a hand tool known as a "slicker." The invention consists essentially in a method of treating leather, characterised by the fact that the leather is set out upon the upper face of the board as it is supported on the support in a suitable position for the operation. The board is then removed from the support and held in such a position that it supports the leather so set out. The support is moved into such a position that the board may again be laid against the support, but with the set-out leather between, without the necessity of moving the board into a position which would risk the set-out leather being pulled therefrom, and the support is then finally brought into a position for setting out leather upon the fresh exposed face of the board.

19746 Wareham: Coupling for the ends of elastic or other exerciser cords. [Date applied for under Rule 13, October 20th, 1909.] 20325 Kaiser: Method of making nitrogen-oxygen compounds. [Date applied for under International Convention, August 31st, 1909.] 20494 Polster: Explosive for detonating pellets and the like. 20518 Strange: Means for the manf. of metal strips or sheets. [Date applied for under Rule

13, October 22nd, 1909.] 20919 Baird and Warrand: Fireproof flooring. 21196 Whitaker: Work holders for sewing. 21289 Pugh: Pawl-locking means for detachable wheels. [Date applied for under Rule 13, September 13th, 1909.] 21966 Howden and Holloway: Means for shrouding blades in turbines. [Date applied for under Rule 13, July 15th, 1910.]

22541 Bell: Pneumatic anti-vibration devices for automobiles. [Date applied for under Rule 13, October 15th, 1909.]

This invention has reference to anti-vibration devices of the piston, plunger, and cylinder type as applied between the wheels and axles, axles and bodies, or wheels and bodies of automobiles, and has for its object to regulate the degree of cushioning at predetermined positions of the displacement, so that the suspension shall be "sensitive" to the absorption of small irregularities of the road surface and at the same time, where a predetermined limited displacement is provided, prevent concussion or shock should the vehicle meet with obstructions which would necessitate a larger displacement than that provided in the device for its absorption, and also prevent shock due to sudden collapse of the air pressure sustaining the load in the device from any cause. In order to augment the volume of air contained in or between the plunger or piston and cylinder, or working parts of the devices, a reservoir is provided so disposed as to admit of ingress and egress of air, without appreciable "wire drawing" at high velocities of displacement, and also without necessity of material modification of the size and displacement of "suspensions" for given conditions of use.

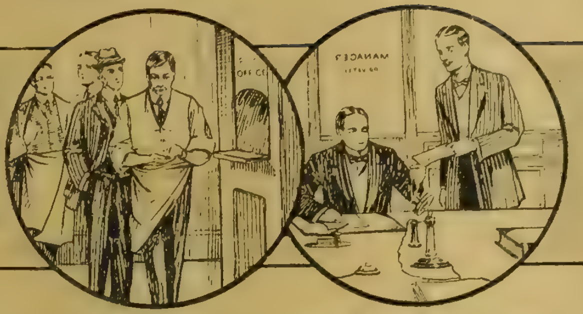


22779 Akt.-Ges. fur Anilin Fabrikation: Manf. of the allyl ester of salicylic acid. [Date applied for under International Convention, November 3rd, 1909.]

COMPLETE SPECIFICATIONS OPEN TO PUBLIC INSPECTION BEFORE ACCEPTANCE, UNDER THE PATENTS ACT, 1907.

1910.

715 Deutsche Gasgluhlicht Akt.-Ges. (Auer.-Ges.): Inverted lamp for incandescent gas light worked by compressed gas or compressed air. 9068 Marcotty: Fire doors for boiler furnaces. 9250 Weber: Mercury carbon filament incandescent lamp. 11049 Houdaille: Shock-absorbing devices. 15791 Lippitz: Transmission of rotary motion. 16560 Rosier: Process for transferring coloured or black impressions on to any transparent or opaque supports. 16662 Smith: Reamers. 16918 Von Middlesworth: Gripper mechanisms. 16919 Von Middlesworth: Feeding mechanisms for paper. 18095 Firm Robert Bosch: Magneto electric machines. 18739 Cake: Propulsion mechanism. 20797 Podolsky and Strausz: Means for returning derailed railway vehicles to the rails. 20964 Soc. Clerget and Co.: Cylinder for explosion engines. 21315 Soc. Thorrand, Durandy, et Cie.: Preparation of cement. 21659 Veit: Sound box for talking machines. 22040 Firm Unterberg and Helmle: Contact breaker for magneto electric sparking apparatus for internal-combustion engines. 22367 Coddingham: Lifting jacks. 22598 Benkiser and Co.: Taps or cocks. 22675



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THE
PRACTICAL ENGINEER
AND ENGINEERS' GAZETTE.

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THE AUTOMOBILE AND CYCLE INDUSTRIES.

THE two great shows held at Olympia during the past month—the first of motor cars and the second of cycles—have an interest extending far beyond those immediately concerned in those industries, either as manufacturers, sellers, or buyers. To the engineer, in particular, the occasion of these annual shows prompts various thoughts, not without application to his own case, in whatever branch of engineering he may be actively engaged.

That the "man in the street" now interests himself in engineering matters is largely due, we believe, to the cycle and to the motor car. We all remember something of the great cycle boom of 14 years ago, when everybody—royalty, aristocrats, and democrats, developed something in the nature of a craze or fever for cycling. Battersea Park became a great rendezvous for the fair and fashionable cycling recruits of London, and the same kind of thing was to be seen throughout the provinces. Our cycle manufacturers were unable to cope with the demand for their machines, and could not obtain the tubes and components required to build them. Everybody talked cycling "shop." Tyres, chains, cranks, pedals, and the like were discussed with enthusiasm in railway carriages, omnibuses, tramcars, and everywhere. The less they knew about it the more they talked. And then of course company promoters became active—as wasps do in summer. Decayed businesses in the Midlands with decrepit premises housing antiquated machinery, were reconstructed—on paper—and the confiding public invited to subscribe for shares and make their fortunes. They got their shares, but the fortunes went elsewhere.

And then the American hustler came along with tall stories of how he was going to flood our market with the surplus product of his own factories at figures which would forthwith overwhelm the home producer. At that time, owing to the great demand, a number of American machines, with their wooden wheel rims and their one-tube tyres, were on sale in this country. But those who bought them do not appear to have become what are the best of all advertisers—satisfied users. At any rate, the American bicycles in this country rapidly declined, and very soon reached the vanishing point. Our own manufacturers (or the best of them), with that sureness which is as characteristic as the slowness of which we hear so much, set themselves earnestly to the task of adjusting their methods and their machinery to meet the new conditions, and so regained the mastery of the situation.

During the last few weeks we have heard much the same kind of shouting as to the doom of our motor industry. It is to go down before an invasion of cheap American automobiles. Everything is arranged—selling agents, sale prices, commissions, publicity matter in the halfpenny press, and so forth. But the industry is not frightened. The memory of some people is proverbially short, and though we quite understand that our transatlantic brethren found it convenient to forget, as soon as possible, the ludicrous ending to the much-vaunted "cycle invasion," we have not forgotten it, and hence can await without anxiety, but not without amusement, the coming of their cheap automobiles. Our good friends apparently find it difficult to appreciate one important fundamental difference between the average American and the average Britisher. The one believes in "get-rich-quick" schemes, and in making a dash whenever he can; he cares more for show than stability. The other would rather sacrifice quickness for sureness, and looking for stability rather than show, he prefers to wait until when he does go in for anything he is able to get a good one.

Concerning purely technical matters, there are no great changes to record in motor construction. The battle between the sliding sleeve and the lift or poppit valve is not yet won. In due course the one will no doubt practically displace the other, as effectually as the live axle has displaced the chain drive.

In the cycle industry, the chief thing of note is the development in motor cycling. A few years ago the motor cycle attained some small degree of popularity. The trade was mainly in machines of Continental origin. After a short time the demand lessened, and it seemed that the motor cycle would practically disappear. But the demand has revived, and to such an extent that the leading cycle firms have found it worth their while to seriously take up the manufacture of these swift little machines. Indeed, it may be said to be, in many cases, a matter of necessity that they should do so in order to maintain their trade in ordinary pedal machines or "push bikes" as the motor cyclist facetiously terms them. A daily contemporary is probably correct in concluding that it is the pressure of the local cycle agents that has caused the famous old bicycle firms to take up the manufacture of the motor bicycle. It is but another instance of the fact that the conservatism of the manufacturer—which is not without its uses—must yield when occasion requires, to meet the demands of the customer.

GAS TURBINE.—A large gas turbine is reported to be in course of construction by Messrs. Brown, Boveri, and Co., Switzerland. Should this turbine prove to be a practical success it will be the first commercial gas turbine, but there have been experimental turbines made and run some years ago. Mr. Sanford A. Moss experimented with one in the United States in the early years of this century. The machine is stated to have developed 3 B.H.P. at 19,000 revolutions per minute, but a separate compressor absorbed much more than this power in supplying it with gas and air. Messrs. Armengaud and Lemale, in France, also experimented with gas turbines, and with a certain degree of mechanical success, but the results so far do not appear to have led to anything practical. The efficiency of these machines has been very poor, and mechanical troubles, chiefly caused by the intense heat of the gases of combustion scouring through the turbine blading, have been insurmountable by any satisfactory devices.

BY RAIL TO INDIA.—The following are the details of a scheme for linking up the Russian and Indian railway systems. It is intended, according to Reuter's Agency, that there shall be from 10 to 15 Russian founders, and an equal number of British founders. The agreement signed by the Russion group provides, among other things: That the company shall be international; that its chief office shall be in some western city (London and Brussels have both been proposed); the direction of the line must follow the shortest route from Calais to Calcutta, using existing lines and going through Persia; the English and Russian interests must be equal; the participation of French, German, Persian, and other groups will be welcomed, but the amount of their participation must be decided later by mutual agreement; and the founders' shares to receive no dividend until after the ordinary shareholders have received six per cent.

SCOTCH IRON TRADE.—An important trade combine, embracing the whole of the Scotch malleable iron trade, is reported about to be launched, with a view to better distribution of trade and the removal of home competition. The combined output will be pooled, each firm will be allotted a percentage of production, and any excess of output will pass into the pool, from which firms who have fallen short in their production will draw and receive compensation. The system is already successfully governing the rail trade. The scheme will come into force in December.

NEW SHIPBUILDING YARD.—It is reported in Sunderland that an application had been received for a river frontage of 3,000 ft. from a shipbuilding firm for the construction of small craft. It is hoped that the application will lead to a satisfactory arrangement, and will be the forerunner of others of a similar nature.

HYDRO-ELECTRIC WORKS.—The new electric works at the Trolhättan Falls, Sweden, have been opened. When the eight turbines and generators are constructed, for which the water supply is ready, the amount of electrical energy available will be 80,000 H.P. It is calculated that, by the construction of new works on the river and the lake, 180,000 H.P. can be obtained. Many of the towns and villages in the neighbourhood of the falls are supplied with power; in the immediate neighbourhood, mills, etc., are already prepared, as well as the electric smelting apparatus installed by the Swedish Iron and Steel Institute, and preparations are also being made with a view to the electrification of the railway. It appears that at present the actual demand does not exceed 10,000 H.P., but it is expected to be much increased in the near future, though not above 30,000 H.P. It seems likely that electrical energy will be used in small quantities for local industries and agriculture, as is the case in Denmark. The budget of the State water and electric works at Trolhättan for 1911 estimates the receipts at £57,000 and the expenditure at £24,000, leaving a surplus of £33,000 on a total capital expenditure of £850,000. Considerable progress is also being made with the railway to the Porjus falls in North Sweden, and it is expected that hydro-electric work at the falls will be begun next spring. A measure is to be submitted to the Riksdag to provide a grant for making a complete survey of all the waterfalls of Sweden, and obtaining full particulars as to the best method of exploiting them.—*The Board of Trade Journal.*

Proposed Harbour Improvements.—The official *Commercial and Industrial Gazette* (St. Petersburg) publishes an article drawing attention to the urgent need for bringing Russian commercial ports up to date by the carrying out of a comprehensive scheme of harbour improvements. The result of the existing backward state of things is, says the *Gazette*, that the average cost of loading and unloading merchandise in Russian ports is far in excess of the cost of similar operations in almost all modern countries, and so much so that, especially in regard to the shipment of grain, it seriously affects trading. In order to remedy this evil, the Russian Ministry of Commerce and Industry have under consideration an extensive project for improving all the principal Russian harbours in the order of their importance. It is anticipated that the carrying out of the scheme will involve an expenditure of some £23,000,000. In this connection, it is noted that an announcement appears in the *Journal de St. Pétersbourg* to the effect that the Russian Ministry of Commerce and Industry have sent to the Imperial Duma a draft bill embodying powers for the expenditure of about £236,000 for improving Reval harbour.—*The Board of Trade Journal.*

Electric Tramway Material.—The *Gaceta de Madrid* contains a notice, issued by the "Ministerio de Fomento," stating that an application has been lodged by the "Compañía del Tranvía Urbano de Bilbao," for a concession for the construction and working of an electric tramway (for the carriage of goods) in Bilbao.—*The Board of Trade Journal.*

THE PRINCIPLES OF IRONFOUNDING.

By **Prof. A. Humboldt Sexton**, F.C.S., F.I.C.

(Continued from page 637)

It is, of course, well known to all workers in the foundry that when the mould is full of liquid metal there is a certain, often very considerable, pressure tending to lift the cope; and to balance that, unless the portions of the flask are firmly keyed together, a weight is put on the top to keep it down. There is nothing mysterious about this pressure; it is simply the hydrostatic pressure due to the liquid contained in the mould, and its value can easily be calculated. The value obtained by the calculations is not always the actual pressure, but it is the maximum towards which the pressure tends, it becoming greatly reduced and ultimately disappearing as the metal solidifies. The calculated pressure is the maximum whilst the gate remains open, that is, full of liquid metal, but should the gate become stopped by solidification of the metal in it, the pressure may rise very considerably on account of the evolution of gas which is thus trapped. The static pressure is simply due to the pressure of the liquid contents of the mould, and depends on the fact that liquids transmit pressure equally in all directions.

For simplicity let us consider first an example in which water is the liquid. Suppose a cylinder C (fig. 100) having an area of one square foot to be fitted with a piston which is watertight, but at the same time can move quite freely, and suppose water to be poured into this from a side pipe having an area of one square inch. It is quite obvious that if the water stands at the same level *a a* in both the cylinder and the pipe, there will be no pressure tending to lift the piston. Now let water be poured into *p*. If no pressure is put on the piston, it will obviously rise and equilibrium will again be reached when the water in *c* and *p* are at the same level, but if the piston is to be kept at the level *a a*, a weight must be put upon it to keep it from rising. Suppose the water in *p b* be raised to a level *b*, so that *a b* = 1 ft., the downward pressure in *p* at *a a* will, of course, be that of the column of water, and as that is 1 ft., it will be just about 7 ozs. (6·94), or as the area is one square inch, 7 ozs. per square inch; and as the pressure is the same in all parts of a liquid in full connection, the upward pressure in *c* on the piston will be 6·94 ozs. per square inch, or 1,000 ozs. on the square foot. A weight of 1,000 ozs. or 62·5 lbs. will be necessary to keep the piston from moving. There is nothing in this contrary to the principle of energy; it is a pressure only, and therefore no work is done. If motion takes place and work is done, then as the water flows from *p* into *c*, as the water in *p* falls one foot, the piston in *c* will only rise $^1/_{444}$ ft.

On this principle the upward pressure on the cope of the mould can always be calculated. It depends on three things: (1) The density of the liquid; (2) the area of the surface to be lifted; (3) the depth of the liquid in the gate.

It is easy to pass from the imagined cylinder of water to the conditions in an actual mould, when an article having a section *c* is being cast. Assume that during pouring the metal is at the level *a* in the pouring basin (fig. 101), then the actual hydrostatic pressure will be due to the column of molten iron *a b* and the horizontal area of the casting. Iron is, of course, much heavier than water, so that the pressure will be much greater. As a cubic inch of iron, when molten, may be taken as weighing 0·26 lbs., the upward pressure on each square inch will be the weight of a cubic inch of iron multiplied by the distance *a b*, or to put it in a formula, the pressure per square inch in pounds

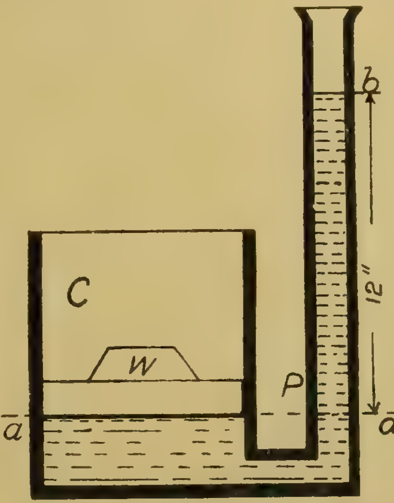

Fig. 100.—Diagram of Hydrostatic Pressure.

$$P = \cdot 26 \times h \text{ (lbs.)}$$

and the total lifting pressure will be this multiplied by the horizontal area of *c*. Suppose for instance that *c* is a flat cylinder having a diameter of 1 ft., and that *h* is 8 in., the total upward pressure will be

$$= \cdot 26 \times h \times (3\cdot 1416 \times 6^2)$$

$$= \cdot 26 \times 8 \times 3\cdot 1416 \times 36 = 235\cdot 224 \text{ lbs.}$$

This is the weight which, if placed on the cope, would just balance the upward pressure, but if the slightest rise of metal took place in the basin the cope would lift. Hence a factor of safety, from 10 to 15 per cent, is added to the weight to ensure that this does not happen.

The exact form of the casting is quite immaterial; it is the horizontal area that is of importance; it makes no difference whether it is flat or curved, plain or irregular. It is not the actual area of the surface, but the area as projected on a horizontal plane. It will be seen that the pressure is very considerable, and that therefore the cope must always be weighted or fixed. As the pressure will be distributed over the whole surface, it is also clear that in the case of a casting of average size, sand alone would not be strong enough to stand it, and the cope must have a grating to give strength.

As soon as the metal begins to set, of course, the pressure is diminished, and immediately a solid skin strong enough to take the pressure of the liquid interior is formed it ceases altogether. It is often thought that there are other conditions which influence the pressure, *e.g.*, if the casting be made in green sand, there may be a rush of gas and steam which is unable to escape at once. Whilst the gate is open this cannot increase the pressure, as it would simply force the still liquid metal back. It is sometimes thought that pouring from a height increases the pressure. This, however, is not so, except in so far as the liquid metal transmits the impact of the liquid falling on to the surface of the metal in the basin. If the metal is poured very rapidly, then there may be a momentary rise of pressure, not due to statical pressure, but to the impact of the rising metal on the top of the mould. For this to be appreciable, however, the metal would have to be poured so rapidly that the mould would certainly be injured.

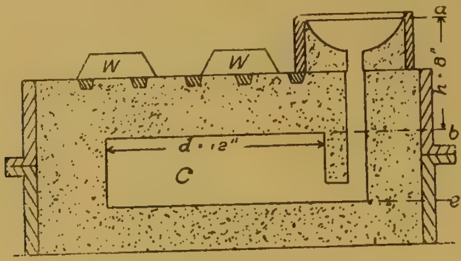

Fig. 101.—Lifting Pressure in Moulds.

The pressure on the bottom of a mould can be calculated, where necessary, on exactly the same principle, only the depth of metal to be taken into account will then be the height *a e* from the top of the metal in the basin to the bottom of the mould. In the case of such a casting as that shown in fig. 101, this will be the same as the vertical upward pressure acting on the cope, added to the weight of the metal in the mould; but in irregular castings it may not be so. It may be considerably greater, and may be got from the product of the greatest horizontal area of the casting, into the total depth of metal and the factor 26. The pressure on the bottom of a mould is rarely of any importance, as it rests on the floor, which, of course will resist any pressure.

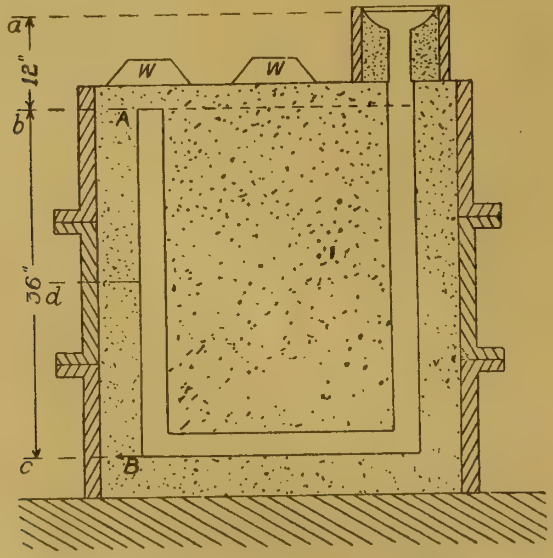

Fig. 102.—Side or Bursting Pressure on Moulds.

In some cases the calculation of a horizontal outward thrust is of importance; it is of course known that the outward pressure may be very great, and that for deep castings strong moulding boxes must be employed.

Consider such a case as that shown at A B in fig. 102, which may be taken to represent one side of a hollow rectangular case, say, 3 ft. square. What we have to calculate is the maximum outward pressure, which will be at the bottom, and also the total outward pressure on the side. Assume the height of the top of the casting basin to be 12 in. above the top of the mould (or *a b* to be 1 ft. and *b c* to be 3 ft.).

The pressure at the bottom, acting downwards, will be, as we have already seen, ·26 × 48 = 12·68 lbs. per square inch, and as the pressure is distributed equally in all directions, the outward pressure at the bottom in the direction of the arrow will be the same, and as the casting is 36 in. long, the outward pressure at the bottom will be 449·28 lbs. This is not quite an accurate statement, because if we consider the bottom inch of the casting the depth to its middle part will be only 27½ in., but if we consider a very narrow strip at the bottom, the pressure will be as indicated per square inch. The pressure therefore will be 12·48 lbs. per square inch at the bottom, and will gradually fall to nothing at the level of the casting basin, or it might be plotted as a triangle shown in fig. 103, where the horizontal line *p q* would give the outward pressure in pounds per square inch at any point *p* at a depth of *a p* from the surface of metal in the basin. The average pressure will be at the middle point of the casting, which will be 2 ft. 6 in. or 30 in. from the top. The pressure there will be 30 × ·26 ≐ 7·8 lbs. per square inch. This may be taken as the average pressure, so that the outward pressure on the whole side of the casting will be 36^2 × 7·8 = 1296 × 7·8 = 10,108·8 lbs., or over 4½ tons; an outward pressure which will need strong flasks to retain it without any sagging.

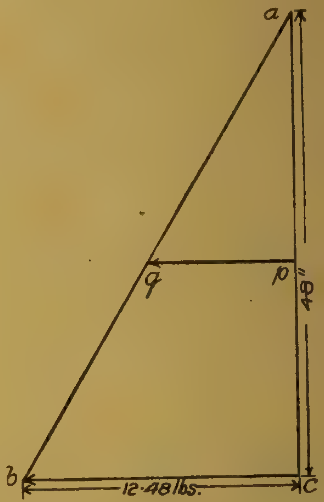

Fig. 103.—Diagrammatic Representation of Outward Pressure.

It must, of course, be borne in mind that this is an average pressure only, and that the actual pressure increases with the depth. It will be noticed that no account has been taken of the thickness of the metal. This is quite immaterial, as the pressure depends on the depth only and not on the mass of liquid.

In practice, this is not exactly the case, as a very thin casting may solidify so quickly that the full hydrostatic pressure never comes into play.

(*To be continued.*)

LARGE GAS ENGINES AND THEIR TROUBLES.*

The purpose of this paper is primarily to discuss the difficulties which have to be overcome by the makers of large gas engines. Hence it is not proposed to describe the various types and makes of large gas engines beyond giving a few brief outline descriptions for the benefit of those who may not be closely in touch with gas-engine work.

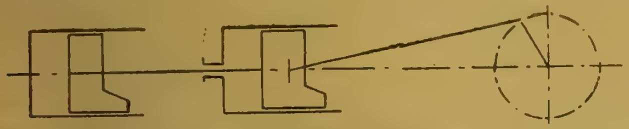

Fig. 1.—Premier-type Engine, Single-acting Horizontal, Tandem, Four-cycle.

Concerning ourselves merely with engines which have had some commercial success, we find six principal types or classes of large gas engines, as follows:—

A. Four-cycle engines—
  (1) Single-acting horizontal.
  (2) Double-acting horizontal.
  (3) Single-acting vertical.
B. Two-cycle engines—
  (4) Single-acting horizontal.
  (5) Double-acting horizontal.
C. Hydro-gas engines—
  (6) Four-cycle and two-cycle.

It is obvious that a great many different engine constructions can be obtained by varying the arrangement of the cylinders, and the designer has often some difficulty in choosing an arrangement in view of the frequently-conflicting considerations of cheapness, floor space, accessibility, turning quality, and fashion. These variations in cylinder arrangement do not substantially affect the type, and for the purpose of an outline description such as is given here are not of importance.

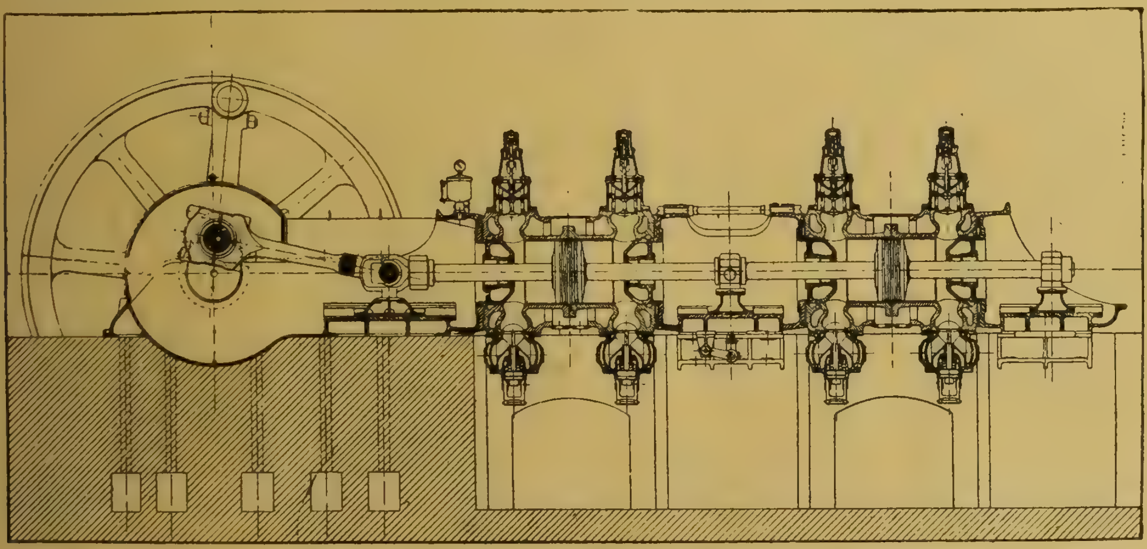

Fig. 2.—HORIZONTAL DOUBLE-ACTING, TANDEM, FOUR-CYCLE ENGINE.

It may be desirable first to state briefly the difference between four and two cycle engines. In all four-cycle engines each working cylinder-end has one power or working stroke in four; that is, one power stroke, or one explosion in two revolutions. In all two-cycle engines there are twice this number of explosions; that is, one per revolution from each working cylinder-end. Signifying explosions by the fig. 1 and blank strokes by 0, these two cycles may be represented as follows: Four-cycle, 1000; two-cycle, 1010; two figures being in each case equivalent to one revolution.

(1) *Single-acting Four-cycle Horizontal Engines.*—Single cylinder engines of this type constitute the world's standard for sizes up to about 250 H.P., and a few have

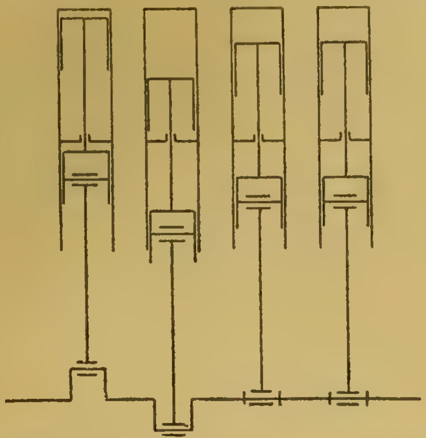

Fig. 3.—Westinghouse-type Engine, Single-acting Vertical Four-cycle.

been built of double this capacity. Even then they can scarcely claim the title of large gas engines, and will not be considered here. The tandem and double-tandem single-acting engines have, however, obtained a considerable vogue in this country, the Premier Gas Engine Company having built a large number developing about 500 H.P. per cylinder. As will be seen from fig. 1, there are two working cylinder-ends, separated, so far as the sequence of explosions is concerned, by one complete revolution of the crank. Hence the explosion may be represented by 1010.

(2) *Double-acting Four-cycle Horizontal Engines.*—Each cylinder-end is now a working end, so that larger powers are possible than with type 1. The usual arrangement is a single-tandem engine, as illustrated by fig. 2, which shows an engine of the Ehrhardt and Sehmer type, as made by Galloways, Manchester. The explosions are 1111. That is, each stroke is a power stroke, and, apart from slight differences in the shape of the turning-moment curve, the turning quality is the same as for a steam engine, having the same number of cranks. This type of engine might almost claim to be the world's standard for large powers. It is made in this country by Galloways Ltd., Manchester; the Lilleshall Company, Oakengates; Richardsons, Westgarth and Co., Middlesbrough; and

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*Paper read by Mr. Frank Foster, M.Sc., at the Manchester Engineering Exhibition, October 24, 1910.

Fraser and Chalmers, Erith; besides about 20 large firms n America and on the Continent. It is frequently referred to as the Nurnberg type, although strictly the Nurnberg type constitutes only one of several embraced by the above outline description.

(3) *Single-acting Vertical Four-cycle Engines.*—These are so far all of the short-stroke, quick-revolution, or high-speed type. Those with tandem cylinders on each crank (fig. 3) might almost be called the British Westinghouse type, as this firm introduced and popularised it. On the Continent and in the United States this type has made no headway. Engines with one cylinder per crank are made by a large number of firms in this country, but most of them can hardly be called large engines. The tandem type has been built in sizes up to 1,000 B.H.P., this engine having four cranks and eight cylinders, as shown in fig. 3. The sequence of explosions can easily be worked out for any case.

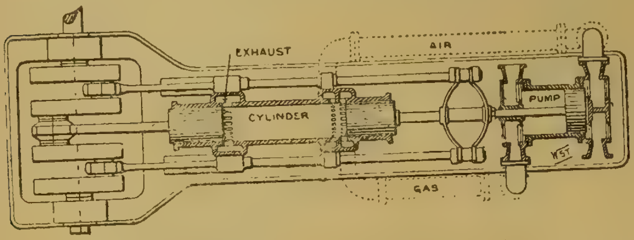


Fig. 4.—Horizontal Single-acting Two-cycle Engine.

(4) *Single-acting Two-cycle Horizontal Engines.*—Small engines of this type, but generally similar to the standard British four-cycle engine for small powers, are almost unknown, but a single-cylinder engine with two pistons, working on cranks 180 deg. apart, and having one common combustion chamber, has gained some popularity. This is the Oechelhauser engine, which is made in this country by Wm. Beardmore and Co. Ltd., Glasgow. The turning quality is the same as engines of type 1, and is represented by 1010 (see fig. 4).

(5) *Double-acting Two-cycle Horizontal Engines.*—This is known as the Korting type, and is made in this country by Messrs. Mather and Platt Ltd., Manchester (fig. 5).

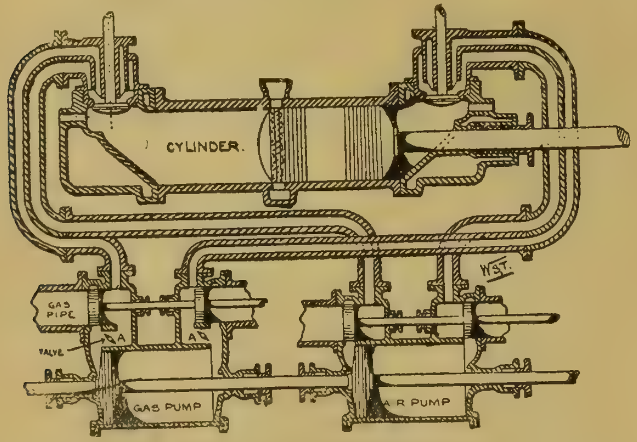


Fig. 5.—Horizontal Double-acting Two-cycle Engine.

Since each cylinder has an explosion each stroke, thus, 1111, there is no point in adopting the tandem arrangement.

(6) *Hydro-gas Engines.*—These are represented by the Humphrey pump. The action may be briefly described as follows: An explosion takes place in the combustion chamber, and drives the water along the pipe and out at the discharge end; at the same time sucking in water through the valves V (fig. 6). The momentum acquired causes the water to shoot beyond the point required for static equilibrium, and hence it returns again, forcing the burnt gases out of the combustion chamber. In doing this it overshoots the mark and moves outwards again, at the same time sucking in a fresh charge of gas and air. On this outstroke its momentum again causes the water to overshoot the mark, and on returning it compresses the charge, which is ignited, and the above cycle repeated. The water is discharged into a tank or under pressure, but if mechanical or electrical power is desired it must pass through a hydraulic turbine, so that for most purposes one unit consists of a hydro-gas pump and a water turbine.

Having thus briefly outlined the types of large gas engines available we will turn to a consideration of the difficulties to be met by their makers. These may be (*a*) constructive, (*b*) operative, or (*c*) commercial. All three are to some extent related, and the first two particularly so.

Dealing with the purely engineering difficulties first, there are certain fundamental considerations to be kept in mind. No exact measurements of the temperatures attained in gas-engine cylinders have been made, but it is known that temperatures between 2,000 and 3,000 deg Fah. (say 1,100 to 1,400 deg. Cen.) are regularly attained. These values are above the melting point of cast iron, and it is evident that steps must be taken by water jackets and other means to keep down the temperature of the cylinder and piston walls, valve parts, etc., as the metal would be ruined if its temperature attained anything like 2,000 deg. Fah. Now, the mean temperature of the inside face of the metal increases with the mean temperature of the gases, and the vigour of their scouring action with the diameter of the cylinder and the thickness of the cylinder or other walls; but decreases with a decrease in the jacket-water temperature, and an increase in the conductivity of the metal. Neither of these last two qualities can be materially controlled by the designer, although it is important not to work with the jacket-water too hot.

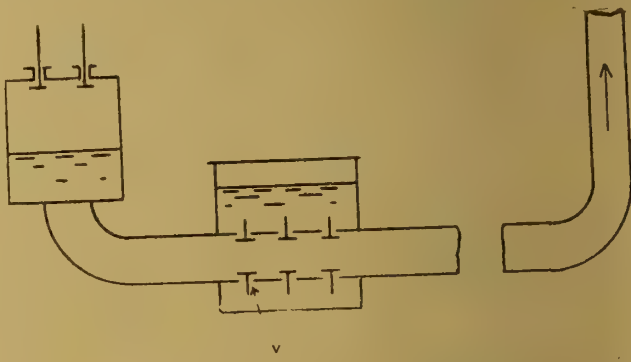


Fig. 6.—Humphrey Gas Pump.

There are several ways of influencing the mean temperature of the gases—and here it should be pointed out that this mean temperature must be reckoned on a time basis, and is not solely a matter of the shape of the indicator diagram. Scavenging, that is, washing out the cylinder between explosions with cold air, if properly applied and with a properly designed combustion chamber and valve parts, gives good results at some little cost in power. If unskilfully applied it may increase the chances of cylinder troubles by increasing the temperature differences between adjacent parts and by increasing the range of temperature fluctuation.

(*To be continued.*)

Lantern Slides.—We have received from Messrs. Siemens Brothers Dynamo Works Ltd., Caxton House, Westminster, S.W., a copy of their new lantern slide list. Since the first issue of this list, it has been revised and considerably increased by the addition of many interesting and up-to-date slides, and now consists of 117 different views. We may mention that these slides are kept in stock at Caxton House, and are intended to be loaned free of charge to lecturers, schools, etc.

AN IMPROVED METHOD OF PRODUCING SOUND WAVES FOR SIGNALLING.

The following description relates to apparatus for converting electric energy into the mechanical energy of sound waves in air, water or other medium of transmission, and more specifically to electric vibratory motors and their application for signalling to a distance by means of "sound waves," that is, waves propagated like waves of sound with frequencies of the order of the frequency of sound vibrations and of sufficient amplitude to produce loud sounds.

It has been proposed to construct a reciprocating engine for purposes, such as percussive drilling, by operating on a heavy iron plunger by coils wound around the same, part of which carried alternating current, and part of which a fluctuating direct current, the arrangement being such that no nett E.M.F. was induced in the direct-current circuit as a whole. Constructions of this kind at most can work at low frequencies because of the difficulties from excessive mass and extent of stroke of moving parts, from which also result wasteful mutual induction between the alternating and direct windings on each side, notwithstanding the fact that no E.M.F. appears at the terminals of the direct circuit.

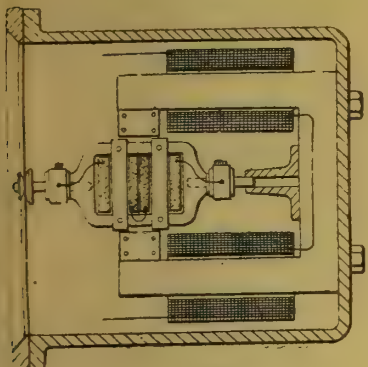


Fig. 1.

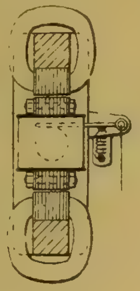


Fig. 2.

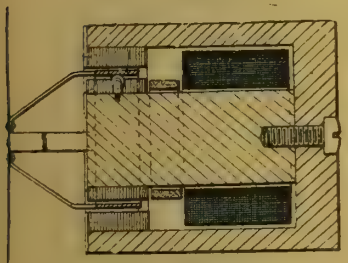


Fig. 3.

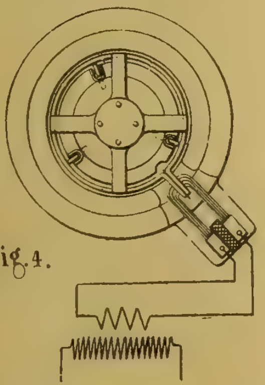


Fig. 4.

The purpose of the apparatus under consideration is to produce continuous or interrupted trains of sound waves of considerable intensity, which, when propagated to a distance, in either air or water, may be heard or detected in any known manner, and may serve as signals or convey messages by Morse code signalling.

The invention, which has been brought out by Messrs. S. Evershed, W. D. Kilroy, and Evershed and Vignoles Ltd., of Acton Lane Works, Chiswick, London, W., consists in a vibratory electric motor sound emitter having substantially no wasteful mutual induction, and also in a vibratory electric motor sound emitter characterised by one or more of the following features:—Operation by steady and changing magnetic fluxes, and arranged to have substantially no wasteful interference; coils arranged to have no wasteful mutual induction, and to carry direct and alternating currents; a compensating winding for the prevention or counteraction of wasteful reaction; a short magnetic circuit or a small part of a magnetic circuit, or a small part of the magnetic material of the motor to which the changing flux is confined; moving coils the flux of which does not thread or cut the exciting coils; a stator excited by direct current or formed of a permanent magnet system for supplying the steady flux and a vibrator carrying an alternating current for supplying the changing flux or a stator supplying the changing flux and a vibrator the steady flux; a stator excited by direct current or formed of a permanent magnet system, together with fixed coils carrying an alternating current and a vibrator of laminated iron; a freely movable sounder substantially without inherent elasticity mechanically coupled to the vibrator of a vibrating motor, with or without an elastic control, such as a spring or its equivalent; a two-phase alternating current exciting arrangement arranged to vibrate a sounder at double the alternating current frequency; two stators each excited by one of the phases of a two-phase alternating current system, and two laminated iron vibrators mechanically coupled together, adapted to be driven to and fro by the stators and to apply a reciprocating force to the sounder at twice the frequency of the alternating current system; a movable conductor adapted to carry an alternating (or direct) current, and adapted to vibrate in the magnetic fixed of a stator excited by direct (or alternating) current, together with means to prevent mutual induction between the movable conductor and the stator windings at zero displacement of the vibrator; a stator having both direct and alternating current windings adapted to produce reciprocating forces upon a movable core, and constructed to prevent wasteful mutual induction between the direct and alternating current windings at zero displacement of the vibrator; and two or more coils acting in conjunction with one or more magnetic circuits and adapted to apply reciprocating forces to a vibratory system, and constructed to prevent wasteful mutual induction between the coils.

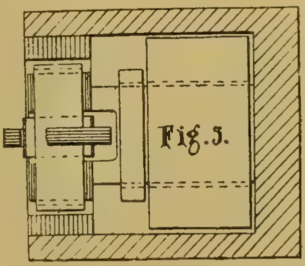


Fig. 5.

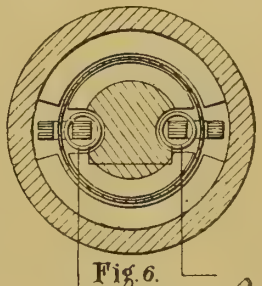


Fig. 6.

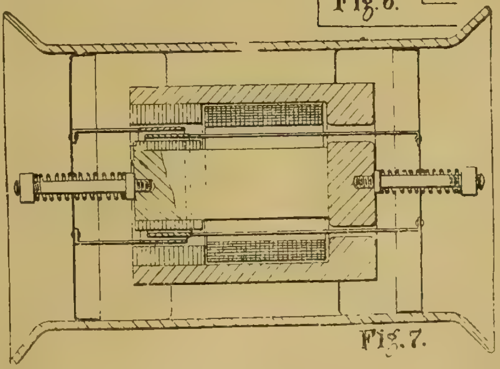


Fig. 7.

In one form a single-phase vibratory motor has as the stator a field magnetic excited by a direct current, and as vibrator an armature with windings which carry an alternating current, and adapted to be moved in and be propelled by the magnetic field of the stator. The vibrator may be composed of laminated iron as a core, and the conductors may be wound thereon or in slots or holes therein, or iron in the vibrator may be dispensed with, and the windings or conductors themselves may be used as the vibrator. Alternating current is led to and from the vibrator by means of suitable brushes and the equivalent of slip rings, or by means of flexible conductors adapted to permit the vibrator to vibrate, reciprocate, or oscillate freely over the required amplitude. The vibrator is suitably supported upon a rod adapted to slide to and fro in guides or equivalent devices, or if the oscillation is circular the vibrator may be fixed to a pivoted axle. In order to eliminate armature reactions of the vibrator upon the stator fixed compensating windings, or alternatively a second vibrator so connected as to reciprocate synchronously with the first but in the opposite phase, or the windings of the vibrator so that they have no mutual induction with the stator windings when the vibrator is at its mean or zero position, may be used. The stator may in another arrangement be constructed as a field magnet with two air gaps in series like the magnetic system commonly employed in moving coil-ammeters and the like, and the vibrator will then take the form of a conductor ring disposed within the annular air gaps and free to move on its own axis. The alternating current is then led in and out at opposite ends of a diameter of the ring, so that half the current flows in each half of the ring. These currents flowing in opposite senses, the ring as a whole has little or no magnetising effect upon the stator. As an alternative to direct-current windings for producing a constant magnetic induction, permanent magnets may be used for the same purpose.

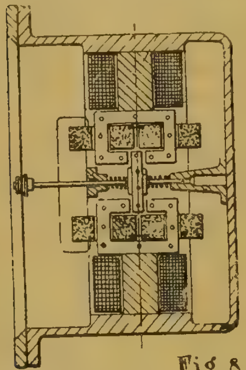


Fig. 8.

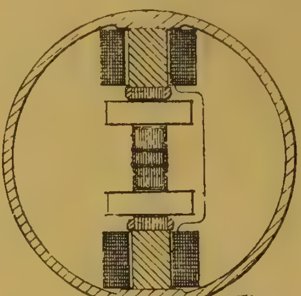


Fig. 9.

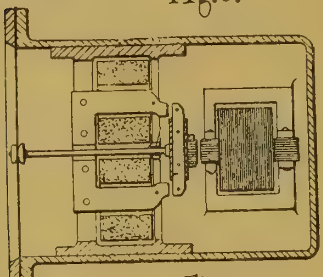


Fig. 10.

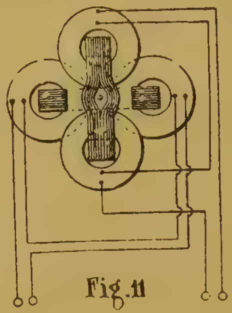


Fig. 11

In carrying out a further part of the invention, a two-phase vibratory motor may be constructed with two laminated electro-magnets as stators, each excited by one of the two phases of a two-phase alternating current system. The stators are adapted to magnetise and attract in opposite directions two laminated iron cores as vibrators, or the two stators may attract in opposite direction two parts of a single vibrator. In either case the resultant effect of the stators upon the vibrators is a vibratory force of double the frequency of the two-phase currents. The two vibrators are mechanically coupled to each other and to a sounder. The windings for exciting the stators and vibrators may be either wholly upon the stators or partly on the stators and partly on the vibrators, and any windings for the latter may be either fixed, or they may move with the vibrators, the broad principle of construction being that each stator with its vibrator is a laminated iron magnetic circuit divided into two mutually attracting parts and magnetised by windings which are linked with it and arranged so as to ensure efficient magnetisation.

The vibrator of the motor is mechanically coupled to the sounder in a rigid manner, so that there may be as little loss of motion and energy as possible in communicating the energy of the vibrator to the sounder. The sounder consists of a disc or other body of suitable shape, having little or no inherent elasticity, and free to vibrate at any frequency and to any amplitude which may be imposed upon it by the vibratory force of the vibrator. This non-elastic sounder may be provided with an elastic recoil by means of an independent spring attached to the sounder or the vibrator, and adapted to give a constant proportionality of elastic force to displacement over a wide range of displacement, or stroke, of the vibrating system. In this way the idle currents flowing in the alternating current windings of the motor may be considerably reduced, and if the frequency at which the sounder is to be used is constant, the strength of the spring may be so adjusted with relation to the mass or inertia of the moving parts as to give the vibrating system the same natural frequency of vibration as that of the alternating current or twice that frequency if a two-phase motor is used. By this adjustment the idle currents may be reduced to a negligible value, and the total alternating current flowing in the motor will be that employed in overcoming frictional and other losses in the motor and in imparting energy to the sounder. It will be of course understood that as an alternative to the spring any other suitable means for giving elastic recoil, such as, for example, an elastic fluid, may be employed.

An an alternative to the sounder without inherent elasticity, any known form and disposition of elastic sound-producing body, in conjunction with vibratory motors, may be used, but whatever form of sounder and type of motor is employed the vibrating system may be adapted to vibrate either freely or against a stop or stops, and it will be seen that the sound-producing devices may be duplicated as required to effect signalling in more than one direction.

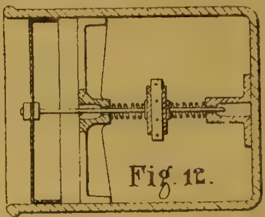


Fig. 12.

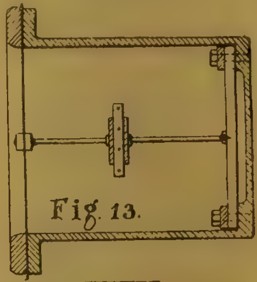


Fig. 13.

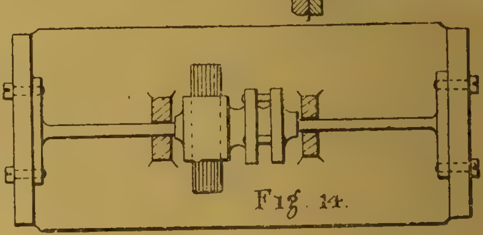


Fig. 14.

Vibratory motors and sounders are particularly adapted for generating sound waves at high frequencies suitable for Morse code signalling and the like, that is to say, at frequencies far above the lower limit of audibility, but they may also be usefully applied for other frequencies, either above or below that limit, and it will be noted that in the vibratory motors, both of the inductor type and the moving conductor type, the periodically varying, or alternating, magnetic flux is confined to a small proportion of the whole magnetic circuit, so that hysteresis and eddy current losses may be small compared with the output of mechanical energy.

The illustrations show in fig. 1 a longitudinal section of one construction of vibratory motor with alternating current windings on the vibrator cores, fig. 2 a cross section of fig. 1, fig. 3 a longitudinal section, and fig. 4 a front elevation of a form of vibratory motor with a ring conductor carrying an alternating current to act as vibrator, fig. 5 a section of a construction with a transformer included, fig. 6 a cross section of fig. 5, fig. 7 a longitudinal section of a duplex vibratory motor in which the two conductor rings are adapted to prevent reaction upon the stator windings, fig. 8 a longitudinal section, and fig. 9 a cross section of a construction of vibratory motor of an inductor type; fig. 10 is a longitudinal section, and fig. 11 a front elevation of the stator magnets of a two-phase construction of motor, and figs. 12, 13, and 14 are details of vibrator constructions with sounders of no inherent elasticity.

BOILER EXPLOSIONS.

Abstracts from Recent Board of Trade Reports.

Explosions from Three Tubes in a Steam-heated Oven.

Report of Preliminary Inquiry No. 1,961.—The explosions occurred on the 6th June last, in a bakery at 81, Hall Lane, Armley, Leeds. No person was injured. The oven was of the double-decked type, constructed with double walls of plating, the space between the plates being filled with insulating material. It contained two compartments, each 6 ft. in length and 4 ft. in breadth, provided with suitable doors and heated by 50 sealed tubes arranged in three rows. The top row contained 16, and the middle row 14, butt-welded, wrought-iron tubes, 7 ft. 6 in. in length, $1^5/_{16}$in. in external and $\frac{3}{4}$ in. in internal diameter. The bottom row contained 20 weldless steel tubes, 7 ft. 6 in. in length, $1^5/_{16}$in. in external diameter, and $\frac{1}{4}$ in. in thickness. The ends of the tubes were plugged and welded, and each contained a suitable quantity of water. They were depressed about 6 in. at the furnace end, and projected into the furnace a distance of about 7 in., the ends of the bottom row forming the firegrate. Each tube was self-contained, and was not provided with any fittings. Suitable furnace and ashpit doors, also two flue doors, and a damper to regulate the draught were fitted. Each compartment of the oven was provided with a mercurial thermometer graduated to 600 deg. Fah. The seventh, eighth, and ninth tubes from the furnace door, in the bottom row, burst at the furnace ends. The eighth fractured longitudinally for a length of about $4\frac{1}{4}$ in., and was deflected about 5 in. below the level of the others. The seventh and ninth tubes bulged and slightly fractured, the opening formed being about $\frac{3}{4}$ in. in length and $^1/_{16}$in. in width. The furnace door was forced open, part of the fire blown on to the bakehouse floor, and a number of bricks displaced in the furnace. Three explosions are stated to have been heard, the first making the loudest report, which was probably the result of the failure of the eighth tube. The explosions were caused by the material of the tubes having become weakened by thinning and overheating until they were unable to withstand the pressure generated, the thinning being due to the working conditions.

Explosion from a Cast-iron Main Steam Pipe.

Report of Preliminary Inquiry No. 1,962.—The explosion occurred on the 15th June, 1910, at Tilmanstone Colliery, Eythorne, Kent. No person was injured by the explosion. The pipe which failed was made of cast iron. It was about 3 ft. 2 in. long, 12 in. in internal diameter at one end, reduced to 10 in. at the other end, and was from $1\frac{1}{4}$ in. to $1\frac{1}{2}$ in. in thickness. It formed part of the main steam range from the boilers to the winding engines and pumps. The pipe was fractured, nearly the whole of one side of the pipe being blown out. A number of minute fractures were also found. The explosion appears to have been due to the repeated percussive action of water accumulated in the pipe range, until the pipe at last became unable to withstand the stresses imposed on it.

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"Drying Machinery and Practice." A Handbook on the Theory and Practice. By T. G. Marlow. London: Crosby Lockwood and Son. Price 12s. 6d.

The subject of drying as carried out as part of the process in many and varied manufactures had hitherto received but scant attention by the press, neither has there hitherto appeared a reliable and comprehensive work dealing with all the principal methods now in use. Most engineering firms engaged in the manufacture of drying apparatus specialise in particular classes of machinery, the purposes for which differ widely from one another, the trades having no connection with one another.

The methods of drying by gravitation, condensation, evaporation, pressure, and centrifugal force all come under discussion, the types of modern machines used being described and fully illustrated. There are, of course, several means by which evaporation of moisture may be effected, the adaptability of each being dependent upon the material under treatment. The methods of applying heat, the removal of the vapour, and the handling of the materials during drying operations are given prominence. It would be invidious to refer here to any particular makes of apparatus that come under purview throughout the book, but it may be said that the examples selected are those of leading makers, and may be looked upon as being typical.

To assist readers to further literature on the subject, an ample bibliography is included in an appendix covering 10 pages, and the glossary of terms will be found especially useful to those less acquainted with the technical expressions used.

As a guide to the practice of drying by machinery, the book stands alone. It is thoroughly up to date, and is likely to become the leading authority on the subject.

"How to Use Electric Light." By F. H. Taylor. London: Perceval Marshall and Co. Price 6d. net.

The popularity of electricity for lighting and other domestic purposes calls for cheap and reliable literature suited to householders. This little handbook is written in language which may be understood by everyone unacquainted with electric terms. It tells of lighting by the incandescent lamps, where economy may be effected, and how small repairs may be effected. Some notes are included upon meters and how to read them, with tips concerning costs and some general notes on electric heating. Those residing within the London district will find the table of supply companies, with voltages of supply, rates, and rents of service.

As a first insight into matters electrical for the home, this little work has only to be known to become popular.

"Compressed Air: Theory and Computation." By Elmo G. Harris. London: The Graw-Hill Book Co. Price 6s. 6d. net.

This book has been specially prepared to assist engineers engaged in the designing of compressed air plants and installations. The subject is treated mathematically, and only those with a fair training in mathematics will be able to follow many of the reasonings given.

The value of the work as a practical aid is greatly increased by the inclusion of tables, diagrams relating to temperature, air measurement, and the friction in pipes, pumps, and compressors.

Practical considerations have been kept to the forefront, the treatment being up to date, and of special value to the particular line in engineering dealt with.

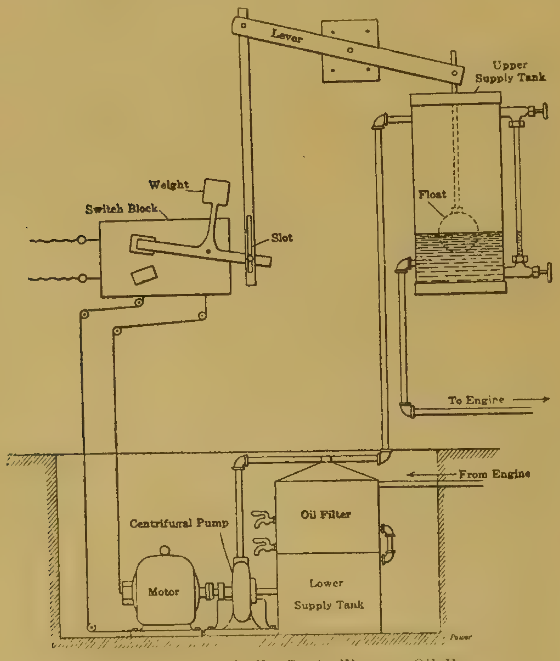
Books Received.

"Official Gazette of the United States Patent Office." Vol. CLX., No. 2. Published by Authority of Congress, Washington.

"Steam Turbines: Their Design and Construction." By Rankin Kennedy. London: Whittaker and Co. Price 4s. 6d. net.

DEVICE FOR AUTOMATICALLY CONTROLLING AN OIL PUMP.

The arrangement for automatically operating an oil pump shown in our illustration is given by a correspondent of our American contemporary, *Power and The Engineer*, New York, and may be of interest to some of our readers. The device is in use at a small power plant, and the writer says a supply tank is attached to the wall near the ceiling, and from this the oil flows by gravity to the engine. The return from the engine is connected to a filter located in a pit under the floor, and from there the oil filters into another supply tank. By means of a motor-driven centrifugal pump the oil is forced from the lower tank into the upper supply tank. A float in the latter tank is arranged so as to make or break the contact required to start or stop the motor. The arrangements of this float and automatic switch are clearly shown in the accompanying sketch.



Device for Automatically Controlling an Oil Pump.

We hear that several "Kerpely" gas producers, which are manufactured in this country by **Messrs. E. G. Appleby and Co.,** are being installed at the works of Messrs. John Summers and Sons, and also at those of the Shelton Iron, Steel, and Coal Co.

THE ELEMENTS OF ENGINEERING ESTIMATING.

By A. Suggate, A.M.I.C.E.

(*Continued from page 647*).

Railway companies, corporations, and other public bodies solicit tenders from firms in whom they have confidence mainly in two styles or ways. In the first they issue detail drawings and very complete specifications, trusting to their inspectors to see that the work will be carried out in accordance with same, hence it is a matter of indifference to them, save that of price, which tender is accepted, and therefore accept the lowest; hence the firm's quotation must of a necessity be a cutting price. In the second case the specification is a very general one, and the firm is asked to forward along with tender designs of the work they propose to supply, with their own detail specification of same. Here the firm's mechanical ability can be brought into play in devising the most economical machinery for accomplishing the object in view, and their commercial ability in making apparent that their customer's requirements are best met by their design and specification, the same being well worth the amount of tender. It is advisable in tendering prices, especially to public companies, if possible, to avoid limiting any conditions as to time of acceptance of same. Companies dislike to be fettered, and the expression in the tender "price quoted subject to acceptance within a month," or one of similar intent, will often cause the tender to be passed over in preference of one a trifle higher in amount, but with the acceptance of the price unconditioned in the matter of time.

Schedule Prices.

Companies in their specification often require a definite number of different articles. The firm, in tendering, quote a lump sum for the whole number of articles, and, upon the acceptance of same, the firm is requested, in the event of the company requiring a repeat order of one or more articles named in the schedule list, to price each article separately. The point to observe is that the sum total of the separate prices must be the same as the lump sum quoted for supplying the whole. This work is easy to accomplish if trade is good and prices high, but not so simple if the lump sum is a cutting price. The estimator is advised to consider those articles of which the company are likely to require the greater number and price them at a very moderate profit, while those of which few are likely to be required may be priced a trifle higher. Take the following example:—

15 cast-iron lamp posts of the C pattern.
1 portable vertical boiler, with 7 in. × 3½ × 7 in. donkey pump attached.
2 wrought-iron 10-cwt. swing wall cranes 6 ft. radius, with eyes and all necessary fixings and bolts for 14-in. wall.
60 ft. of 2¼ bright steel shafting in three 20-ft. lengths.
2 2¼ loose collars with set screws.
7 2¼ plummer blocks, with brass bearings.
1 turned cast-iron pulley, 4 ft. diameter, 8 in. face, 2¼ bore.
2 turned cast-iron pulleys, 2 ft. 6 in. diameter, 6 in. face, 2¼ bore.

A lump sum has been tendered for the above and accepted. It is not likely the company will require a second boiler and pump, nor at present more cranes or shafting, but more lamp posts and pulleys may be required, hence the former can be quoted net catalogue prices, while the latter should be quoted as low as possible so as to leave a small profit. It is not fair to tie a firm down to the same price for too long a period, so a time limit to the prices quoted are here permissible. "Prices subject to revision at end of three months," or even six months, is a common form of expression.

MARKET PRICE DIAGRAMS.

An important adjunct to the knowledge possessed by an estimator is his being conversant with the latest market prices of materials, and also with its "tone," *i.e.*, the prices constant, or fluctuating, rising or falling, and if possible knowing the reason of such changes. Journals, such as *The Iron and Coal Trade Review*, or *Rylands' Iron Trade Circular*, and most of the engineering weeklies, will give the prices quoted or realised, and while supply and demand will largely influence its tone, the market is also affected indirectly by labour disputes, strikes, war alarms, financial panics, stocks and shares, etc., etc. He should carefully study the curve of prices made on the squared paper, and familiarise himself with the difference in its shape in successive years. No difficulty will be found in this, as the bound-up back numbers for any year of most of the leading journals can be found in the libraries. Engineers wishing to study in their office the market prices, and watch its rise and fall, pin to the wall, or on to a drawing board, a sheet of squared paper, 1 in. divided horizontally into 12 equal divisions in the usual scale, and writing under the vertical ordinates the successive weeks or months of the year, according to the exactness with which the prices are to be examined, and letting the horizontal ordinates denote shillings, the amount being figured on the left hand of the sheet, then the sub-divisions will indicate pence. All as per sketch No. 1.

Suppose it is desired to make a diagram of No. 3 Cleveland Pig Iron for the year 1909. The first market closing price of the new year mark off on the first ordinate, and the last market price in each month tick off on their respective ordinates, join the ticks by straight lines, and the diagram is completed as per sketch. It is obvious if the curve is drawn as shown in full to represent prices quoted, another curve can be drawn alongside, dotted to represent prices realised; also if pig-iron prices are shown by the curve drawn in black, wrought-iron prices by the curve being drawn in blue, copper by a curve in red, and brass by a curve in yellow. By this expedient the same sheet of squared paper may be used for the market-price diagrams of different materials. By adding together the varying prices for the 12 months, and dividing by 12, is obtained very approximately the average market closing prices for the whole year. In the example taken of No. 3 Cleveland Pig, this average equals in amount to 49s. 4·49d., and is shown plotted down in position on diagram by a dotted line, and is spoken of as the yearly average price line, or for brevity, merely the average line. It is to be noticed that if the monthly divisions had been subdivided into their respective weeks, and the weekly market prices ticked off and joined by straight lines, the diagram would have nearly approached a curve, and to that extent more exactly represented the rise and fall of prices than one made by straight lines joining the monthly market prices only. Also that if the mid-monthly market prices be added together, and divided by 12, the yearly average price line would be more correct in amount than that obtained by adding the monthly market prices, and dividing by 12.

It is desirable to closely examine this diagram, and see what amount of information can be derived from the study of it. And it is at once apparent that if the average price line be correct in amount and position on the diagram, the area enclosed by the average line and the curve above it, on the right hand, is equal to the area enclosed by the average line, and the curve below it, on the left hand of the diagram. On measuring this area, it will be found to equal nearly eight square inches, above and under the average line.

Suppose the new year's average price had been known in the month of January and drawn on the squared paper, as shown, then by marking off on the ordinates for the months of January, February, March, April, the market prices, and joining the marks by straight lines, it is seen that the line, while continuously falling the first three months of the new year, after the month of March commences to rise, and it is not difficult for anyone possessing a slight acquaintance with market price diagrams to draw the curve very approximately for the remaining months of the year, as shown by dotted lines, merely taking care that the area enclosed between the curve and average line is the same above and below the latter. It is thus apparent that in the coming months of October or September the price of No. 3 Cleveland Pig will advance nearly five shillings above the price quoted in the month of March. Again, supposing that during the first three months of the new year the curve, instead of falling below the average price line, as it did in the year 1909, rise above it, then it is known that in the latter part of the year the curve must fall below it, so as to make the enclosed area above and below the average line equal; therfore the curve can very approximately be drawn in by hand, and the probable amount of fall in price known some four or five months beforehand. Or again, suppose the curve alternates a little above and below the average price line the first few months of the new year, it is then probable that the curve will continue to alternate till after the middle of the year, when it may suddenly move up or down, and the curve completed by hand for the whole year as before. Thus it is seen that having drawn on squared paper the average price line, and plotted in the curve of market prices for the first three or four months of the new year, the curve can very approximately be completed for the whole year, and a probable forecast of market prices obtained. It does not matter much about the yearly average price being exact in amount, so long as it is within a few pence of the correct average is all than can be expected. There are many ways of computing the approximate new year's average price, all based on the one principle, that the coming year's prices are the results of causes that germinated many years previously, and developing in the successive and following years, culminate in determining the new year's prices, so that the further back the number of years are taken from which to compute the new average the more accurate are the results likely to prove. At least the yearly average price for 10 years back should be taken, and to illustrate the methods of computing the new average the following table gives the yearly average price of No. 3 Cleveland Pig since the year 1899:—

Year.		Average price quoted.			Differences.	
1899		60·166			8·917	
1900		69·083			23·508	
1901		45·575			3·611	
1902		49·186		1st	2·77	
1903	1st	46·416			2·666	2nd
1904		43·75	2nd		5·208	
1905	3rd	48·958		3rd	6·5	4th
1906		55·458	4th		·533	
1907		56·091			5·375	
1908		50·716			new difference	
1909		new average				

1st Method.—Consider the list, and it is obvious that the prices of pig are somewhat inflated for the years 1899 and 1900, in comparison with the prices of same for the remaining years; hence, omit these years, sum the remainder, and divide it by the number of years, and the quotient will equal approximately the new year's average price. New average

$$= \frac{\text{sum}}{8} = \frac{396{\cdot}15}{8} = 49{\cdot}518.$$

The objection to this method lies in the arbitrariness of omitting prices thought to be inflated; besides, it is contended that those years with inflated prices influences to some extent the prices of succeeding years, and should therefore be taken into account; hence the

2nd Method.—Bracket off the 10 yearly average prices as shown, then, as the sum of 1st bracketed numbers is to the sum of 2nd bracketed numbers, so is the sum of 3rd ditto to the sum of 4th ditto; dividing the result by number of years bracketed will give approximately the new year's average price, thus:—

1st bracket.		2nd bracket.		3rd bracket.		4th bracket.
418·592	:	414·517	::	396·150	:	392·293

and $\frac{392{\cdot}293}{8} = 49{\cdot}036$ approximate new average price.

3rd Method.—Take the difference between the yearly average prices and bracket them off as shown by the right-hand column, then as the sum of the 1st bracketed differences is to the sum of the 2nd bracketed differences, so is the sum of the 3rd ditto to the sum of the 4th ditto; divide the result by the number of differences bracketed, and subtract from the average of the ten years' prices:—

1st bracket.		2nd bracket.		3rd bracket.		4th bracket.
53·18	:	44·796	::	23·053	:	19·418

The average of the ten years averages equals 52·5399, and

$52{\cdot}5399 - \frac{19{\cdot}418}{7} = 49{\cdot}765$, approximate new average price.

The objection to this method is that it is uncertain if to add or subtract the difference from the 10 years' average; this can only be surmised by working out the new average by one of the other methods first. Take the average of the results of the three methods

$$\frac{49{\cdot}518 + 49{\cdot}036 + 49{\cdot}765}{3} = 49{\cdot}439, \text{ or } 49\text{s.} - 5\tfrac{1}{4}\text{d.}$$

This calculated average price is so near the actual price of 49s. 4½d. that it must be considered as a coincidence only, and not as of any value in proving the accuracy of the methods adopted, for they are based on the supposition that the new year's prices will simply have a normal rise or fall, similar in amount to that prevailing in the market the previous six or eight years. Hence the rules are simply to aid, and not to supplant, the judgment. Suppose by the end of the March month market prices all round had improved, one or two of the large ship-building firms had booked orders, sufficient to keep them busy 12 months ahead, perhaps indications of a blast furnace being opened up that had been closed down some years previously, less number of men out of employment than the same time last year, all indicating improvement of trade above that of last year, then the experienced estimator would plot down on the square paper the average price line some five per cent greater than the amount given by the rules; and, conversely, if two or three successive years of good trade had prevailed, followed by a year having its early months indicating a falling off in trade, then a small percentage should be deducted from the amount as given by the rules. If the new year opens up with prospects of trade similar to its three or four predecessors, the average price as found by the rules may be accepted as correct, needing no alteration. In a similar manner can forecasts be made of the probable market prices of all materials in the engineering trade.

(*To be continued.*)

CLEAN IRON CASTINGS.

By Walter J. May.

In making castings in the ordinary way it is not unusual for them to have dirty patches, or porous parts caused through dirt, and while there is no real reason why this should be so, apparently many of the iron casters cannot avoid getting a big percentage of wasters from this cause. Even when melted in an air furnace or in a crucible iron in the hands of some persons appears to behave in a most peculiar way, and—well, what is the use of considering this feature of the matter as it cannot be remedied?

In the ordinary course of events, iron, when in a fully molten condition, has its content in solution, and when the metal stands steady for a time certain of the content slags off, while the balance of the alloy remains unchanged for practical purposes. Of course, segregations of certain of the contents take place, the free carbon being segregated out of the mass for instance, but this does not make the castings dirty or porous. Assuming that you start with a good clear iron, and you use clean coke, and your furnace lining is such that it will not give matters that will be taken up by the iron, in ordinary cases you should bring down clean metal and produce clean and sound castings if the moulds and cores are made from proper materials, but you must make your metal fluid enough to permit the slag to rise freely and, at the same time, quickly, or it will get caught and held in the metal. Of course, one can use one of the various "fluxes" to effect the clearing of the metal more quickly, and as these things are only more or less efficient deoxidants they might be of use, but as no foundryman uses fluxes of any kind owing to the superior quality of the metal which goes into the furnaces, such fluxing cannot be advised. As there is a fairly steady sale for the foundry fluxes, the writer often wonders what they are used for, because they are not suitable for the manufacture of pills or patent medicines, nor are they of much use as road paving.

However, you cannot take out of your furnace stuff which you do not put in; consequently, if good metal is used it should come out good, although it is in a molten state, particularly if there is a receiver to the cupola, or you can tap off big ladles of metal at each tapping, because in either case you can give time for the metal to slag off before pouring, and then if you pour dirt into your moulds you have only yourself to blame, as it is quite easy to skim the metal before pouring. If it is too much trouble to skim the metal you will get dirty castings.

The moulds and cores, if made of clean materials, will not communicate dirt to the castings, and this does not necessarily mean that new sand, etc., must be used, but if the sand consists of sand, coal, brass dirt, and other things—particularly the other things of unknown content—then unless you heavily face your moulds with a clean and well-prepared facing sand, you will likely get dirty castings; not necessarily castings holding sand, but castings which, when dressed, have surface porosity and other like undesirable features. Old sand is not necessarily dirty sand, but very often a foundry floor is the receptacle of all kinds of rubbish, and the moulds suffer in consequence.

In itself, clean metal usually casts sound enough if ordinary care in moulding and coremaking is exercised, but naturally in some moulds the sand will wash up unless special care is taken. Run the metal down hot and fluid, let it stand until the slag has risen, and then skim and pour. You will then get clean castings from decent iron, but if you use rubbish you will have either doubtful castings or you will have to treat your metal with something or other, and no foundryman does this.

MEANS FOR PRIMING PUMPS.

The device for use in priming pumps we are about to describe operates by exhausting air or gas therefrom, and an arrangement is provided embodying a positive air or gas exhauster which is automatically brought into action whenever the pump requires priming, and at other times is automatically cut out.

The arrangement comprises an air pump having its suction pipe connected to the main pump at a convenient point on the supply side of a non-return delivery valve, means normally tending to place the air pump in driving connection with its motor, means responsive to liquid pressure in the delivery of the main pump for interrupting such connection, and means responsive to liquid in the main pump for interrupting communication between the latter and the suction pipe of the air pump, when the main pump is primed.

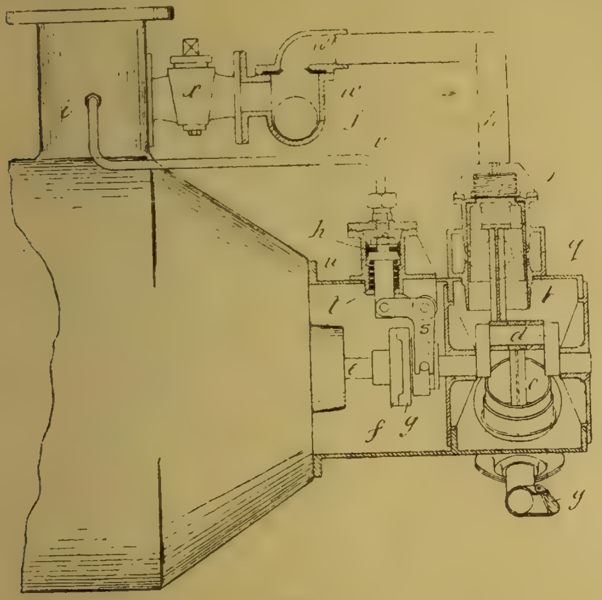


Fig. 1.

The device is the invention of Messrs. The Pulsometer Engineering Company Limited, of Nine Elms Iron Works Reading, Berks., in conjunction with Mr. Jörgen Björnstad, and is shown in the accompanying illustrations, fig. 1 being a part sectional side elevation, and fig. 2 a part sectional end elevation with the suction pipe of the air pump connected to the main pump at the delivery side thereof.

The vacuum pump or exhauster is of the reciprocating type with one or more cylinders, preferably three, *a*, *b*, *c*, driven either from three cranks placed at an angle of 120 deg. from one another, or from one common crank *d* if, as shown, the cylinders are placed at an angle of 120 deg. from one another, to make the turning movement for driving it, and the suction effort, as even as possible.

The vacuum pump is driven from the main pump shaft *e* or other revolving shaft, through a coupling or clutch *f*, *g* which is arranged to be automatically put into and out of gear as required. The suction pipe *h* of the vacuum pump is connected to a suitable part of the main pump casing or body, as for example to the delivery outlet *i* thereof on the supply side of a non-return delivery valve, and is provided as is customary with a valve *j* arranged to automatically close the pipe when the water has risen in the main pump to the desired level, whereupon the main pump will at once commence to draw its own water and to create a pressure in the pump casing. This pressure is caused, as for example through a piston *k*, to disengage the clutch *f*, *g* driving the vacuum pump, and leave the same at rest until the pressure in the main pump again drops, either through temporary stoppage or through the admission of air into the suction pipe causing the water to run out of the main pump through the suction pipe, whereupon the clutch will at once automatically re-engage the driving shaft *e* and re-start the vacuum pump. The automatic valve *j* in the suction pipe *h* of the vacuum pump will, at the same time, automatically open to allow the vacuum pump to again exhaust the main pump casing and thus cause it to become refilled with water and again start on its work.

The cylinders *a*, *b*, *c* of the vacuum pump are single-acting with trunk pistons *m*, *n*, *o*, the suction inlet to each cylinder being in the form of a circular slit or port *p* formed through the cylinder wall and arranged to be uncovered by the corresponding piston as the same reaches its extreme outward position. A belt or receiver *q* of large capacity connected to the suction pipe *h* is formed outside this slit or port *p* to enable the air to quickly enter and fill the cylinder during the short space of time the slit or port is left uncovered. On the return stroke, the piston first covers the slit or port *p* and then expels the air enclosed in the cylinder through a loaded delivery valve *r* which is placed in the cylinder cover.

The automatic clutch *f*, *g* may be of the friction type or of the claw type, preferably the latter, as shown, with the driving faces tapered slightly and the edges well rounded to facilitate the engaging and disengaging of the two parts of the clutch, and to enable the clutch parts to slip out of gear if the resistance should accidentally become excessive. The clutch is actuated by a forked lever *s* and a spring *t* arranged so that the clutch is normally pressed into gear by the spring. The clutch piston *k* is connected to the lever *s* so as to act in opposition to the spring *t*, and is arranged to work in a cylinder *u* connected by a pipe *v* to the main pump casing, so that when there is a sufficient pressure in the pump the piston *k* will counteract the effort of the spring *t* and open the clutch *f*, *g*.

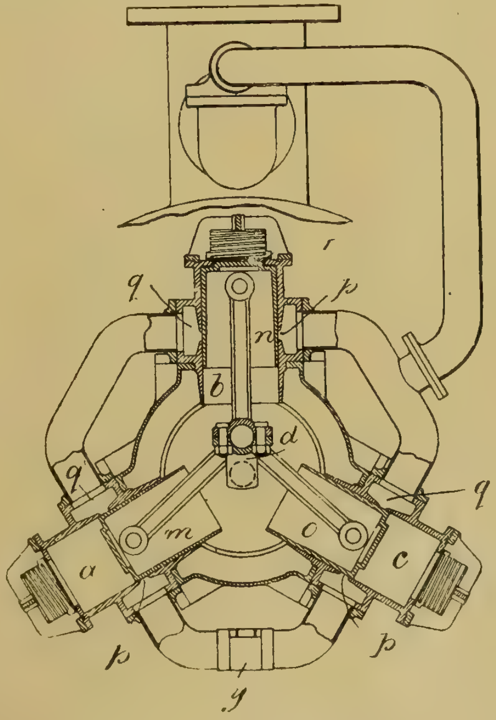


Fig. 2.

The automatic valve *j* in the suction pipe *h* is preferably of the ball type, the ball being of such specific gravity that it just floats in water. The chamber *w* containing the ball is connected to the main pump casing and placed in such a position that the ball will float up against its seat w^1, when the water level in the pump casing reaches the level at which the pump will start work, the upper part of the chamber above the valve seat being connected to the suction receivers q of the vacuum pump.

A cock, or screw down valve x, may be placed between the automatic valve j and the pump casing to shut off, by hand, the suction to the vacuum pump should the automatic valve j fail to close completely, owing, for example, to solid matter lodging on the valve seat w^1 and thus prevent the discharge from the main pump escaping through the vacuum pump.

The lowest point in the suction pipe h to the vacuum pump is fitted with an escape valve y to allow any water which may find its way into the suction pipe h to escape, and also to prevent a pressure being set up in the pump in case the automatic valve j should fail to close completely at the required time.

Where, as may happen, it is found of advantage to connect the suction pipe h of the vacuum pump to the suction side z of a pump as indicated for example in fig. 3, then the casing w for the valve j may be provided with two seats w^1, w^2. Whilst the vacuum pump is operating to fill the main pump, the valve j will hover between both seats, this continuing until the liquid reaches the height at which the main pump begins to work, when the valve j will be held by the liquid against its upper seat w^1 so as to close the communication between the suction pipe h and the suction side z of the pump, this action coinciding with the disconnection of the vacuum pump from the driving shaft therefor.

Whilst the vacuum pump is idle, the partial vacuum on the suction chamber of the main pump, due to the suction lift, may tend to cause air to be drawn past the pistons of the vacuum pump through the suction pipe h into the said suction chamber, but such air is prevented from entering the suction chamber of the main pump, where its presence would disturb the pumping action by reason of the water level in the valve chamber w gradually falling, under the action of the air, and allowing the ball valve j to bear against its lower seat w^2, and so close the communication between the suction chamber and valve casing w.

It will be seen from the above that the invention consists essentially of a positive air or gas exhauster having its suction pipe connected to the main pump at a convenient point on the supply side of a non-return delivery valve, means normally tending to place the air pump in driving connection with its motor and means responsive to liquid pressure in the delivery of the main pump for interrupting such connection when the main pump is primed.

COST OF ELECTRICAL PRODUCTION IN A PLANT WITH RAILWAY LOAD.

The power plant of the Hyde Park Electric Light Company, in one of the suburbs of Boston, has the distinction, according to *The Electric Railway Journal*, of supplying more electrical energy for street railway service than any other central station in Massachusetts. The return of the company for the year ended June 30, 1910, was recently filed with the Board of Gas and Electric Light Commissioners, and it shows that a total energy sale and distribution of 4,103,384 kw.-hours, 88·5 per cent, or 3,636,390 kw.-hours, were supplied to electric railway feeders. The total output of the plant at the busbar for the year was 4,357,648 kw.-hours. The plant is under the management of the Old Colony Street Railway Company.

The return shows that the maximum load upon the station occurred on January 14, 1910, the peak output being about 3,439 amp. The maximum load on the day of least output during the year was 1,300 amp., the date being August 8, 1909. The station equipment consisted of nine boilers of an aggregate rating of 1,350 H.P., operating at 115 lbs. steam pressure, and five reciprocating engines driving five d.c. 500-volt generators and two alternators. The total generator capacity was 1,775 kw. The two largest generators in the station were rated at 850 kw. and 525 kw., and were each driven by a direct-connected cross-compound engine. The station pay roll includes three engineers, three firemen and two coal passers. The cost of manufacture at the busbar was as follows for the year:—

Cost of Production (net at switchboard) Hyde Park, 1910.

Fuel	$34,228·04	or 0·78 cents per kw.-hour.
Oil and waste	746 45	
Water	707·63	
Wages at station	9,609·76	or 0·22 cents per kw.-hour.
Station building repairs	607·44	
Steam equipment repairs	2,966·14	
Electric equipment repairs ...	652,71	
Minor station tools	776·19	
	$50,294·36	or 1·15 cents per kw.-hour.

The coal burned was bituminous at $3·94 per ton and No. 3 buckwheat at $3·17 per ton.

ELECTRICALLY-DRIVEN CLOCKS.

Mr. Ball, in a lecture on "Some recent examples of modern electrical time service," given at Coventry, said engineers were indebted to the clockmakers of the past for having invented the wheel-cutting engine. Dealing with the measurements of time, he recalled the first hydraulic means—the water clock as used in India at the present time, in which a ball placed in water sank at a certain time. Clockmakers had given a great deal of attention to different forms of escapements, and had produced a number of very ingenious devices. The introduction of the pendulum was a great advance on the rocking balance, and by means of diagrams its application to various escapements was shown, including that invented by Lord Grimthorpe.

The two absolute courts of appeal in measuring time were obtained from the sun and the stars, and he explained the methods and instruments used in each case, and diagrammatic views of the mechanism employed in distributing Greenwich time were exhibited.

Passing on to the use of electric clocks, he called attention to a master clock he had fitted up and connected up with two other time keepers. Mr. Ball, aided by his mounted clocks, demonstrated how the electric clocks, no matter what number, all leaped together. He claimed it was a simple system, there being only one pendulum to regulate. The pendulum, he explained, was made of "Invar," a particular alloy of nickel and steel in very accurate proportions.

Besides linking up all the clocks in a building, the electric system could also be applied so as to include the workmen's time recorders.

The lecturer concluded with some particulars of the largest electrical clock in the world, now under construction, and which would have four 25 ft. dials, and built so as to resist a wind pressure of 12½ tons on the dial.

Answering questions, he said the mercury pendulum was excellent, but it had the disadvantage of being affected by the varying heat of the atmosphere. The cost of an installation of 50 clocks would be about equal to that of good English spring-dial clocks, but the cost of up-keep was less. The drain on the battery was very small, and the longest run he had known on one charge, with simply the addition of water, was two and a half years.

THE PROFITABLE ORGANISATION OF WORKS.

The active co-operation of the personnel is indispensable in works, and should be freely but systematically consulted. The means of realising these consultations is to create permanent committees, charged not only to occupy themselves with current work, but also to solve other important problems, such as those relating to progress to be made, to new projects, to economy to be made in cost of manufacturing, and to the welfare of the staff.

There might be thus created a general works committee, uniting under the presidency of the director, or of the manager-in-chief of the works, the chief of the instruction or scientific department, the works manager, the head of the cost price department, and two or three foremen of departments chosen for their intelligence and their spirit of initiation. Each branch of manufacture should have a secondary committee, presided over by a member of the principal committee, and the questions considered will be analogous. Once a fortnight, moreover, a meeting of the works managers and foremen should be held.

These consulting committees form, according to the writer, one of the best elements of progress, and give rise to a wholesome emulation and to an *esprit de corps* very profitable for the firm.

These meetings of committees should take note of what ought to be accomplished in each branch of the industry, and of what has been actually done. The reports might be as follows: The analytical monthly report of profits and losses; the commercial report; the factory report; the report on cost prices. The utility of all these documents will depend upon the constitution of these consulting committees, and they should as far as possible elaborate them.

The organisation of the experimental and designing departments is one of the chief factors in the economical production of a works. This organisation should ensure the following results:—

(*a*) To obtain from the staff progressively improving work as regards economy in general production, and of accuracy in manufacture.

(*b*) Study of the new work and of that already made, with the view of utilising the plant in stock, or in current use.

(*c*) Assuring the co-operation between the instruction or scientific department and the shops, between those who conceive the projects and those who execute them.

(*d*) Ensuring co-operation between the instruction or scientific department and the commercial service, in order to obtain an output more and more adapted to the requirements of the customers and to the struggle with competition.

These results depend chiefly on the value of the chief draughtsman, who should possess first-rate qualifications and extensive knowledge of drawing, of machine tools, of methods of manufacture, of tools, of foundry work, and of pattern making, etc. If he possesses these qualities, no hesitation should be made about paying a good price to secure his services.

It would be found advantageous to bring together from time to time the draughtsmen, and to discuss the different questions of service and of the courses of study. Attempts must be made to develop a cordial spirit of co-operation between the instruction or scientific department and the drawing office and foremen.

One of the most important problems is the study on a modified basis of improvements regarding the manufacture of current work of all design. This problem once attacked, should not be abandoned until a satisfactory programme of progress and improvement has been established. This programme should be afterwards rigidly adhered to and never abandoned, as is sometimes the case after the lapse of a certain time. A daily amount of progress each day is required, even if it be upon a new line of a new project.

It would be found useful to submit the new researches or the old researches recommended to a committee formed by the chief of the scientific department, the chief of the works, and the members of the principal committee of the works.

It may be said that the workshops form the heart of the establishment. If this be badly managed the latter will be badly organised. This department should be itself brought to a maximum of work and of economy in the output of machine tools. Day work is nevertheless necessary in the shop by reason of the precision required. Some satisfactory method of control must, however, be established in order to provide for manufacturing at a low cost, and to ensure the workmen and foremen giving every satisfaction, from a point of view of cost price and workmanship.

It is possible to have workshops, even with incongruous plants, yet having the same common elements, and it would be possible to turn out repeat work, and consequently to realise a certain economy. The most important operations should be performed by men doing no other work and working with precision. The work should be passed rapidly through the machine-tool shops, as delay in preparation by the machine tools may be very prejudicial to a whole works.

It is advisable to systematically compare the cost price of the work turned out by the tools with that estimated. The men might be encouraged by reasonable bonuses to finish work within specified times, without, of course, sacrificing precision. The time required to execute any given piece of work should be fixed by the shop committee.—Translated from an abstract in *La Machine Moderne*, from *Le Mois Scientifique et Industriel*.

THE STEAM ENGINE INDICATOR AND ITS DIAGRAM.

At the Institute of Marine Engineers, on November 21st, a paper on "The Steam Engine Indicator and Its Diagram," by Mr. W. G. Winterburn (member), was read. Opening with a short description of the indicator, the author said the steam pipes to the indicator should be as short as possible, and the string for rotating the drum flexible, and led by easy-running grooved pulleys through as few angles as circumstances would permit. The indicator should be kept clean, but not necessarily polished; scouring the brasswork was apt to leave particles of grit in the delicate places of the mechanism. The external motions also, if free from rust, worked just as well when dull as when bright; the pressure laid on by a heavy hand when poilshing delicate parts might slightly distort them. When applying the indicator, before admitting steam the pipes should be blown through; then the steam cock should be gradually opened and the piston worked slowly up and down a few times. The presence of a little water was very apt to break the spring through "water hammer" projecting it too violently. The author then explained a number of diagrams, showing the variations in the cards and describing the causes which produced them. Indicator diagrams, he observed, sometimes deceived. In one case the card showed serious throttling at the top end, yet the engines were running well and the consumption was normal. It was eventually discovered that the spigot of the cylinder cover had partly closed the steam passage when in place, thus wire-drawing the steam as it entered the indicator. The effect produced on the diagrams by fluctuating back pressures was not only governed by the capacity of the steam receiver, but also by the relation of steam admittance of one cylinder to the closing of exhaust of another. In multiple crank engines equality of steam distribution was most nearly approached, though much might be done by a correct sequence of cylinders.

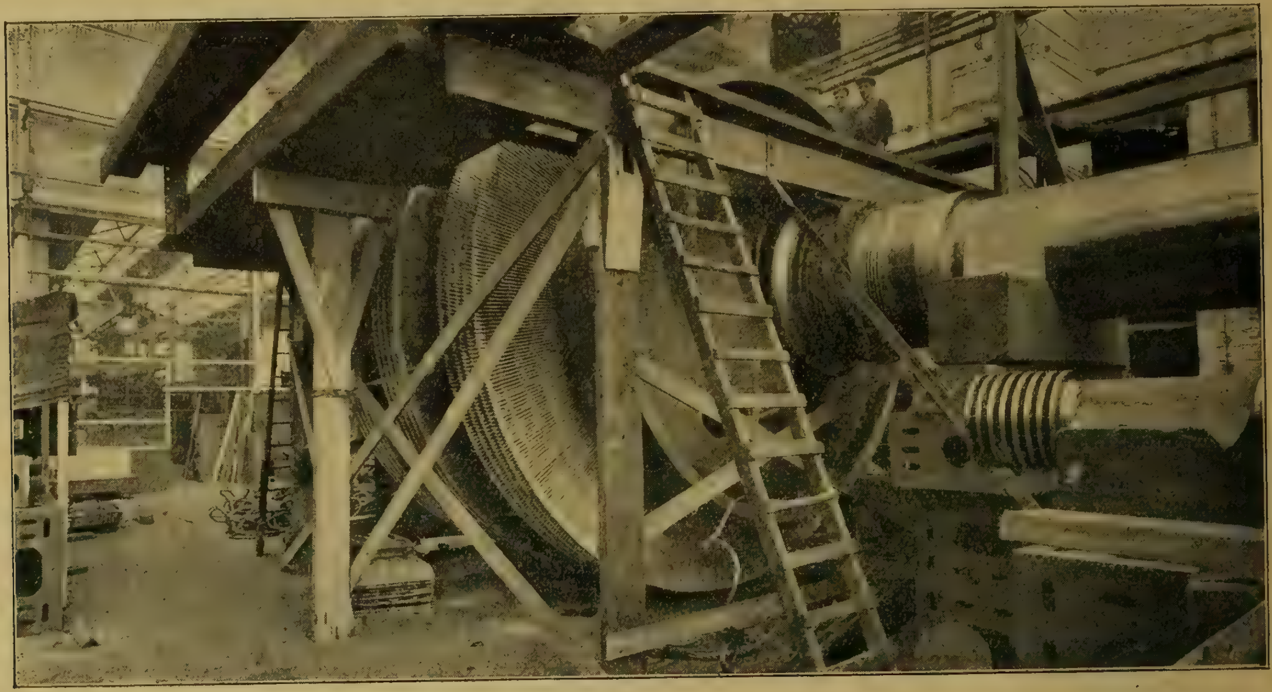
MACHINERY OF WHITE STAR LINER "OLYMPIC."

Our illustrations show the starboard reciprocating engines and the steam turbine of the White Star Liner Olympic in course of construction in the shops.

The reciprocating engines consist of two sets, one to each wing shaft, and are of the four-cylinder, triple-compound type, working at a pressure of 215 lbs. per square inch, and exhausting at an absolute pressure of about 9 lbs. absolute. The engines are of the four-crank type, and the system of balancing used is that of Yarrow, Schlick, and Tweedy, a practice which has been found most successful by Messrs. Harland and Wolff. The principal dimensions are as follows: High-pressure cylinder, 54 in. diameter; intermediate cylinder, 84 in. diameter; and the two low-pressure cylinders each 97 in. in diameter, with a stroke in each case of 75 in. The arrangement of the valves and cylinders is as follows: Two slide valves having each two ports in a common chest operated by two rods, through crosshead, to single links, low-pressure cylinder, high-pressure cylinder, a single piston valve, two piston valves similarly arranged to the twin slide valves, intermediate pressure cylinder, and lastly two slide valves at the aft end. Stephenson's link motion is employed for operating the slide valves. As in the Oceanic, the thrust shaft is fitted with an intermediate bearing, and all the plummer blocks are provided with forced lubrication working at a pressure of 20 lbs. and draining into tanks located low down in the vessel. From this tank the oil is pumped up through an oil filter and cooler to a supply tank situated at a high level. A flow of cooling water is also forced through the plummer blocks.

The diameter of the crank and thrust shafts is 27 in., that of the line shaft 26¼ in., and that of the tail shaft 28½ in., all the shafts being hollow, the hole in the crank and thrust shafts being 9 in. in diameter, and those in the others 12 in. in diameter. On the tail shaft a loose coupling is provided, thus admitting of its being withdrawn from the stern, an arrangement which obviously greatly facilitates the execution of repair work. All the shafting was machined at Messrs. Harland and Wolff's Belfast works. The propellers are 23 ft. 6 in. in diameter, they are driven by the reciprocating engines, and are each provided with three bronze blades fixed to a cast-steel boss. When developing 15,000 I.H.P. for each of the engines, they run at a speed of 75 revolutions per minute.

The central screw propeller is driven by the exhaust-steam turbine, which is of the Parsons' type, and arranged to take the exhaust steam at 9 lbs. pressure absolute, expanding it down to a pressure of 1 lb. absolute, a vacuum of 28½ in. with the barometer at 30 in. being maintained in the condenser. The temperature of the circulating water is maintained between 55 deg. and 60 deg. Fah. The rotor is built up of steel forgings according to the ordinary practice, the diameter being 12 ft. and the blades ranging from 18 in. to 25½ in. in length. These latter are constructed on the segmental principle, and are laced on wire through the blades and distance pieces at the bases, and binding being soldered on the edge in the usual manner. Between the extreme edges of the first and last ring of blades the rotor has a length of 13 ft. 8 in., and enclosed in a cast-iron casing made at the works in Belfast.



WHITE STAR LINER "OLYMPIC." STEAM TURBINE.

The central shaft is put out of action when the vessel is being manœuvred, so there is no astern turbine, and the bearings thrust and governor are of the type usually employed in turbines of the Parsons' type. The turbine can be rotated by electric motor, and the lifting gear for the upper half of the casing and the rotor is likewise operated by an electric motor. The shaft of the turbine has a diameter of 20 in., and that of the tail shaft is 22½ in., each having a hole 10 in. diameter bored through it. The propeller driven by the turbine shaft is of manganese bronze, built solid, with four blades, the diameter being 16 ft. 6 in. At a speed of 165 revolutions per minute 16,000 S.H.P. is developed

The weight of the rotor is about 130 tons, and that of the complete turbine 410 tons.

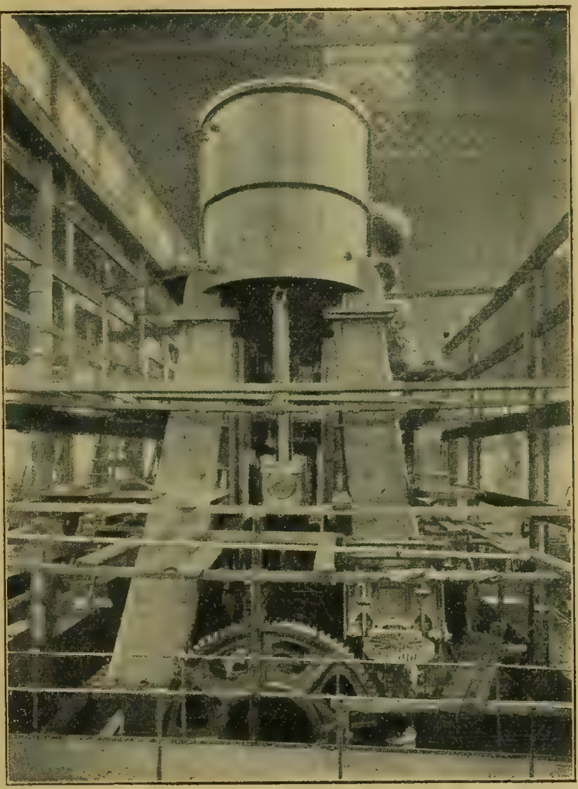
The condensers are of pear shape, and of the pattern generally used on Messrs. Harland and Wolff's engines. Following the usual practice, the inlet of the turbine condenser is of the full length of the condenser, being thoroughly stayed in a vertical direction by division plates, and in the condenser corresponding division plates are arranged in line with the above, so as to provide for the steam being equally distributed over the entire area of the condenser tubes. An advantage, moreover, of the pear shape is that the tube surface is concentrated at that point at which the greatest volume of steam is admitted, and is most required. The circulating pumps are of gun metal, and consist of four sets, viz., two for the port and two for the starboard condensers, the inlet pipes being 29 in. These pumps are driven by Harland and Wolff compound engines. Each condenser is fitted with two sets of Weir's "Dual" type of air pumps, the air and water barrels being both 36 in. diameter by 21 in. stroke. A feed tank is provided to receive the water from each condenser, from whence it is drained into a suitable control tank, from which latter it is drawn by the hot-well pumps, and is discharged through the Weir surface heater to a contact heater of the Weir pattern, which is located at an elevated position on the engine-room bulkhead. The exhaust from the electric engines is delivered to the surface heater, where it serves to heat the feed; the exhausts from the other auxiliary engines are passed to the contact heater and serve for the same purpose. The contact heater delivers its water by gravity to the main feed pumps, of which there are two pairs, placed on each side of the reciprocating engine room, either of the two pairs being sufficient to perform the feeding operation for the entire set of boilers. The diameter of the main feed pumps is 14 in. by 28 in. stroke, and that of the steam cylinders 19 in. All the pumps in the system are so arranged as to be interchangeable, as far as the feeding of the boilers is in question.

Four 400-kilowatt engines and dynamos for generating the requisite electric current for light and power are to be fitted in a separate compartment formed watertight, and situated aft of the turbine room at the level of the tank top. The engines develop 580 H.P. They are of the Allen vertical three-crank-compound enclosed forced lubrication type, running at 325 revolutions per minute, and each set has one high-pressure cylinder 17 in. in diameter, and two low-pressure cylinders each 20 in. in diameter, the stroke being in all cases 13 in. The steam pressure is 185 lbs. per square inch, and exhaust either into a surface heater of the ordinary type used at sea or to the condenser. Each of the engines is coupled direct to a compound wound dynamo, having an output of 100 volts and 4,000 amperes, continuous current, the collective current capacity being 16,000 amperes. The dynamos are of the ten-pole type, fitted with inter-poles. Besides the four main generating sets two 30-kilowatt engines and dynamos are provided, which are located in a recess off the turbine room at the level of the saloon deck, and well above the water line. Steam will be supplied to three sets from either of several boiler rooms, and thus be available for emergency purposes. These are of a similar type and make to the main sets, but they have two cranks.

The current will be distributed on the single-wire system, and a main switchboard situated on a gallery in the electric engine room, to which the main dynamo cables and feeders are connected, is provided for controlling and metering it out. The cables and feeders pass up through port and starboard cable trunks to the several decks, from where they radiate to master switch and fuse boxes grouped at points where found convenient in the machinery spaces and accommodation, branches running from thence to the distribution fuse boxes controlling the lamps and motors scattered throughout the ship.

The vessel will be fitted with a very complete system of electric lighting, and besides being employed for motive power, electricity will be employed to a very considerable extent for heating purposes. For ventilation there will be 75 motor-driven "Sirocco" fans of from 55 in. to 20 in. in diameter, serving the passenger and crew spaces and engine and boiler rooms. The fan motors are all provided with automatic hand speed regulation.

There are six cargo hatches, three forward and three aft. Steam winches are provided for serving two of the forward ones, the gins being fixed to cargo spans; the third hatch is served by two Stothert and Pitt electric cranes, capable of lifting 50 cwts. The radius of these cranes is 27 ft., the height from the deck to the centre of the pulley 29 ft., and the total lift 100 ft. The hoisting motor is of 40 B.H.P., and the slewing motor of 5 B.H.P. All the hatches in the after part of the ship are served by electric cranes of similar make. Two are on the promenade deck serving two small hatches to the hold below. These cranes have a capacity of 30 cwts. and a radius of 21 ft. Height between deck and pulley is 20 ft., the total lift being 80 ft. The hoisting motor is of 30 B.H.P., the slewing motor of 3 B.H.P. The remaining two hatches aft are provided with four electric cranes of 50 cwt. capacity, the radius in the case of two being 28 ft., and of the other two 29 ft. Height to the centre of the pulley is respectively 27 ft. and 26 ft. In other respects these cranes correspond to those already referred to.



White Star Liner "Olympic." Starboard Engines.

At full load the lifting speed is 160 ft. per minute for the 50-cwt. cranes, and 200 ft. per minute for the 30-cwt. ones, increasing automatically at lighter loads. The slewing speed is in all cases 500 ft. per minute. In conclusion we may mention that the main engines, electric light engines, and pumping engines are all fitted with United States Metallic Packing made at Bradford.

THE BRIQUETTING OF IRON ORES.*

General Remarks.—The question of briquetting iron ore is one which becomes of increasing importance every year, not only owing to the fact that iron ore in general, and lump ore in particular, are becoming more and more scarce, at least in Europe, but also because of the severe conditions imposed by modern blast furnaces; not only in regard to the chemical composition, but also to the physical condition of the ore.

The use of improved and more effective explosives in the iron mines, as well as the fact that iron ores have to be transported over long distances and frequently re-loaded before they reach their destination, tend to increase the percentage of small and dust ore to the disadvantage of blast-furnace working which—on account of the greater height of the furnaces themselves, the high pressure of blast, and the use of blast-furnace gases for gas engines—require an ore which is not too fine nor too dusty.

The blast, being of comparatively high pressure in modern blast furnaces, will naturally blow out a considerable portion of the fine ore, which will mix the escaping blast-furnace gases, causing well-known inconveniences. This is the more objectionable, as the blast-furnace gases are now, almost everywhere, utilised for driving gas engines, for which purpose the gas must be almost entirely free from dust.

The fine ore during its downward passage in the blast furnace advances quicker than the lump ore charged at the same time; consequently it is not exposed long enough to the beneficial reducing influence of the carbon monoxide gas arising from below. It therefore leaves the zone of reduction in the blast furnace imperfectly freed from oxygen, and, as a consequence, clogs together as soon as it reaches the zone of carbonisation, causing scaffolding, and even explosions.

A considerable number of methods for briquetting iron ore have been brought out, but none as yet which can be applied generally with success. A few of the methods introduced into practice have proved successful, but only for certain kinds of ore, or in local circumstances and conditions. Some methods which have yielded favourable results with a particular kind of ore have entirely failed with other ores. Experience has also shown that the method to be adopted must be modified to suit to the nature of the ore, not alone with reference to its physical condition, but more especially with regard to its chemical composition. Most of the different methods which have been tried for the briquetting fine-grained ore have proved to be too expensive, not alone with reference to initial outlay and cost of manufacture, but also, indirectly, on account of the great reduction of the contents of iron in the ore which occurs owing to too great an addition of binding material.

The conditions for successful briquetting are—

1. The iron ore briquettes must have a certain resistance against mechanical influences. They must resist a pressure of not less than 2,000 lbs. per square inch, and, when dropped from a height of 10 ft. on a cast-iron plate, they must not fall into dust, although they may break into pieces.

2. They must resist heat. Heated to 900 deg. Cen. they may commence to sinter, but they must not disintegrate into small fragments.

3. They should be capable of being placed in water for a certain time without softening.

4. They must resist the influence of steam at 150 deg. Cen. without crumbling.

5. They must possess a certain amount of porosity in order to allow the carbon-monoxide in the blast furnace to penetrate the interior of the briquette and to exercise its beneficial reducing influence.

In order to test the briquettes for porosity, they are, after being dried, placed for about 25 minutes in water, during which time they ought to absorb not less than 12½ to 16 per cent of water, according to the nature of the ore.

6. The binding medium, if any is used, should not contain noxious substances (sulphur, arsenic) to such an extent as to be injurious to the quality of the pig iron produced.

7. The cost of producing briquettes should not exceed the difference in the prices between lump ore and fine ore.

The different systems of briquetting ore can be divided into those in which a binding medium is used and those in which no binding medium is used. The former may again be divided into methods employing inorganic and organic binding materials respectively.

Briquetting without a Binding Medium.—In most of the cases, where no binding medium is used, the briquettes have to be heated at considerable expense, but there are exceptional cases where no heating is necessary, notwithstanding that no binding medium is employed. This case presents itself where the iron ore contains a certain percentage of clay, because in such cases it contains in itself a binding medium. Clay iron ore and bean ore are instances.

At Kertsch, in Russia, where bean ore is briquetted, the latter is mixed with 8 per cent of water and made into briquettes under a pressure of about 5,600 lbs. per square inch. At Ilsede, in Germany, where clay iron ore is used, it is mixed with the waste of the iron ore washing plant and with other powdery waste products coming from the rolling mills and containing sufficient iron. The mixture, which is not allowed to contain more than 6 per cent of water, is heated to about 75 deg. Cen. and pressed into briquettes, the pressure being about 4,000 lbs. per square inch. In both the above cases no heating of the briquettes is necessary and no binding medium is used.

The results obtained at Kertsch and at Ilsede naturally suggest the addition of common clay to other iron ores (containing no clay) as a binding medium in order to make briquettes by means of a cheap medium, and without going to the expense of heating the briquettes. However, it has been found that, in order to achieve the desired result, it is necessary to add a comparatively large percentage of clay to the ore, thus indirectly reducing its contents of iron to too great an extent. Common clay contains, moreover, a high percentage of silica, requiring extra additions of limestone. The practice of using clay as a medium has therefore been abandoned, and it is only employed in cases where ferruginous clay is at disposal.

In some cases it has been sought to avoid the use of a binding medium, as well as the heating of the briquettes, by employing very high pressures, rising gradually to 11,000 lbs. per square inch, for making briquettes; but although the briquettes made in this way have been very firm and offer great resistance to mechanical influences, they expand when exposed to heat and fall to pieces; besides which they are too dense, and this considerably interferes with their reducibility.

Of all systems of briquetting iron ores without a medium, by heating the briquettes after they have left the press, the Gröndal process, so called after the name of the inventor, has proved to be the most successful for magnetic ore.

The following is a short description of this process: The raw ore, containing from 27 to 58 per cent of iron, is broken up by means of a stone breaker and then ground to sand in a ball mill. From this sand the pure magnetic ore, the so-called "concentrate," is extracted by means of magnetic separators.

The "concentrate," containing from 67 to 71 per cent of iron, is moistened and made into briquettes about 6 in. square and 2½ in. thick with rounded edges. No addition is made.

The briquettes are then laid in three rows edgeways upon small iron wagons and transported into a furnace heated with generator and blast-furnace gases. Heated and compressed air is supplied by means of a Körting blower in such quantity as to produce a highly oxidising flame, whereby the magnetic ore (Fe_3O_4) is oxidised to peroxide of iron (Fe_2O_3). The sulphur is considerably reduced during this operation.

The following comparative table gives the chemical composition of the raw ores, concentrates, and briquettes in different cases:—

Name of the place.	Raw ores.			Concentrates.			Briquettes.		
	Fe per cent.	S per cent.	P per cent.	Fe per cent.	S per cent.	P per cent.	Fe per cent.	S per cent.	P per cent.
Flogberget	27·3	0·31	0·003	67·4	0·04	0·003	65·3	0·007	0·003
Herrang	40·2	1·21	0·003	67·3	0·17	0·002	65·5	0·003	0·007
Lulea	58·2	0·11	1·23	71·1	0·015	0·005	69·3	0·005	0·000
Strassa	46·8	0·03	0·015	69·2	0·015	0·003	67·1	0·005	0·035
Cornwall, U.S.A.....	30·6	1·60	0·012	69·9	0·036	0·003	67·9	0·010	0·050

One furnace, about 150 ft. long and 5½ ft. wide, produces on an average 200 tons of briquettes in a week, the cost of production being given at 3s. 4d. per ton of finished briquettes, exclusive of general expenses and royalties.

The briquettes are hard and porous, and quite suitable for the blast furnace, but the cost of production appears to be rather high, in consequence of which the Gröndal process has not, except in Sweden, been much adopted. In Sweden there are at present 27 Gröndal furnaces at work, with a total output of about 300,000 tons of briquettes per year.

The reason why the Gröndal process is of special value to Sweden lies principally in the fact that the working of the blast furnaces in that country is almost entirely based on the use of charcoal. The slag of charcoal furnaces being, for well-known reasons, acid, it does not absorb sulphur, consequently nearly all the sulphur in the iron ore goes into the pig iron instead of into the slag. This is also the reason why the blast-furnace owners in Sweden object to use any iron ore containing more than 0·015 per cent sulphur. From the above comparative table it will be seen that the raw ore contains considerably more sulphur than the above-mentioned limit, and it is therefore absolutely necessary to reduce the percentage of sulphur in the raw ore, not only by means of the magnetic separator, but also by heating the briquettes to a high temperature (given at 1,400 deg. Cen.) and in an oxidising flame.

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* Paper read by Chevalier C. de Schwarz at a meeting of the Iron and Steel Institute.

Although the percentage of iron in the briquettes is somewhat reduced, owing to the transformation of magnetite (Fe_3O_4) into peroxide of iron (Fe_2O_3), this advantage is more than compensated for not only by the expulsion of sulphur, but also by the fact that peroxide of iron (Fe_2O_3) is much more easily reduced and requires considerably less fuel in the blast furnace than black oxide of iron (Fe_3O_4).

Considering that charcoal is becoming more and more scarce from year to year, and, as a consequence, more expensive, the question of economising fuel is of special importance to Sweden.

Experience has shown that briquettes made of Fe_3O_4 (magnetite) require in the blast furnace 300 lbs. more charcoal per ton of pig iron than those made of Fe_2O_3, equal weights and percentages of iron being taken in each case. This difference in the consumption of charcoal represents a reduction in the working expenses of about 6s. 6d. per ton of pig iron in favour of Fe_2O_3 against Fe_3O_4. The success of the Gröndal process, notwithstanding its high cost, is therefore justified for Sweden, as well as in such other countries in which charcoal, together with sulphurous ores, have to be employed.

(To be continued.)

THE UTILISATION OF ELECTRIC POWER IN THE IRON AND STEEL INDUSTRY.*

(Continued from page 684.)

Resistance Regulation for Induction Motors.

As already mentioned, the continuous-current motor adapts itself in a favourable manner to the different forms of speed regulation. The most varied characteristics may be obtained with the shunt, compound and series motor. However, the use of continuous current is limited in large plants for the reasons given before, so that alternate current has now generally been adopted.

The best known and most extensively used alternating-current motor is the three-phase induction motor. It has the great advantages of simplicity and safety of operation, but in its original form the speed, which depends upon the number of poles and the supply frequency, cannot be economically regulated. The simplest means of varying the speed is to insert an adjustable resistance—known as a slip resistance—into the rotor circuit. This method has often been used for regulating the speed of rolling mills, but is very uneconomical, because an amount of energy, which is proportional to the percentage of the regulation, is lost in the slip resistance. When, for instance, the speed is decreased to 30 per cent below normal, 30 per cent of the energy taken from the line is lost. In consequence the efficiency is very low.

Another disadvantage of this system of regulation is that for a once-adjusted slip resistance the speed changes to a very great extent with variations of the load, and rises to practically its normal value at no load. This running back to the synchronous speed can be of great inconvenience in the operation of rolling mills, as it is just when running light that a low speed is required in order that the rolls may be sure of getting a hold on the steel.

Power Factor.

The power factor is another characteristic of the induction motor to which close attention should be given. It is the power factor which determines the proportion of the total current generated which is available for power purposes; a low power factor means larger and more expensive generating plant, increased losses throughout the system, and often inferior pressure regulation.

Exact measurements have shown that industrial plants which are driven by induction motors have usually a power factor between 60 and 85 per cent, although the upper limit is but seldom reached. Rolling mills are examples of installations with a low power factor. The reasons for this are that low-speed motors (which naturally have a low power factor) are commonly employed, that the load has an intermittent character, and that rolling mill motors have large air gaps for mechanical reasons, so that their magnetising current is large.

From the foregoing it results that the induction motor in its original form possesses disadvantages for the driving of iron and steel works machinery. From a suitable motor should be expected an easy and efficient speed regulation, and, if possible, compensation of the phase difference, resulting in a favourable power factor. Recently certain systems of economical speed regulation for induction motors, which fully meet these requirements, have come into use.

Scherbius and Krämer Systems of Regulation.

The principle involved in each of these systems is illustrated in fig. 2. Instead of connecting a variable resistance to the slip rings of the induction motor, these are connected with a so-called "regulating motor," which is of the three-phase commutator type. Its purpose is to make use of the slip energy which was formerly lost in resistance, and to convert it into mechanical energy. It is generally shunt excited, and is so wound that it possesses no inductance, and hence for all practical purposes can be regarded as operating as a continuous-current machine.

The speed regulation of the main induction motor is obtained in a simple manner by adjusting the excitation of the commutator motor. As is well known, the slip on an induction motor is proportional to the rotor voltage. When the rotor voltage is forced by exterior means to increase, the speed will have to decrease. For a strong excitation of the regulating motor, the speed of the main motor will consequently be low, whereas for weak excitation it will be in the neighbourhood of synchronism. As the armature voltage of the regulating motor, which differs from the rotor voltage of the induction motor only to the extent of the ohmic drop in voltage, merely depends upon the excitation, the speed will remain constant from no load to full load. When a drop of speed is required between no load and full load, in order, for instance, to make use of the flywheel effect of the rotating masses, the regulating motor is provided with a compound exciting winding. As in the case of a continuous-current compound motor, the speed will then drop from no load to full load over a certain adjustable range. Finally, a series excitation can be provided, which entails a form of regulation similar to that by resistance.

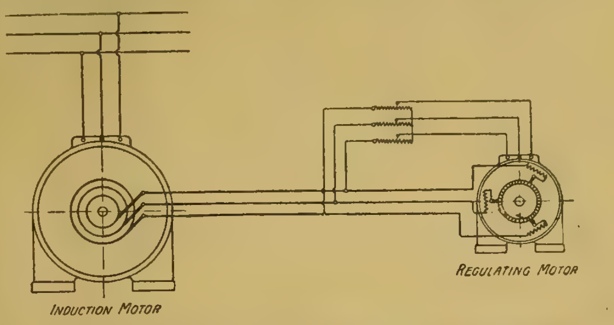

Fig. 2.—Principle of Scherbius and Krämer System of Speed Regulation.

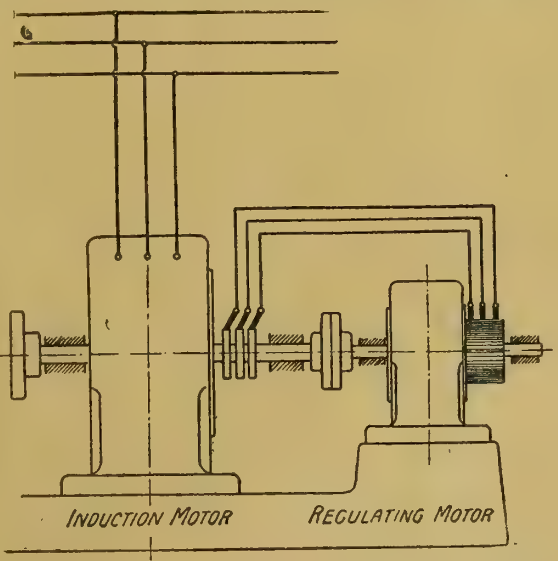

Fig. 3.—Krämer Regulation with Direct-coupled Regulating Motor.

The question how the slip energy, which the regulating motor converts into mechanical energy, can be most favourably recovered can be solved in two different ways. In the first place, the regulating motor can be coupled mechanically to the main motor (Krämer system) so that the slip energy is given back to the main driving shaft (see fig. 3). In the second place, the regulating motor can be coupled with a small induction generator (Scherbius system), this regulating set converting the slip energy into electrical energy, and returning it to the line (see fig. 4). The first arrangement, in which the regulating motor is coupled directly or by means of a belt to the main motor, is in general the better one, as the available energy on the main shaft remains constant—that is, with decreasing speed the torque can be increased. In case of the arrangement with the regulating set only a constant torque is available (as in the case of regulation by resistance), so that the output must decrease with decreasing speed. Further, the total efficiency is more favourable in the case of mechanical coupling between the regulating motor and the shaft of the main motor. However, this arrangement is not always possible, as with it the regulating motor must follow the speed fluctuations of the main motor, and on this account becomes too expensive for very wide ranges of regulation. In such cases the regulating set, which runs at constant speed, is preferable.

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* Paper read by Mr. J. J. Flink Schuurman at the Iron and Steel Institute.

A great advantage of these regulating systems lies in the possibility of extending the regulation above synchronous speed. The result is that the regulating motor can be built smaller than is possible with regulation solely under synchronism. In order to obtain over-synchronous speeds it is only necessary to reverse the direction of the excitation of the regulating motor. The latter then runs no longer as a motor, but as a generator. It does not take up slip energy, but, on the contrary, delivers slip energy to the main motor. The possibility of running above synchronism can also be of value for reaching very high speeds, as is sometimes necessary for rotary blowers, rotary compressors, etc. It should be realised that with a frequency of 50 cycles per second, 3,000 revolutions per minute is the highest speed which can be obtained in the ordinary way, this being a synchronous speed of a two-pole motor. The next lowest speed is 1,500 revolutions per minute for a four-pole motor. The advantage of being able to obtain intermediate speeds and, above all, speeds over 3,000 revolutions per minute is the highest speed which can be obtained in the ordinary way, this being the synchronous speed of a two-pole motor. The next lowest speed is 1,500 revolutions per minute for a four-pole motor. The advantage of being able to obtain intermediate speeds, and, above all, speeds over 3,000 revolutions per minute, is obvious. Such a degree of speed regulation has hitherto been unattainable with induction motors.

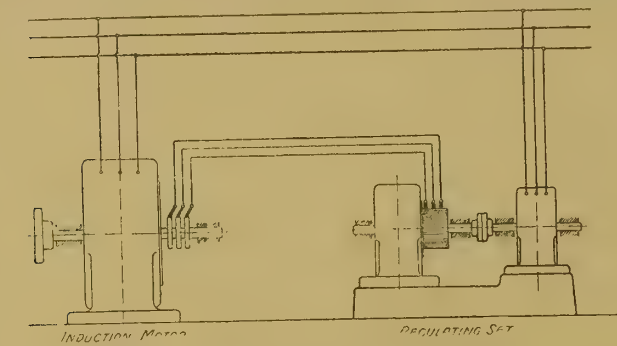

Fig. 4. Scherbius Regulation with Regulating Set.

These systems also permit of compensating the phase difference between current and voltage of the main motor, so that its power factor becomes unity, independently of the load. By a small change in design, the regulating motor can be made to supply the magnetising current necessary for the excitation of the main motor. The generators at the power station and the transmission line are then relieved from delivering their wattless current. If necessary, the regulating motor can also be designed to supply the excitation for other motors on the line, and thus will contribute still further to raise the power factor of the entire system.

It has been mentioned that the regulating motor is of the three-phase commutator type. The simplest variable speed three-phase motor would be such a commutator motor used directly as a main motor, if it could be constructed for the normal working conditions. However, certain difficulties with respect to good commutation stand in the way of building such motors. The higher the frequency and the larger the output, the greater are these difficulties. A commutator motor for several thousand horse power, for instance, as often required in rolling mills, could not be built at the present time, although in the next few years considerable development may be made in this direction. The regulating motor described is connected to the rotor of an induction motor, in which the frequency is low and, moreover, its output is small when compared with the output of the main motor. Again, the rotor voltage of an induction motor can be chosen at will within wide limits, even when the stator is directly connected to the high-voltage line, and thus the voltage of the regulating motor can be kept low, which still further facilitates its design.

These systems may be used for new installations as well as in connection with induction motors which already exist.

(To be continued.)

NOTICES OF MEETINGS, &c.

December 3rd.—The British Foundrymen's Association: Lancashire Branch. Meeting to be held in the Municipal School of Technology, Manchester, at 4 p.m. A paper will be read on "Imperfect Castings," by Mr. S. G. Smith.

Leicester Association of Engineers. A paper will be read on "Modern Aeroplane Practice," by Mr. J. P. Chittenden, A.M.I.Mech.E.

The Birmingham Association of Mechanical Engineers. Annual Meeting at Grand Hotel, Colmore Road. Election of Officers, and Social.

December 5th.—Institute of Marine Engineers. Meeting to be held at 58, Romford Road, Stratford, London, E. A paper on "Notes on Salving a Gold Gredge," by Mr. F. G. Butt.

Engineering and Scientific Association of Ireland. Meeting to be held in the Physics Theatre of the Royal College of Science, St. Stephen's Green, at 7-45 p.m.

The Society of Engineers. Ordinary meeting to be held in Room 18, Caxton Hall, Westminster. A paper will be read entitled "The Working of the Road Development Act, 1909," by Reginald Brown, A.M.Inst.C.E., F.S.I. Chair will be taken at 7-30 p.m.

December 6th. — The Institution of Civil Engineers. Ordinary meeting at 8 p.m.

Manchester Local Section of the Institution of Electrical Engineers. Meeting at the Physical Laboratory of the University of Manchester, at 7-30 p.m. A paper on "The Method of Braking in Electric Winding Engines," by Dr. E. Rosenberg, M.I.E.E.

December 7th.—The Society of Engineers. Mr. L. W. J. Costello, M.A., LL.B. (Cantab.), will deliver his fifth lecture on "The Law and its Relation to Engineering," at Caxton Hall, Westminster, at 7-30 p.m.

The Association of Engineers-in-Charge. A paper will be read at 8 p.m., on "Practical Notes on the Working and Control of Steam Boilers," by John B. C. Kershaw, F.I.C.

Yorkshire Local Section of the Institution of Electrical Engineers. Meeting to be held at the Department of Applied Science, The University, St. George's Square, Sheffield, at 7 p.m. An address will be given by A. J. Cridge, A.M.I.E.E., on "The Cost of Cooking and Heating by Electricity."

December 8th.—Rugby EngineeringS ociety. Meeting at 8 p.m. A lecture will be given on "Electricity in the Himalaya," by B. F. McMurtrie.

The Institution of Electrical Engineers. Meeting to be held at 8 o'clock.

December 9th.—Coventry Engineering Society. A paper will be read on "Case Hardening," by David Flather, Esq.

Glasgow Local Section of the Institution of Electrical Engineers. Meeting of the Students' Section at the Glasgow Technical College, at 8 p.m.

North-East Coast Institution of Engineers and Shipbuilders. The institute dinner will be held in the Great Hall, Armstrong College, Newcastle-upon-Tyne, at 7-15 p.m.

December 9th and 10th. — The Association of Water Engineers. Fifteenth winter meeting to be held at the Apartments of the Geological Society, Burlington House, W. The proceedings will commence on Friday at 2 p.m., and on Saturday at 10-30 a.m. The following papers are to be read and discussed: (1) "Guaging and Recording the Flow of Streams," by S. C. Chapman, A.M.Inst.C.E.; (2) "The Advantages of Co-operation in Rural Water Supplies," by F. Graham Fairbank, M.Inst.C.E.; (3) "The Eliminating Effect of Chlorine on the Bacteria of a River Water," by Leslie C. Walker, A.M.I.M.E.

December 10th.—North of England Institute of Mining and Mechanical Engineers. General meeting at 2 p.m.

The Manchester Association of Engineers. Quarterly meeting. Election of members. A paper on "Motor Cars" will be read by Mr. J. L. Milligan, B.Sc., Coventry.

The British Foundrymen's Association. Birmingham Branch: Meeting will be held at the Technical School, Suffolk Street, Birmingham, at 7 p.m. There will be a general discussion on "Foundry Difficulties."

The British Foundrymen's Association. Scottish Branch: Meeting to be held in the Technical College, George Street, Glasgow, at 4 p.m. A paper will be read on "Foundry Iron," by J. F. P. Lewis, Esq.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 24th November, 1910.

ABERDEEN.—*First class:* G. A. Cooper, W. C. Gardiner. *Second class:* S. F. Jamieson.

BRISTOL.—*First class:* C. Mackenzie, G. Edwards. *Second class:* H. J. Devonald, S. J. Dart.

GREENOCK.—*First class:* J. Young, B. M. Martin, A. Livingston, S. McG. Harris, S. D. Primrose, P. Shevlin. *Second class:* J. W. P. Bentley, J. Stewart, R. Miller.

HULL.—*First class:* A. Fitzgerald, J. Charlton.

LIVERPOOL.—*First class:* J. Weir, W. T. Morrow, D. Oakes, W. H. Johnston. *Second class:* A. R. Parker, J. Rae, J. B. Murphy, T. W. Kelly, A. E. Dench, J. C. Ekberry, J. S. Bate.

LONDON.—*First class:* F. F. Maynard, C. C. Whitehead, R. W. R. Ford. *Second class:* C. G. Hulett.

LONDONDERRY.—*Second class:* W. M. Taylor.

NORTH SHIELDS.—*First class:* A. C. Thomas, J. Marshall. J. Shand, J. T. L. Ching, T. P. Sanderson, W. Snowdon, A. E. Wilson, R. Hobson. *Second class:* G. E. Pattinson, H. F, Brough.

SUNDERLAND.—*First class:* J. W. White. *Second class:* E. Stephenson, W. Crichton, R. Forbes.

STEAM.

LIVERPOOL.—E. J. Rodgers.

LAUNCHES AND TRIAL TRIPS.

Syndic.—The screw steamer Syndic, built by the Blyth Shipbuilding and Dry Docks Co. Ltd., for Messrs. The Syndic Steamship Co. Ltd. (Messrs. Isaac B. Pearson and Co., Glasgow, managers), was taken to sea on Tuesday for trial. This vessel, which measures 326 ft. in length, with a beam of 45 ft. 10 in., has been constructed under Lloyd's special survey for their highest class. She is of the single-deck type, having poop, bridge, and top-gallant forecastle. The Syndic is specially adapted for the general cargo and wood trade, having large hatches and clear holds, together with the best and latest design of deck machinery, including five cargo winches for the quick and economical working of the cargo. Triple-expansion engines of good power have been fitted by Messrs. The North-Eastern Marine Engineering Co. Ltd., Wallsend, the cylinders being 23 in., 38 in., and 62 in., by 42 in. stroke, working at 180 lbs. pressure.

Perdita.—Messrs. Mackay Brothers, Alloa, launched lately the coasting steamer Perdita, built to the order of Messrs. Robert Gilchrist and Co., Liverpool. The principal dimensions of the vessel are: Length, 175 ft.; breadth, 26 ft.; depth, 13 ft.

NAVAL NOTES.

Yarra and Parramatta.—The new Australian torpedo-boat destroyers Yarra and Parramatta, which are to form the nucleus of the Australian navy, have arrived at Perth (Western Australia) from England, and the day was observed as a public holiday throughout the State.

Redpole.—The new ocean-going destroyer Redpole, which returned to Messrs. John Samuel White and Co.'s works at East Cowes on November 26th, after highly successful full-power trials in the North Sea, proved herself to be the swiftest destroyer of the Acorn class which has yet undergone trials. On the measured mile the Redpole attained a speed of over 30 knots, whilst the mean speed on the eight hours' run was over 29 knots per hour. Redpole's contract speed is 27 knots.

TRADE CATALOGUES.

WE have received from **Messrs. A. Reyrolle and Co. Ltd.,** Hebburn-on-Tyne, a pamphlet illustrating a line of controllers, star-delta switches, etc., which they are putting on the market, and these are also supplied in the oil-immersed explosion-proof type. The controllers are suitable for all voltages up to 650 and in capacities up to 500 H.P. Also a pamphlet illustrating their double revolution drum type starter regulators, which have been on the market for some time, and which they inform us they are selling in large quantities.

WE have received from **Messrs. J. Hopkinson and Co. Ltd.,** Huddersfield, a leaflet illustrating their "Kulrym" valve hand wheels with insulated rims.

TRADE NOTES.

ACCORDING to a Reuter cable **Messrs. White and Co.,** of East Cowes, Isle of Wight, have obtained from President Gomez the contract for the construction of two 200-ton gunboats for the Cuban Government.

THE **United States Metallic Packing Co. Ltd.,** Soho Works, Bradford, have received word from the authorities of the Buenos Ayres Exhibition that they have been awarded a gold medal for their exhibit of United States metallic packing.

AFTER extensive experiments and careful consideration the Mines de Pierrefitte Ltd. are said to have decided to adopt the principle of roasting and dry magnetic separation at their mines at Pierrefitte-Nestalas, and have signed a contract with the **British Humboldt Engineering Co. Ltd.,** of Dixon House, Lloyds Avenue, London, E.C., for supplying the adequate plant.

Mr. H. H. Cressall, 13, Summer Row, Birmingham, has been apointed sole agent for the sale in Great Britain of the whole of the manufactures of Mr. C. Schniewindt, Neuenrade, Westfalen. The principal goods comprise asbestos woven resistance nets for starting and controlling apparatus, cinematograph lamps, heating and cooking appliances.

STEAM AND ELECTRIC TRAMWAY MATERIAL.—The *Bulletin Commercial* (Brussels) announces, on the authority of the Belgian Legation at The Hague, that the "Eerste Groeninger Tramweg-Maatschappij," domiciled at Veendam, has decided, electrification not being practicable, to convert the lines into steam tramways at a cost of 1,300,000 florins (about £108,000), the length of line involved being 31 miles. There is also a project before the Netherlands Lower House for improving the steam tramway line between Rijnsburg and Noorwijck. The company which works it, the "Noord Zuid Hollandsche Tramweg Maatschappij," proposes to substitute electricity for steam, and at the same time to re-build the track in order to do away with existing sharp curves.—*Board of Trade Journal.*

PROJECTED NEW RAILWAYS.—The *Journal de St. Pétersbourg* reports that permission has been granted for the construction of the following lines of railway. A line from Nijni Novgorod, *via* Malmyj and Serapoul, to Krasnooufimsk, with branch lines from Malmyj to Kazan, and from Serapoul to the factories of Ijeff and Votkino, total length 660 miles; a line from the confluence of the Vytchegda and Vym to the naphtha regions of the Oukhta, a tributary of the Petchora; and a line from Kholm, *via* Vladimir-Volynsky, Lontzk and Doubno, to Tcherny Ostroff, a distance of 220 miles.—*Board of Trade Journal.*

LOCOMOTIVES, PASSENGER COACHES, AND GOODS WAGONS.—*Bollettino* (Italy) announces that the next lot of tenders invited for railway material will include 193 locomotives; 20 first class, 65 second class, 100 third class, and 55 combined first and third class carriages; 4,600 goods wagons.—*Board of Trade Journal.*

RAILWAY MATERIAL.—The *Diario Official* (Brazil) publishes the following decrees: 1,911,000 milreis for the construction of a 32-mile extension of the Baturité railway between Iguatu and Cedro; 21,000,000 milreis for the construction of a 161-mile section of the Victoria-Diamantina line; a credit of 250,000 milreis for the construction of a section of line from Cruz Alta to Ijuhy in the State of Rio Grande do Sul; a concession for the construction of 37½ miles of line from Rio Claro, situated in the municipal area of Sallesopolis, State of Sao Paulo, to Mogy das Cruzes station on the Central Railway of Brazil; a credit of 1,800,000 milreis for the construction of a branch line from Governador Portella to join the Central Railway of Brazil, passing by way of Vassouras, etc., and for the transformation of the existing tramway between Tres Ilhas and the Barra Longa into a railway. According to the *Dépêche Coloniale* (Paris) the Belgian Government are considering a project for a railway between Broken Hill and Kindu, which would facilitate trade between Katanga and the lower Congo. The route of a second line through the heart of Kasai has already been surveyed, and construction work will shortly be begun. It appears that surveying operations relative to the large Congolese section of line, designed to improve the communications between the Cape, Katanga, the Great Lakes, and the Nile, are on the point of completion. It is estimated that the cost of the section from Bukama to Elisabethville will be about £2,000,000—*i.e.,* £4,000 per kilometre.—*Board of Trade Journal.*

RAILWAY CONSTRUCTION.—H.M. Consul at Constantinople reports that tenders are invited by the Turkish Ministry of Public Works for concessions for the construction and working of a standard gauge line from Karaferia *via* Ibelli, Serfidje, Besh, Punar, to Bey Deirmen (Greek frontier), and a 1·05 metre gauge line from Ibelli to Avlona, with a branch line to Yanina. Offers will be received up to 2 p.m. on 28th February, 1911.—*Board of Trade Journal.*

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing. nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2288. **Ornamental Hammer Work.**—Information is wanted as to the best sort of material to use when making ornamental scrolls, names, letterings, etc, for what is called ornamental hammer work—that is, the best substance or composition to hammer upon.—PERTH.

Answer.—The best answer that can be given is to refer "Perth" to published works dealing with the subject. He should obtain a copy of Leland's "Elementary Metal Work," and Horth's "Repousse Metal Work." These will doubtless give all the information required.—METAL WORK.

2289. **Heating Steam Tank.**—Will some reader give me a rule by which I can determine the final temperature assumed by a steam heated water tank (naked steam) into which I feed steam, and from which I draw water at a uniform rate? Express general result in terms of steam used.—TANK.

Answer.—The information given in the inquiry is very vague; no working conditions are stated, nor the quantity of steam available and the amount of water desired. A British thermal unit (B.Th.U.) is the amount of heat required to raise 1 lb. of water 1 deg. Fah. when at its maximum density, viz., from 39 deg. Fah. to 40 deg. Fah. When calculating the amount of heat in 1 lb. of steam it is usual to measure the total heat from the temperature of melting in, 32 deg. Fah., and the formula for calculating the amount of heat in 1 lb. of steam is: $H = 1146{\cdot}6 + 0{\cdot}305\,(t - 212)$; where H = total heat, and t = temperature of steam. For our example we will take steam at 100 lbs per square inch, and this corresponds to a temperature of 337·8 deg. Fah., therefore the total heat in 1 lb. of this steam will be $1146\,6 + 0{\cdot}305\,(337{\cdot}8 - 212) = 1{,}285$ B.Th.U. To this sum must be added 32, which is the temperature of melting in, thus the total heat will now be 1,317 B.Th.U. Assuming the temperature of the heated water when drawn off is required to be 200 deg. Fah., then the quantity of water 1 lb. of this steam will heat up to this temperature will be $1{,}317 - 200 \div 200 = 5{\cdot}553$ lbs. To this must be added 1 lb. of condensed steam, thus making the total amount of water available at 200 deg. Fah. 6·553 lbs. A table of pressures and corresponding temperatures will be found in the "*Practical Engineer* Pocket Book." The figures 6 553 lbs. are the theoretical result, but owing to radiation from 3 to 5 per cent must be deducted from this, according to the arrangement of the plant and the distance the steam and water have to travel.—V. S.

2293. **Cost of Engines and Boilers.**—I should be obliged if some of your readers would give me a few reliable figures on the cost of installing and maintaining various types of engines and boilers. Also the costs of fuel, wages, and supplies per annum (on a "per H.P." basis throughout).—MULTO.

MISCELLANEA.

THE ELECTROMOBILE CO. LTD., of Mayfair, formerly established at Curzon Street, have recently inaugurated a company called the Hertford Street Motor Hiring Co. Ltd. for the purpose of letting out six-cylinder Napier limousines, landaulets, and touring cars. The Electromobile Co. was established in the year 1902, and its electric carriages have always been considered the acme of comfort and luxury for purely town use.

A MEETING of the recently-formed East of Scotland branch of the Association of Mining and Electrical Engineers was held in the Carlton Hotel, Edinburgh, when the opening address for the session was delivered by the acting president, Mr. H. Gordon Fraser, electrical engineer to the Fife Coal Co., Leven, who touched upon some questions relating to "earthing" systems for collieries and upon proper design of switch gear and other plant.

INSTITUTION OF CIVIL ENGINEERS.—At the ordinary meeting held on the 22nd November a paper was read by Mr. H. K. Bamber on "Portland Cement and the Question of its Aeration." After touching on the defective methods of manufacture used in the past, the author observes that the improvements which have been effected, particularly since the end of the 19th century, have lifted cement making to a high position in the list of scientifically conducted industries. One of the most important improvements in the manufacture of the process is the introduction on a practical scale since 1900 of the rotatory kiln.

PROPOSED NEW RAILWAYS IN QUEENSLAND.—The Queensland Government according to Reuter introduced into Parliament on the 24th November a bill authorising the construction of a railway across Western Queensland, from Camonweal, in the north-west of the State, near the South Australian border, via Windoral, to a point about 200 miles south-west of Charleville. This railway will connect with the extensions of the existing Southern, Central, and Northern trunk lines. The total mileage will be 1,282 miles. A bill was also introduced authorising the linking up of the existing north coast lines from Rockhampton and Cairns by the construction of new lines to the extent of 454 miles. The cost of the total construction is estimated at £7,000,000.

THE METALLOGRAPHY OF STEEL.—At a joint meeting of the members of the University of Birmingham Metallurgical Society, the Birmingham Metallurgical Society, and the Staffordshire Iron and Steel Institute held at the University, Edmund Street, Birmingham, under the chairmanship of Professor T. Turner, a lecture was delivered by Dr. Walter Rosenhain, superintendent of the metallurgy department at the National Physical Laboratory, London, on "Some Recent Advances in the Metallography of Steel." The lecturer gave an account of experiments which he and Mr. J. C. W. Humfrey had carried out during the last 15 months at the National Physical Laboratory. The closing portion of the lecture was devoted to a discussion of the hardening of steel, Dr. Rosenhain's view being that the recent work which he had described greatly strengthened and confirmed the theories put forward some years ago by Roberts-Austen in England and Osmond in France.

AVIATION.—The French Army and Navy have joined in breaking all previous records for aeroplane flights with a passenger. The feat has been accomplished by Lieutenant Delage, of the French Navy, and Lieutenant Maillols, of the army, as passenger, who flew without a break from Etampes to Blois and return, covering a distance of 125 miles. They competed for the Lazare-Weiller prize for the longest cross-country flight with a passenger during this year. Setting out from Etampes in the midst of a threatening fog, they flew from village to village, which served as landmarks, and never rose higher than about 900 ft. They finally reached the Chausée Saint-Victor at Blois, recognised the bell tower on which the national flag was hoisted, and, after doubling it, started back at once for Etampes without having landed. On their return they followed the line of the same villages and descended low enough to be able to read the names of the railway stations. They landed at their starting point at Etampes after an unbroken flight of 3 hours 15 minutes.

MOTOR SHOWS.—In March next Manchester will hold a motor car show, and Olympia starts on March 31st to April 8th, inclusive. Smithfield, at the Agricultural Hall, Islington, starts on December 5th to December 9th, and here a number of the makers of tractors will be well represented. Aveling and Porter Ltd. will show one of their compound engine rubber-tyred steam wagons; Charles Burrell and Sons Ltd. a five-ton spring-mounted steam tractor, similar to the gold medal winner in the R.A.C. 1907 trials; Barford and Perkins a new pattern of motor roller suitable for either grass or arable land; Clayton and Shuttleworth Ltd. a compound engine steam tractor spring-mounted over the rear axle; Richard Garrett and Son Ltd. one of their patent superheated steam tractors; the Ivel agricultural motor, with its two-cylinder horizontal engine; Mann's Patent Steam Cart and Wagon Co. Ltd. a tipping cart for five-ton loads, with its platform for tipping hinged on the back axle; McLaren a five-ton tractor; Marshall, Sons, and Co. Ltd. an oil tractor; Ransomes, Sims, and Jefferies Ltd. a big steam tractor, besides other of their well-known engines; William Tasker and Sons Ltd. their "Little Giant," as well as a light traction engine and an improved type of threshing machine; Wallis and Steevens Ltd. their steam tractor, with its engine completely enclosed in a steel sheet casing from the dust; and Saunderson and Gifkins petrol tractors of 14-16 H.P. and 45-50 H.P.

OSRAM·LAMPS

PATENTEES' CHRONICLE
OF
Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

NOVEMBER 21st, 1910.

26960 Flying machine. Welsh.
26961 Gas regulator. Crawshaw.
26962 Speed gear. Sangster.
26963 Motor cycle frame. Sangster.
26964 Motor cycle frame. Sangster.
26965 Starting lever. Pinson.
26966 Copying letters, etc. Rayward.
26967 Cycle handlebars. Parker.
26968 Safety pin joints. Haseler.
26969 Mops. Lester.
26970 Showing liquid level. Wood.
26971 Aeroplane alarm. Ringwood.
26972 Lock. Keen.
26973 Tyres. Welford.
26974 Internal-combustion engine. Horsley.
26975 Valve. Broadhead.
26976 Display stand. Gilbert.
26977 Ladder clip. Downes.
26978 Lung expander. Hounsell.
26979 Water supply device. Bodin.
26980 Cycle gear. Browne.
26981 Kettle. Parry.
26982 Firelighters. Dodd.
26983 Conveyor. Jones.
26984 Electric motors. Haigh.
26985 Match, etc., case. Byers.
26986 Lubricating device. Ickringill.
26987 Driving gear. Korte
26988 Weight recorder. Denison.
26989 Grinding lawn mower blades. Garfitt.
26990 Motion converting. Lamplough.
26991 Wheels. Ward.
26992 Production of ammonium chloride. Ledoux.
26993 Press knives. Lovell.
26994 Spinning machine. Leydel.
26995 Driving belts. Morrison.
26996 Piano player. Gittins.
26997 Steering gear. Barber.
26998 Fire extinguisher. Oxley.
26999 Gas lamps. Howlett.
27000 Safety device for cyclists. Grew.
27001 *Screening device. Dodds.
27002 Moulded panel boards. Atkinson.
27003 *Elastic webbing. Kops.
27004 *Lace manf. Woll.
27005 Turbine. Friend.
27006 Injectors. Gresham.
27007 Wood fastenings. Pike.
27008 Tobacco pipe. Lange.
27009 Valves. Byron.
27010 Shaving mugs. Pappenhein.
27011 Pumps. Butler.
27012 Pessaries. Stewart.
27013 *Spectacle glass grinding. Eckstein.
27014 Gears. Raven.
27015 Ordnance. Benediktsson.
27016 Tracks. Wightman.
27017 Tobacco pipes. Harvey.
27018 *Loose-leaf books. Lehnhoff.
27019 Dress stand. Stone.
27020 Gold leaf manf. Johnson.
27021 Suction pipes. Flack.
27022 *Reinforced screw bores. Craig
27023 Looms. Binns.
27024 Burners. Mackay.
27025 Leather treatment. Wood.
27026 *Telephone circuit. Siemens.
26027 Umbrellas. Izlucki.
27028 *Horse shoe. Neil.
27029 *Smoke consumer. Swanell.
27030 *Duplicating bills, etc. Vineberg.
27031 Valve gear. Morse.
27032 Nut crackers. Lotz.
27033 Tea manf. Snelling.
27034 Collars, etc. Bray.
27035 Gun firing. Lisbod.
27036 Relating to clothing. Zastrow.
27037 Electric generator. Leitner.
27038 Production of discharge effects. Johnson.
27039 Joining device. Rowell.
27040 *Locks. Brohmann.
27041 Carburetter. Lamotte.
27042 Carburetter. Lamotte.
27043 *Internal-combustion engine. Jackson.
27044 Head covering. Wilder.
27045 Cooking ranges. Russell.
27046 Acid manf. Newton.
27047 Dye manf. Newton.
27048 *Motors. Oschatz.
27049 *Acid manf. Schrauth.
27050 Nailing machine. King.
27051 Dye manf. Ransford.
26052 Pumps, etc. Browett.
27053 Flying machine. Bailey.
27054 Paper cutting. Vickery.
27055 *Scooping device. Meyer.
27056 Water flow indicator. Smith.
27057 *Tables. Elly.
27058 Window sash. Cross.
27059 Sterilising liquids. Sturdee.
27060 *Electric device.
27061 Roller skates. Ennis.
27062 Inflating footballs, etc. Carney.
27063 *Metallic leaf packing device. Smith.
27064 *Smokeless powder. Claessen.
27065 *Speed gear.
27066 *Wheels. Boult.
27067 *Air purification. Jost.
27068 Boot manf. Goldsmith.
27069 *Theatre curtain. Maas.
27070 Ladders. Martin.
27071 Umbrellas. James.
27072 Corsets. Reynolds.
27073 Cartridges. Hubbard.
27074 Wheels. Restucci.
27075 *Air heating. Haggemeister.
27076 *Extracting products from wood. Marks.
27077 Clutch. Sarginson.

NOVEMBER 22nd, 1910.

27078 Coin-freed mechanism. Haynes.
27079 Small arms. Nicholson.
27080 Beehives. Cooke.
27081 Game. Sawers.
27082 Ferro-concrete floors. Thomson.
27083 Golf balls. Coulter.
27084 Speed gears. Sumpter.
27085 Hydraulic jet apparatus. Brooks.
27086 Vehicle moving recorder. Carter.
27087 Aerial propeller. Wittgenstein.
27088 Manhole cover. Adams.
27089 Air heating. Douglas.
27090 Doll dressing set. Bertenshaw.
27091 Sewage sprinkling. Grimshaw.
27092 Motor cycles. Mills.
27093 Fireplaces. Morrison.
27094 Water closet seat. Summer.
27095 Fertilizer. Curry.
27096 Urinals, etc. Kent-Johnston.
27097 Looms. Robinson.
27098 Electric lamps. Davis..
27099 Cycle fittings. Potts.
27100 Advertising device. Spree.
27101 Roller skate construction. Davis.
27102 Railway point levers. Vellere.
27103 Golf-swing training device. Logan.
27104 Wind screen. Showell.
27105 Electric switchboard. Garnett.
27106 Sketching books. Friedenson.
27107 Bottle. Meadows.
27108 *Grinding cane. Hamilton.
27109 *Air brushes. Vilbics.
27110 Valves. Blakebrough.
27111 Fireguard. Macnamara.
27112 Internal-combustion engine. Ellingham.
27113 Rotary pumps. Petermöller.
27114 Greasing bakers' tins. Ingham.
27115 Non-skid device device. Dewhurst.
27116 Electricity production. Sanderson.
27117 Broom handle. Woods.
27118 *Flying machine. Webb.
27119 Electric motor starting. Fletcher.
27120 Dripping tin. Hipwood.
27121 *Valves. Mackintosh.
27122 String holder. Edgington.
27123 Gas motors. Rowe.
27124 Engine cleaning. Atherton.
27125 Mathematical instrument. Thornton.
27126 *Windlasses. McOnie.
27127 Toasters, etc. Hassall.
27128 Valve mechanism. House.
27129 *Feed water heater. Muchka.
27130 Cement manf. Ranhoff.
27131 Bed pans. Sears.
27132 Incubator. Rippon.
27133 Wheels. McCormick.
27134 Golf club head. Dunn.
27135 *Bedsteads. Venn.
27136 Mudguard. Lane.
27137 Loose leaf books. Boyse.
27138 Railway stations. Vinall.
27139 *Tape holder. Malick.
27140 Easel. Harrison.
27141 *Tobacco pipe. Carpenter.
27142 *Artificial stone manf. Kesler.
27143 *Pump. Compton.
27144 *Submarine signalling. Klupathy.
27145 Boot manf. Wilkinson.
27146 Gas burner. Shaw.
27147 *Concrete sheet manf. Norton.
27148 Advertising device. Gibbons.
27149 Fire extinguisher. Frost.
27150 Tooth powder. Griffin.
27151 Calculator. Lake.
27152 Aeroplane face guard. Tomlins.
27153 *Cloth board manf. McFarlane.
27154 *Gas burner. Barnong.
27155 Electric ignition device. Lonis.
27156 Centrifugal pump. Chance.
27157 Fuel economiser. Blake.
27158 *Gas engine governor. Okey.
27159 Typewriter. Brownlee.
27160 *Matrix shaping. Girlot.
27161 Energy transmission. Cross.
27162 Dynamo brushes. Beeton.
27163 *Vapour lamp. Ritzmann.
27164 *Bridle bit. Haddon.
27165 *Production of litho matrices. Bassain.
27166 *Treatment of liquids. Paschka.
27167 *Guns.
27168 *Ignition device. Bosch.
27169 Valve. Lindemann.
27170 *Repulsion motors. Siemens.
27171 *Gun carriage.
27172 Belt pulley. Beaumont.
27173 Power transmission. Beaumont.
27174 *Electric wires. Priestley.
27175 Printing machine. Ahoznanski.
27176 *Electric accumulator. Robertson.
27177 *Bottles. Breitung.
27178 *Reflectors. Westenberg.
27179 Life boat. Senacol.
27180 *Turbines. Junggren.
27181 Captive flying machine. Page.
27182 Mirror manf. Thompson.
27183 *Spraying liquid fuel. Schmidt.
27184 Draught excluders. Thornton.
27185 Motors. Smith.
27186 Measuring device. Dunn.
27187 Amusement. Cooper.
27188 Straw hat manf. Wright.
27189 Treatment of rubber. Werner.
27190 *Addressing machine. Sefton-Jones.

NOVEMBER 23rd, 1910.

27191 Stair rod. Russell.
27192 Castors. Lloyd.
27193 Window fastener. Russell.
27194 Curtain clip. Russell.
27195 Window fastening. Lloyd.
27196 Compass. Lloyd.
27197 Stair rod. Lloyd.
27198 *Anti-cribber. Bignell.
27199 Lamp holder. Heath.
27200 Cooling apparatus. Hart.
27201 Candle holder. Williams.
27202 Washing machine. Wilkinson.
27203 Swath turners. Phipps.
27204 Bioscope apparatus. Fenn.
27205 Electrical apparatus. Pensabene.
27206 Towel holder. Edmonds.
27207 Cinematograph. Diggle.
27208 Cycle brake. Sangster.
27209 Acid concentrating. Green.
27210 Cuff links. Reid.
27211 Advertising device. Marshall.
27212 Ships steering. Holme.
27213 Speed gear. Grieves.
27214 Cutting tool. Bart.
27215 Punchball. Scrivner.
27216 Door securing. Bradley.
27217 Cloth manf. Edwards.
27218 Sterilising milk. McClelland.

27219 Wall tie. Cowman.
27220 Wall tie. Cowman.
27221 Hats. Cathow.
27222 *Wheels. Ganby.
27223 *Electric apparatus. Gardner.
27224 Manifold writing. Bailey.
27225 Valve gear. Moore.
27226 *Twist drill manf. Wilt
27227 Spraying sewage. Brown.
27228 *Engine. Goodwin.
27229 *Cloth. Pillers.
27230 *Ignition device. Pieper.
27231 Cigar holder. Cooke.
27232 Buttonhole balloon. Terrell.
27233 Boilers. Niblock.
27234 *Jute softener. Parker.
27235 Fire extinguisher. Garry.
27236 Parachute carrier. Murray.
27237 *Propeller. Jones.
27238 Valves. Daw.
27239 Screens. Harvey.
27240 *Electric lamp. Bacci.
27241 Locking bolt. Price.
27242 Snow removers. Archer.
27243 *Heating plant. Marks.
27244 *Railway safety device. Seras.
27245 Agricultural machine. Schrabel.
27246 *Paper weight. Ropf.
27247 *Emission of Hertz oscillations. Girardeau.
27248 *Switch plug box. Kalamba.
27249 Type setting device. Gyles.
27250 Door bolts. Meaby.
27251 Perambulator. Maggs.
27252 *Ships. Webster.
27253 *Gas testing. Arndt.
27254 *Gas testing. Arndt.
27255 Pens. Pudney.
27256 Ignition apparatus. Forster.
27257 Boiler brush. Turner.
27258 *Celluloid production. Eichengün.
27259 *Fuse. Müller.
27260 Superheater. McLaren.
27261 Electrodes. Karavodine.
26762 *Pump. Loebinger.
27263 *Welding device. Schieher.
27264 Gas purifying. Knowles.
27265 Dynamos. Leitner.
27266 Internal-combustion engine. Douglas.
27267 Lace manf. Jardine.
27268 Lace manf. Jardine.
27269 Stretchers. Marinitsch.
27270 Turbines. Doulby.
27271 Knitting machine. Berridge.
27272 *Hosiery. Jenkins.
27273 *Decorative leaf. Lake.
27274 *Looms. Gagnon.
27275 *Combing machine. Evans.
27276 Cycle saddle. Aitker.
27277 Electric switch. Dickson.
27278 *Monorail car. Allsani.
27279 *Concrete manf. Mouchart.
27280 Glass plate cooling. Pilkington.
27281 Refrigerators. Crossman.
27282 Aerial machine. Navarro.
27283 *New compound. Medveczky.
27284 *Torpedoes. Leon.
27285 *Umbrella frame. Teste.
27286 *Umbrella frame. Teste.
27287 *Propelling device. Brianne.
27288 *Sanitary receptacle. Trayne.
27289 *Fabrics. Meade.
27290 Reflector. Barnet.
27291 Cycle frame. Usher.
27292 Gas turbine. Bour.
27293 Clocks. Lowne.
27294 *Flying machine. Silvestri.
27295 *Internal-combustion engine. Serex.
27296 *Bridge marker. Jolly.
27297 Seats. Galloway.
27298 *Piano player. Zachariae.
27299 Hoist. Ramsbottom.
27300 Motor. Schtscherbakoff.
27301 *Recorder. Davies.
27302 *Automobile head lights. Rasmussen.
27303 *Yarn manf. Tissier.
27304 *Preparing hemp. Heide.
27305 Boot manf. Boult.
Motor starter. Corrick.
27307 Firearms. Enklaar.
27308 Billiard cue. Alexander.
27309 Fire extinguisher. Dark.
27310 *Seats. Madden.
27311 Valves. Round.

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27312 Electric device. Taylor.
27313 Door lock. Bennett.
27314 Hammers. Lancaster.
27315 Corn cure. Watts.
27316 Valve. Bavley.
27317 Boilers. Rae.
27318 Grates. Harrison.
27319 Wound shield. Torrens.
27320 Reducing gear. Lawrence.
27321 Clock. Korte.
27322 Counters. Korte.
27323 Boot cleaner. Ellin
27324 Soldering iron. Ellin.
27325 Cycle seat. Brooks.
27326 Grease cup. Showell.
27327 Wheels. Baird.
27328 Tyres. Billington.
27329 Holder. James.
27330 Hook and eye. Itter.
27331 Hook and eye. Itter.
27332 Fluid meter. Kent.
27333 Wheels. Cowle.
27334 Fuel. Hodgkinson.
27335 Loose leaf book. Jefferson.
27336 Cultivator. Hardy.
27337 Internal-combustion engine. Dorman.
27338 Washing machine. Meikle.
27339 Game. Lambert.
27340 Hoisting device. Fielding.
27341 *Cartridge carrier. Wise.
27342 Tricycle. Hough.
27343 Seat indicator. Wilkins.
27344 Toy. Fletcher
27345 *Tyre pump. Williams.
27346 Firelighter. Walker.
27347 Dress stud, etc. Mitchell.
27348 *Furnace. Williams.
27349 *Concrete railways. Delille.
27350 *Dolly peg. Blount.
27351 Portfolio. Parkinson.
27352 Tyre. Palmer.
27353 Tobacco pipe. Ingham.
27354 Cricket pads. Bailey.
27355 *Collar stiffeners. Poulain.
27356 Safety meters, etc. Davey.
27357 *Forks. Schloemilch.
27358 Tyre. Cowle.
27359 Fastener. Blaisdell.
27360 Warning horns. Davidson.
27361 Game. Egan.
27362 Clamp. Redman.
27363 Woodworker. Ogilvie.
27364 Canvas separator. Lurker.
27365 Cigar cases, etc. Bedford.
27366 Collar support. Kleinmann.
27367 Collar support. Kleinmann.
27368 *Aeroplane. Sloan.
27369 Stockings,, etc. Maguire.
27370 *Railway switch. Dicker.
27371 Rotary engine. Barry.
27372 Letter clip. Myers.
27373 Concrete bars, etc. Hatton.
27374 Concrete bars, etc. Hatton.
27375 *Wall plug. Kalamba.
27376 *Springs. Williams.
27377 Toy. Westmorland.
27378 *Stocking suspenders. Bailly.
27379 *Stereoscopes. Pigeon.
27380 Armour plate. Wedgwood.
27381 Pincer lasting machine. Farrar.
27382 *Rails. Goldschmidt.
27383 Distillation. Shaw.
27384 Trussing casks. Brooks.
27385 Engine. Wilsmore.
27386 Envelope. George.
27387 Elevated railways. Paelman.
27388 Belting. Alkin.
27389 *Treatment of gases.
27390 *Cranes. Camnistrow.
27391 *Internal-combustion engine. Saunion.
27392 Table Haverley.
27393 Life saving device. Schermuby.
27394 *Leak stopping. Vallee.
27395 Electric transmission. Leitner.
27396 Lighting device. Leitner.
27397 Tea leaf rolling. Davidson.
27398 Ammonia manf. Willton.
27399 Wheels. Richardson.
27400 *Contour map. Douglas.
27401 Lamp. Horvath.
27402 Tubes. Nesfield.
27403 *Printing press. Lake.
20404 Production of discharge effects. Johnson.
27405 Production of discharge effects. Johnson.
27406 Production of reserve effects. Johnson.
27407 Lamp. Constantinescu.
27408 *Overcoats. Harris.
27409 *Overcoats. Harris.
27410 Furnace. Anderson.
27411 Knife, etc. Sharpener. Jones.
27412 Combs. Bowen.
27413 *Boots, etc. Holot.
27414 Dental cast holder. Hammond.
27415 *Arc lamp. Mackenzie.
27416 Tilling machine. Russell.
27417 Liquid elevators. Hodden.
27418 Draught excluder. Gell.

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27419 Dynamo. Cooper.
27420 Oval cutters. Johnson.
27421 Dust separating device. Smith.
27422 Rubber manf. Sutton.
27423 Pencil sharpeners. Shaw.
27424 Internal-combustion engine. Spencer.
27425 Boot manf. Fraser.
27426 Printing press. Stevenson.
27427 Fire extinguisher. Bitling.
27428 Railway switch. Williams.
27429 Colliery. Lloyd.
27430 Coke washers. Draper.
27431 Cooking apparatus. Abbott.
27432 Hats. Burgess.
27433 Blind roller. Moore.
27434 Beer drawing. Garland.
27435 Weighing device. Hipkins.
27436 Gyroscopic device. Barr.
27437 Speed gear. Storey.
27438 Boots, etc. Allen.
27439 Cycle pedals. Allen.
27440 Cornice poles. Hill.
27441 Soldering irons. Ellin.
27442 Motor control. Harper.
27443 *Tobacco pipe. Schlie.
27444 *Sponge. Auliff.
27445 Wheels. Boulton.
27446 Duster. Beaumont.
27447 Crane. Branston.
27448 *Electric cable. Robertson.
27449 *Steam generator. Howden.
27450 *Gas producer. Farnham.
27451 Cameras. Roberts.
27452 SECRET APPLICATION.
27453 Engine. Hommel.
27454 Internal-combustion engine. Saunders.
27455 Chemical. Hunter.
27456 Grinding rollers. Schmidt.
27457 Grinding rollers. Schmidt.
27458 Furnace. Marken.
27459 Wire stitching machine. Rudd.
27460 Electric motor. Schupp.
27461 Blind shutters. Prout.
27462 Record box. Groom.
27463 *Oxygen production. Pictet.
27464 *Aeroplane. Maistre.
27465 Stone saw. Bastard.
27466 Breathing apparatus. Dräger.
27467 *Distillation of zinc. Hütten.
27468 *Luminous dials. Lipmann.
27469 Gas generator. Tempest.
27470 Steam drying. Melhuish.
27471 *Corn sifters. Zudse.
27472 Dye manf. Newton.
27473 *Straw, etc., cutters. Klingele.
27474 Fans. Edwards.
27475 Small arms. Ashton.
27476 Cycle wheels. Cliff.
27477 *Chemical device. Ballo.
27478 *Quenching coke. Bleichert.
27479 Cotton gins. West.
27480 Hats. Baker.
27481 Bandlaux. Baker.
27482 *Photo device. Dupuis.
27483 *Turbine. Parsons.
27484 Knife sharpeners. Barker.
27485 Mangle. Marsden.
27486 Photo device. Thompson.
27487 *Tramway points. Jones.
27488 *Earth anchor. Schmid.
27489 *Brewing. Rheinhardt.
27490 Tyres. Prideaux.
27491 Ball and cup joint. Glover.
27492 Feed-water heater. Green.
27493 Moulding box. Fraies.
27494 *Material. Howells.
27495 *Lamps. Purchas.
27496 *Linoleum. Delmenhorst.
27497 *Paper manf. Toniolo.
27498 Beds. Paterson.
27499 Production of oxide of nitrogen. Strutt.
27500 *Liquid.
27501 Boot trees. Peal.
27502 Refrigerators. Potter.
27503 Nailing machine. Boult.
27504 Gas meter. Wilson.
27505 Figure improving. Paechtner.
27506 Metal plate joint. Koopman.
27507 Firegrate. Birch.

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27508 Call bell. Heath.
27509 Looms. Kershaw.
27510 Wheel caps. Masters.
27511 Stem. Bolton.
27512 Metal tubes. Bolton.
27513 Bolts, etc. Mills.
27514 Turbine. Dothie.
27515 Carriage hoods. Harries.
27516 Scaffold grip. Smith.
27517 Coal cutters. Spence.
27518 Twisting frame. Hitchon.
27519 Typewriter. Gordon.
27520 Scrimp rails. Shaw.
27521 Pram hood. Luther.
27522 Water raising. Southall.
27523 Weed cutters. Yeats.
27524 Smiths' hearths, etc. Bone.
27525 Condenser. Hunt.
27526 Fire escape. Wormald.
27527 Couch heads, etc. Travers.
27528 Concrete columns. Thomson.
27529 Internal-combustion engine. Miller.
27530 Battery. Hart.
27531 Carburetter. Everest.
27532 Lavatory basin. Cutford.
27533 Game. Hornby.
27534 Tyre. Gane.
27535 Fishing reel. Allcock.
27536 Fusible cut-out. Hope.
27537 Bedsteads. Bates.
27538 *Hatpin. Hall.
27539 *Utilisation of washing liquids.
27540 Locking lid. Osborn.
27541 *Taps. Adams.
27542 *Spring. Blackmore.
27543 *Internal-combustion engine. Jörgensen.
27544 Curtain rods. Hitchman.
27545 Gas analysis. Knowles.
27546 *Pumps. Bridger.

27547 Internal-combustion engine. Fletcher.
27548 Internal-combustion engine. Fletcher.
27549 Internal-combustion engine. Fletcher.
27550 Motor boats. Cooper.
27551 Clothes drier. Reavley.
27552 Holder plug. Osborn.
27553 Tyre. Yule.
27554 *Musical instrument. Jäger.
27555 Erythene, etc., manf. Newton.
27557 Electric contact. Fokes.
27558 Oxide of nitrogen. Phillips.
27559 Condenser Phillips.
27560 *Fuse. Kope.
27561 *Bedstead post knobs. Robertson.
27562 *Water heater. Brockdoff.
27563 Sad irons. Drabble.
27564 *Lifting apparatus. Daydé.
27565 Garment marking-out. Jones.
27566 *Pipe, etc., stoppers. Dayol.
27567 *Boiler. Peaucellier.
27568 *Cement manf. Thompson.
27569 Loose-leaf binder. Lee.
27570 Treatment of fibres. Prato.
27571 *Hooks. Harvey.
27572 *Revolution counter.
27573 *Hair fasteners. Brahn.
27574 *Sparking plugs. Kuhn.
27575 Sieve brushing. Peter.
27576 *Trucks. Hudson.
27577 *Trucks. Hudson.
27578 Internal-combustion engine. Knudsen.
27579 Internal-combustion engine. McKechnie.
27580 Hydrometers. Rorke.
27581 *Envelope opener. Michelius.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to January 2nd, 1911, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

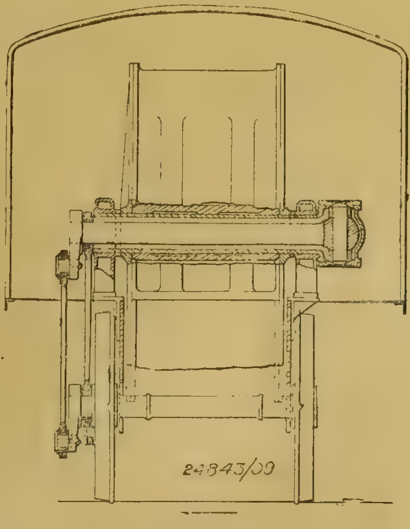
Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

14910 Wolfendale and Seymour: Detachable dust shield for motor cars and such like vehicles to be fixed outside the wheels of the cars. [Post-dated October 26th, 1909.] 15348 Middlehurst and O'Connor Ltd.: Spring-operating device for doors and the like. [Post-dated January 3rd, 1910.] 16895 Evershed, Kilroy, and Evershed and Vignoles Ltd.: Electro motors and the production of sound waves for signalling to a distance. 16908 Davies and Richards: Process for the treatment of liquid hydrocarbons. [Cognate Application. 19081, 1909.] 17087 Johnston: Crushing or grinding auriferous quartz and other hard ores or substances. 17088 Johnston: Filtering apparatus. 17089 Johnston: Domestic and other cooling appliances. 19081. *See* 16908. 1909. 20770 Donisthorpe: Films for animated photography. [Post-dated March 11th, 1910.] 21522 Poole: Projectiles. 21584 Isherwood: Treatment of refractory zinc-lead ores. 21602 Wadsworth and Campbell: Method or process of and means for producing copper plate prints in two or more colours for pottery and like articles. 21654 Petermann: Folding typewriters. 21834 Vernet: Portable screw-punching machines. [Date applied for under International Convention, December 26th, 1908.] 21862 Pedersen: Centrifugal separators. 21932 Martineau: Marine steering gear. [Cognate Application. 30205, 1909.] 21943 Vernet: Portable screw punching machines. [Application for Patent of Addition to No. 21834, 1909.] 22324 Liney: Wrenches. [Post-dated April 1st, 1910.] 22484 Hudson: Joints of curtain poles and the like. [Post-dated March 1st, 1910.] 23634 Sheward: Construction of electric lamp holders. [Post-dated April 15th, 1910.] 23696 Gonnella: Apparatus for polishing floors. [Post-dated April 16th, 1910.] 23877 Weller: Harmoniums. 23895 Davenport: Speed and direction indicator for moving bodies of all kinds. [Post-dated April 19th, 1910.] 24076 Bloch: Cable connections for electric burglar alarms and the like apparatuses. 24111 Kuldkepp and Graf: Process for sizing and impregnating paper, wood, and like substances. 24119 Perry: Manf. of paints, varnishes, and stains. 24130 Diemel: Electric pocket igniter. 24155 Livesey: Internal-combustion engines. 24182 Forbes: Apparatus for sterilising liquids. [Date applied for under International Convention, October 22nd, 1908.] 24202 Davies: Ventilators. 24205 Welles: Headlights and the like. 24249 Dixon: Power-operated capstans. 24257 Jeffrey: Hydraulic jigs. [Application for Patent of Addition to 830, 1906.] 24273 Osmond: Article of domestic furniture. 24305 Starck: Wood and like wind musical instruments relating more particularly to bagpipe chanters. 24320 Strange: Means for the manf. of metal strips or sheets. 24330 Brook: Jointing of ropes of rubber to be used for wheel tyres and the transmission of power. [Cognate Application. 9817, 1910.] 24371 Alderson and Holmes: Means or arrangements for detecting and indicating the presence of gas in coal mines and other places. 24426 Dickinson: Attachment of lids to circular boxes made of tin or other material. 24430 Palmer: Controlling mechanism. 24438 Carter: Self-feeding envelopes into typewriters. 24458 Simpson: Apparatus for distilling volatilisable solids and for drawing off gases in vacuo. 24521 Morris, Kirke, and Lloyd: Controlling mechanism, governor relays, and the like. 24551 Leask: Apparatus for moistening air. 24561 Milne: Electrical conduits and accessories. 24567 Creer: Seats and the like. 24592 Lecaime: Reversible rotary engines, pumps, and the like. 24612 Powley, Powley, and Powley: Machines for brushing and washing bottles, jars, and like receptacles. 24618 Ritchie: Machines for supplying and affixing covers to books and the like. 24625 Hall-Simons: Means for receiving corks from cork drawers. 24626 Justice (Plant): Machines for slashing soles of boots and shoes. 24650 Howorth: Humidifiers or apparatus for moistening and purifying air. 24654 Pearson: Apparatus for providing hot water in the lavatories of railway carriages. 24716 Eycken, Le Roy, and Moritz: Electrolytic apparatus for the production of pure oxygen and hydrogen. [Date applied for under International Convention, December 9th, 1908.] 24722 Maguire and Gatchell Ltd., and O'Leary: Apparatus for carburetting air. 24748 Poate, and Fawcett, Preston, and Co.: Accumulator or bye-pass valves for hydraulic presses. 24751 Leach: Inhaler for the purpose of medicinally impregnating air with curative properties. 24766 Fairburn-Hart (Electric Renovator Manufacturing Co.): Vacuum and like cleaning apparatus. 24813 Berry: Electrical heating apparatus. [Cognate Application. 29954, 1909.] 24816 Catling and Corner: Prevention of deposits in hydraulic mains in gas works. 24825 Freymuth: Centrifugal separators and the like for the treatment of lac. 24829 Trepreau: Electric heating apparatus. 24833 Haddan (American Car and Foundry Co.): Machines for forming nut blanks. 24839 Reid: Process for recovering precious metals from ores. [Date applied for under International Convention, February 3rd, 1909.]

24843 Akt.-Ges. Brown, Boveri, and Cie.: Electric drive for railway vehicles. [Date applied for under International Convention, December 18th, 1908.]

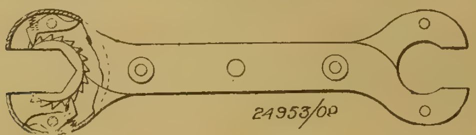
This invention relates to the electric driving of rail vehicles in which the wheel axle is connected to the motor axle through a hollow motor-driven shaft with a universal joint at one end, a second shaft passing through the hollow shaft and being geared at the other end to the wheel axle and a distance rod connecting the wheel axle to the free end of the second shaft. The invention consists essentially in forming either the motor or the wheel axle of a hollow shaft connected to the wheel axle or motor shaft respectively through a universal or jointed coupling.



24876 Snell: Cocks and faucets. 24894 Raab: Combined match box and cigar cutter.

24953 Connor: Spanners or wrenches.

This invention relates to spanners or wrenches of the type in which the advantages of both the open-jaw spanner and the box spanner are combined. The invention comprises a spanner having a plurality of displaceable members adapted to embrace a removable rotatable member actuated by spring-controlled pawls arranged on the displaceable members, which latter are rigidly locked whilst the rotatable member is actuated. Special features of the invention are the ready detachability of the jaw and the combination of it with jaws of the monkey wrench type.

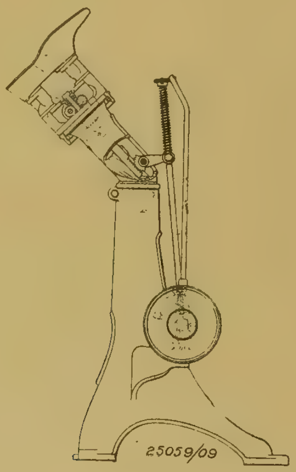


24953/09

24987 Walker (Merganthaler Setzmaschinen-Fabrik Ges.): Escapement mechanisms of typographical composing machines. 25038 Roseman: Brush-making machinery.

25059 Cridland, and British United Shoe Machinery Co.: Machines for re-forming "turn" shoes.

This invention relates to improvements in machines for re-forming what are known in the art as "turn" shoes. The invention comprises the arrangement of an expansible jack that is supported in, or can be brought into, a position in which the sole of the shoe on the jack is inclined from the horizontal in the general direction of the shoe. The jack is rotatably mounted or arranged to tilt upon the machine frame so that the toe, the sides of the shoe, or the heel end thereof may be brought into that position which is found to be most suitable for the convenience of the operator. Another feature is the combination with an expansible jack of a support that not only permits the jack to be rotated into any desired position, but also allows it to be expanded or contracted independently of the rotary movement. This arrangement permits the jack to be rotated while in its expanded condition or will permit it to be rotated into any desired position before being expanded.

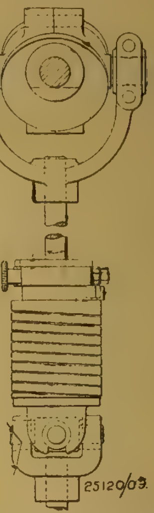


25059/09

25101 Harris: Time-controlled apparatus for regulating the lighting and extinguishing of gas, and for analogous purposes. 25116 Kny: Heavier-than-air aeronautical machines. [Cognate Application. 13119, 1910.]

25120 Wood: Change-speed gearing.

This invention relates more particularly to that class of change-speed gearing in which a coil friction clutch is employed in transmitting and converting rotary motion derived, say, from a constantly driven shaft to a worm or like gearing to which it is desired to impart an intermittent movement in one direction. In carrying the invention into effect, a fixed inclined cam groove and an engaging yoke are provided to directly convert the constant rotary motion of the driving shaft into constant oscillating motion of a second shaft and to re-convert the latter into intermittent rotary motion in one direction. Mounted on the constantly rotating shaft is a boss carrying an inclined collar race or cam groove in which rest pins attached to a yoke which in turn carries a second shaft, the outer end of which is keyed to a hub or drum carrying a projection adapted as the shaft is moved in one rotary direction to make contact with a projection on the end of the coil friction clutch and by tightening the coil to cause it to bind on a second drum or hub attached by a universal joint or otherwise to the worm shaft. To secure a return of the coil when the yoke-driven shaft reciprocates in the other rotary direction, a collar is provided carrying a suitable projection to contact with the end of the coil and carry it back to its first position if desired, but by mounting the collar loosely on the hub and providing a feed screw engaging with teeth formed on such hub or by otherwise making the position of the collar adjustable on the hub the distance the coil is turned back may be limited, and this, of course, will also limit its movement forward or, in other words, there may be any desired amount of lost motion between the rotary reciprocating shaft and its action on the coil clutch with a corresponding limitation of movement to the worm shaft which may, in fact, be thrown entirely out of operative gear without stopping the constantly rotating shaft or source of power.



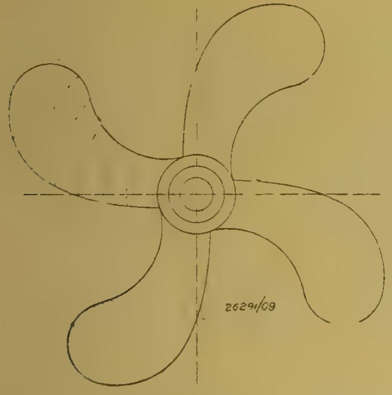
25120/09

25124 Henderson: Method of converting existing roads into dustless roads, and improvements in the formation of surfaces such as those of roads, yards, floors, roofs, and the like. 25144 Smith and Good: Dynamo electric machines or electromagnetic power devices. 25147 Degener, and General Composing Co. Ges.: Type-line setting and casting machines for producing mixed copy. 25148 Lakhovsky: Liners for fixing screw spikes in railway sleepers. [Date applied for under International Convention, November 4th, 1908.] 25174 Deighton and Jarmain: Variable-speed and reversing gearing. 25191 Gardner: Appliances for submarine sound signalling. 25199 Rushton: Differential gearing for roving and other machines preparatory to spinning. 25230 Lecoche: Direct-current electric motors. 25239 Becker: Friction transmission mechanism. [Date applied for under International Convention, November 9th, 1908.] 25241 Boult (United Shoe Machinery Co.): Manf. of eyelets or the like. 25246 Boivin: Machines for breaking and packing sugar. 25247 Gray and Drummond: Rotary engines, pumps, and compressors. 25254 Rorke and Rorke: Thermostats or heat-controlling devices. 25515 Thompson: Bottle seal or cap. [Post-dated May 5th, 1910.] 25552 Lake (Firm of H. J. Salomon): Machine for uniting boards. 25605 Hollingworth (Crompton and Knowles Loom Works): Shuttle-changing mechanism for looms for weaving. 25646 Hammon: Motor cycles. 25681 Burton: Internal-combustion engines. 25691 Metropolitan Amalgamated Railway Carriage and Wagon Co., and Wheeler: Combined seat backs and berths for railway carriages and ships. 25726 Paget: Methods and means for the control of flying machines. 25992 Harrison: Air-heating furnaces. 26151 Griffiths and Griffiths: Presses for operating on metal or other sheets. 26174 Brooke and Morrison: Appliance for operating screw stoppers of bottles and the like.

26291 Bamforth and Roy: Screw propellers.

This invention relates to screw propellers, and consists essentially of a screw propeller wherein the pitch of the blades is increased from the point adjacent to the boss towards the tips, and the blades are thrown back at an inclination from the boss to the tips, while at the same time the front or leading edges of the blades are inclined in a direction opposite to that in which the blades normally rotate.

26292 Gillespie, Fraser, and Gillespie: Roofing and paving material. 26312 Williams: Multiple sheave pulley blocks. 26328 Birrell: Folding woodwork bench. 26386 Ferrier: Self-closing doors. 26772 Sherwood: Certain kinds of oil lamps. 26819 Geissinger: Thermostats. [Date applied for under International Convention, November 30th, 1908.] 26897 Crump: House for poultry, pigeons, and other birds or animals. 26944 Edwards: Substitute for a bath sponge. 27323 Turner: Expanding wardrobes. 27333 Dixon: Loose-leaf books. 27339 Martini: Hand saws. 27369 Senssenbrenner: Combined evaporating and condensing apparatus for ice-making machines. 27400 Spiers: Cigar, cigarette, card, match, and stamp cases and the like. 27505 Jenks and Cattell: Manf. of cold pressed nut blanks. 27511 Adams: Internal-combustion engines. 27552 Spiller: Eyeglasses. 27576 Read: Apparatus for forming solidified carbonic acid gas.

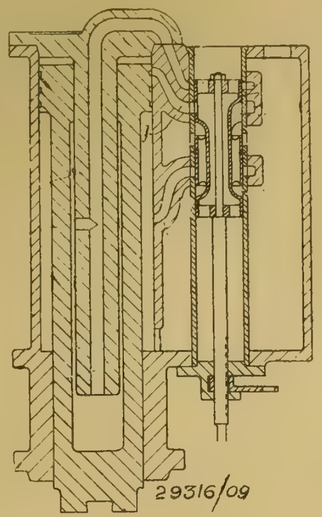

26291/09

27622 Smith: Hooks for the support of pictures and the like. 27709 Jones: Elevators and transporters. 27834 Hawley and Collier: Pneumatic tyres for road vehicles. [Request under Section 19 of the Act not granted.] 27874 Graham: Gears for the application of indicators to steam, gas, or oil engines. 27899 Higgins and Spensley: Drying or "stoving" of soap. 27980 Hyde, and R. Hyde and Co.: Food for rabbits, cavies, and other domestic pets. 28023 Whitaker and Whitaker: Concrete-mixing machines. 28103 Gregson: Means for fastening the lid of a case for transport purposes. 28150 Gottsleben: Process for the production of a soluble powder formed from the yolks of eggs. 28181 Grondal, Kjellin Co., and Hay: Handling of blocks or briquettes discharged from kilns or furnaces. 28677 Allen: Tobacco. 28691 Milne: Filters or sieves for milk or other liquids. 28695 Elson: Cylindrical brushes and the like. 28725 Zorn: Method of and apparatus for holding persons in unusual positions. 28957 Plischke: Stoves and furnaces. 29069 Hirst and Angold: Electric arc lamps. 29100 Jubb: Method of and means for tipping or unloading railway wagons. 29147 Hall: Appliance for holding soap. 29261 Pulsometer Engineering Co., and Bjornstad: Means for use in priming pumps. 29287 McKechnie and Beasley: Extraction and separation of metallic compounds from ores, mattes, residues, and other metalliferous substances.

29316 Massey and Snow: Hammers worked by elastic fluid.

This invention relates to hammers worked by elastic fluid under pressure which work automatically. The invention is applied in a hammer having the lower face of the piston considerably smaller than the upper face and the lower end of the cylinder in constant communication with the supply of compressed air and which has only automatic action in the following manner. In such a hammer a passage is carried from a suitable place in the cylinder some distance from either end and generally situate so that it is overrun by the piston when it has moved through about half its downward stroke. This passage leads from the place into the upper part of the cylinder at or near the top. The piston or ram is made hollow and a plunger rigidly attached to the upper end of the cylinder projects down into it. In this plunger there is a passage which opens into the cylinder at a convenient place generally so that it is overrun by the piston at or about the middle of its upward stroke. The other end of this passage is open to the atmosphere. In a suitable place in one of the passages there is a cock or valve which can be operated by the attendant.

29406 Gornell: Fountain pens and the like. 29452 Kost: Inverted incandescent gas light burners. 29539 Harris: Certain kinds of collapsible push carts or baby carriages. 29672 Cox: Apparatus for the production of air gas. 29690 Jennings: Automatic locking door or window bolt. 29779 Von Schlippenbach: Apparatus for continuous oxidation, reduction, or other treatment of ores, metallurgical products, or the like by means of gas or air passed therethrough. [Date applied for under International Convention, January 23rd, 1909.] 29817 Saft: Spring mattress. 29826 McKenzie and Tivendale: Locks and hatches. [Aplication for Patent of Addition to 24776, 1908.] 29865 Rose, and Rose Bros. (Gainsborough) Ltd.: Apparatus for making cases, bags, or the like, for the reception of articles, such, for instance, as cigarettes. 29892 Gelderman: Warp stop motion for looms. 29927 Taylor: Locking apparatus for levers and the like. 29954. *See* 24813, 1909. 30059 Engelsmann: Apparatus for showing kinematographic pictures. 30205. *See* 21932, 1909. 30338 Heinitz: Calculating machines.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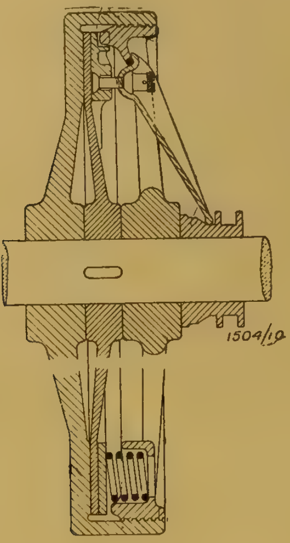
1910.

86 Freeth and Cocksedge: Manf. of ammonium chloride from ammonium sulphate and common salt. 145 Spaulding: Folding and reclining chairs. [Date applied for under International Convention, January 2nd, 1909.] 221 Edwards (Goss Printing Press Co.): Stapling mechanism for binding pamphlets from rotary printing machines. 441 Marks (De Neveu): Incandescent gas burner. [Rights under Section 91 of the Act not granted.] 469 Leistler: Safety devices for automatically locking locks. [Date applied for under International Convention, November 5th, 1909.] 553 Bratt: Circular wood cutters. 699 Wiedemann and Templin: Method of pumping air or other fluids. 703 Martin and Martin: Hinged windows. 860 Rundlof: Means for controlling the working of pumps, particularly for internal-combustion engines. [Date applied for under International Convention, January 15th, 1909.] 893 Ashby: Lamp and analogous brackets for cycles and other road vehicles. 917 Pirkis: Game apparatus or toy. 954 Weber: Egg beaters and twirling sticks. 978 Auster: Fittings for wind or weather screens for motor cars and other vehicles. 1188 Douglas and Shriver: Irrigating cultivators. 1208 Boyland: Clasps. 1274 Taliani: Anti-vibration frame for bicycles. 1320 Petermann: Typewriting machines and escapement thereof. [Date applied for under Rule 13, September 22nd, 1909.] 1321 Petermann: Platen shift mechanism particularly for folding typewriters. [Date applied for under Rule 13, September 22nd, 1909.] 1322 Petermann: Typewriters. [Date applied for under Rule 13, September 22nd, 1909.] 1323 Petermann: Ink ribbon mechanism for typewriters. [Date applied for under Rule 13, September 22nd, 1909.] 1324 Petermann: Line-spacing mechanism for typewriters. [Date applied for under Rule 13, September 22nd, 1909.] 1325 Petermann: Typewriting machine and keyboards therefor. [Date applied for under Rule 13, September 22nd, 1909.] 1483 Schiebe: Control apparatus for vapour electric devices. [Date applied for under International Convention, January 21st, 1909.]

1504 Benn, Unbreakable Pulley and Mill Gearing Co., and Buck: Friction clutches.

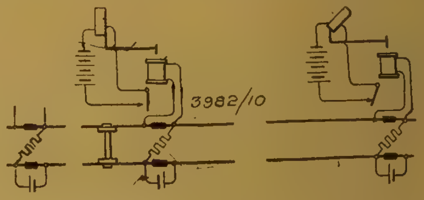
This invention relates to friction clutches of the plate or friction disc type, in which a plate or disc carried by the driven shaft is adapted to be gripped between two parts carried by the driving shaft or member. The invention comprises the combination with a drum-like driving member and a driven disc or plate of a sliding plate formed from a plurality of independent segments driven from the drum, a carrier secured to the drum, springs interposed between the carrier and segments, and means acting upon each of the segments for controlling their positions relatively to the driven disc or plate.



1531 Hippel and Hippel: Speed indicators for motor cars. 1563 Sturge: Suspension of gas pendants, chandeliers, lamps, and like gas fittings. 1613 Fortnum and Mason, and Hall: Water bottles or the like for military, sporting, and like uses. 1897 Fischer: Knife and fork-cleaning machines. 1913 Henderson: Sheet delivery mechanism particularly for use with printing presses. 1947 Cross: Tin openers. 2000 Neumann: Fire escapes. 2005 Tucker: Corsets. 2118 Icasate-Larios: Flying machine. [Date applied for under International Convention, January 28th, 1909.] 2130 Baillot: Cupola furnaces. 2162 Brookes: Boxes or cases for containing tobacco cartridges and a pipe filler. 2172 Stacey: Grinding rolls for treating wheat and other granular substances. 2217 Dawson and Buckham: Sighting apparatus for ordnance. 2263 Blackwell: Arc lamps. 2451 Lenthall: Tide indicators. 2774 Hopthrow, Hopthrow, and Patterson: Stanchions for guard rails for ships, platforms, and the like. 2824 Bloch: Electro-magnetic apparatus for burglar alarm and like systems. [Date applied for under Rule 13, October 20th, 1909.] 2874 Laubisch: Apparatus for cutting the recess for mortice locks in doors. 3156 Hughes: Means for supporting the glass panels of rain and wind shields for motors and the like. 3157 Hipkins: Weighbeams. 3212 Feidt: Mechanism for transforming rotary motion into reciprocating motion. [Date applied for under International Convention, February 20th, 1909.] 3218 Hodge: Sheet-feeding devices. [Date applied for under International Convention, May 4th, 1909.] 3375 De Back: Method of and apparatus for recovering iron and steel from waste enamelled articles. 3383 Winters: Combined trolley wire hangers and automatic circuit breakers. 3407 Main: Generation of gases and products of combustion under pressure for operating motive power engines. 3631 Schneider: Manf. of accumulators, and more particularly the manf. of positive electrodes for the same. 3736 Lake (Ingersoll-Rand Co.): Mountings for drills. 3752 Bedford and Williams: Catalytic reduction of organic substances. [Date applied for under Rule 13, July 21st, 1909.] 3781 Buchanan and Bowler: Golf and like balls. 3921 R. Walker and Sons Ltd., and Hardy: Straight-bar knitting machines. 3928 Pierpont, and Lanston Monotype Corporation Ltd.: Automatic controlling mechanism for clutch-driving mechanism. 3966 Stranahan: Means for varying the clearance in internal-combustion engines.

3982 British Thomson-Houston Co. (General Electric Co.): Signal systems for railways and the like.

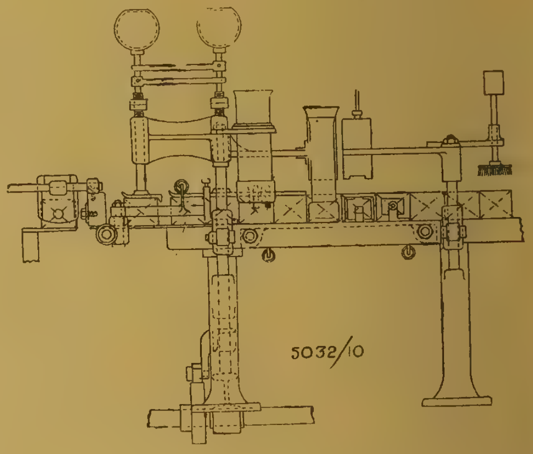
This invention relates to block signal systems for railways, and its object is to provide a novel form of track circuit in which particularly reliable relay operation is obtained. The invention consists in a novel arrangement of the track circuit connections. The rails of adjacent blocks are insulated from each other in the usual manner by insulated joints, but the track relays which are polarised are connected across the insulated joints instead of between the rails, as in the ordinary track circuit, and the track circuits are closed by resistances cross connecting diagonally opposite rails of adjacent blocks. The advantages of this novel connection are, first, that more positive shunting is obtained than with the ordinary track circuit, since when the train has just entered a block, the track relay for that block has a reverse torque, and, second, the breaking down of insulated joints cannot produce a false clear indication, as is possible with the ordinary track circuit.



4235 I'Anson: Game apparatus. 4342 Hartopp: Athletic boots. 4536 Newton (Farbenfabriken vorm F. Bayer and Co.): Manf. and production of new dyestuffs of the anthracene series. 4578 Firm of Bremer and Bruckmann: Slotted burners for soldering apparatus. [Date applied for under International Convention, February 23rd, 1909.] 4716 Dudgeon: Insulators as used on the overhead wires of electric tramways and railways and the like. 4749 Dixon and Fraser: Toy. 4782 Breton: Explosion motors. [Date applied for under International Convention, February 25th, 1909.] 4813 Aktiebolaget Ljungstroms Angturbin: Method of manufacturing blade rings for turbines. [Date applied for under International Convention, February 26th, 1909.] 4896 Budingen: Exercising apparatus for bedridden persons. 4897 Kimber: Copper-plate printing presses. 4900 Scale: Pressure-generating apparatus for motive power purposes. 4980 Lilienthal and Lauer: Preparation or treatment of mica.

5032 Nyberg: Packeting machines. [Date applied for under International Convention, February 27th, 1909.]

This invention relates to packeting machines of the type in which the wrapper which embraces the packet is folded at its ends by means of folding devices which are placed apart a distance equal to the length of the packet. The invention comprises means whereby the wrapper is folded at the ends of the packet after the wrapper at each end has been folded over the edge of the packet, consisting of two longitudinally displaceable folders, which are arranged at a distance from one another corresponding to the length of the packet, and which after the wrapper has been folded by them from one direction move the packet forward to two other folders which fold the wrapper at the ends of the packet in the opposite direction to that previous.

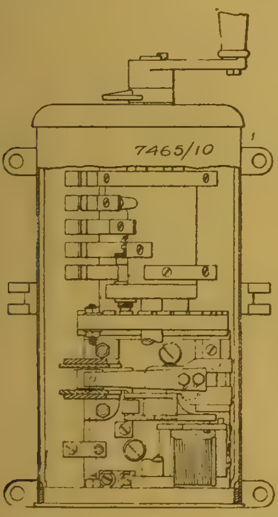


5344 Griffiths: Valve mechanism for internal-combustion engines. 5511 Whate and Kelly: Device for generating and discharging moist steam into the interior of bakers' ovens. 5611 Place and Chapon: Rims for pneumatic tyres. [Date applied for under International Convention, March 5th, 1909.]

5620 Frais: Railway time tables and the like. [Application for Patent of Addition to 9511, 1907.] 5829 Pickup: Spare wheel carriers for motor vehicles. 6129 Timmis: Locomotives. 6185 Haubner: Internal-combustion turbines. 6210 Russell, and Ludlow Bros. Ltd.; Dust bins and like articles. 6277 Ironside: Coin-freed message displaying and advertising machines. 6365 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of pigments or lakes. 6422 Summerley: Smokers' combination articles. 6523 Regina-Bogenlampenfabrik Ges.: Alloy for use in the manf. of electric soldering tools or other apparatus heated by or standing under the influence of an electric arc. [Date applied for under International Convention, May 4th, 1909.] 6560 Govier: Stop-motion or breaking-piece mechanism or appliances for drawing or roving frames and the like, for jute, hemp, and other fibres. 6597 Schott and Gen: Electrolytic apparatus having a liquid anode. [Date applied for under International Convention,, March 30th, 1909. Application for Patent of Addition to 14288, 1909.] 6603 Le Sueur: Self-lubricating vehicle axle. 6690 Barton: Pneumatic tyres. 6915 Dobson: Electrically-operated locking means for the doors of strong rooms, large safes, and the like. 7053 Baumann: Dirigible balloons. [Date applied for under International Convention, March 22nd, 1909.] 7242 Macpherson and Heys: Apparatus for printing or impressing bars of soap or the like. 7259 Erikson and Roland: Envelopes. 7413 Speare: Apparatus for the production of castings.

7465 Adams Manufacturing Co. (Cutler Hammer Manufacturing Co.): Electromagnetically-controlled switches.

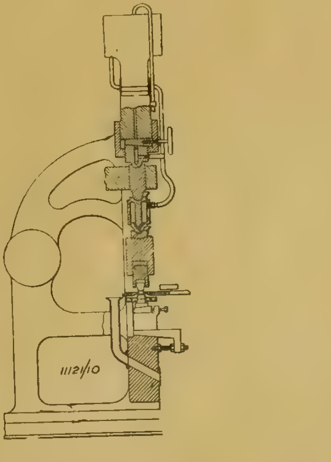
This invention relates to improvements in electric switches, and more particularly to those adapted to open an electric circuit automatically upon the occurrence of abnormal conditions. According to the present invention a pivot of the actuating lever is provided with an abutment or fulcrum which is held by the controlling magnet in the position that permits closing of the switch arm by means of the actuating lever. For example, the actuating lever is pivotally mounted on the switch arm and has a pivot which engages with a slot in the pivotally mounted armature of the controlling electromagnet. By this means, when the switch arm is opened by its spring and the controlling magnet is de-energised, the actuating lever has no fulcrum whereby force can be exerted to close the switch arm or to hold the latter closed and thus there is no possibility of the switch being closed through the actuating lever unless the controlling electromagnet be first energised. The switch can, moreover, be opened automatically by a spring when the controlling magnet is de-energised.



7757 Holldampf and Hallmayer: Beverages. 7900 Leigh: Valve discharging flushing apparatus. [Application for Patent of Addition to 1277, 1910.] 8040 Berry: Means applicable to carts and other road vehicles for relieving or regulating the weight on the horse's back. 8125 Firm W. C. Heraeus Ges.: Means for starting alternate current mercury vapour lamps. [Date applied for under International Convention, January 17th, 1910.] 8186 Praetorius: Starting and reversing device for marine internal-combustion engine. 8191 Hare: Vacuum cleaner nozzles. 8232 Moore: Silencers for firearms. 8307 Drumgold: Boxes for containing mantles for incandescent gas lighting. 8433 Campbell: Containers or capsules for compressed or liquefied gas. 8724 Siemens: Rotary cement kilns. [Date applied for under International Convention, May 28th, 1909. Application for Patent of Addition to 23534, 1909.] 8810 Dura Elementbau Ges., and Lessing: Galvanic batteries. [Application for Patent of Addition to 23622, 1904.] 9095 Tiefbau-und Kalteindustrie Akt.-Ges.: Device for connecting up the tubes of borehole clinometers. [Date applied for under International Convention, July 16th, 1909.] 9251 Boult (Automatic Wrench Co.): Wrenches. 9372 Daime: Apparatus or system for the continuous purification of water. [Date applied for under International Convention, May 21st, 1909.] 9375 Johnson (Deutsche Gold and Silber Scheide Anstalt vorm. Roessler): Manf. of sodium cyanide. 9481 Tuchler: Brakes for the steering wheels of vehicles. [Date applied for under International Convention, April 19th, 1909.] 9650 Flintoff: Means for balancing window sashes. 9779 Rosenberg: Apparatus for drying varnished articles. [Application for Patent of Addition to 26778, 1909.] 9817. *See* 24330, 1909. 9849 Sprott: Acetylene generators. 9969 Habermann: Superheater for tubular boilers. [Date applied for under International Convention, April 23rd, 1909.] 10090 Gross and Gross: Driving adjuncts of tang-driven tools. 10136 Gray: Method of and means for packing articles in postal tubes. 10137 Meiklejohn: Single and double action swing and other doors. 10185 Metfler, and Allgemeine Maschinen and Apparate Ges.: Device for measuring lengths and for effecting a correct measuring of stretchable materials. 10205 Emer: Safes having coin-operated locks. [Date applied for under International Convention, April 26th, 1909.] 10229 Petsche: Method of and apparatus for separating pulp fibres from pigments and other impurities such as are present in waste papers. 10522 Pillionnel and Cherpit: Snow plough. 10528 Voss: Windlass for cranes. [Date applied for under International Convention, July 23rd, 1909.] 10759 Miller: Rope drums. [Application for Patent of Addition to 5903, 1909.] 10855 Williams, Williams, and Hawken: Dies and punches for cutting metal sash bars. 10858 Williams, Williams, and Hawken: Tools for cutting slots in metal sash bars. 10894 Bolle (Akt.-Ges. der Maschinenfabrikation Escher, Wyss, et Cie.: Vanes of steam and gas turbines, turbo-compressors, and the like. 10916 Boult (Soc. A. Demond et Cie.): Bracelets or the like. 10930 Kent and Lacell: Production of silica glass. 10973 Troupenat: Guards for circular saws. [Date applied for under International Convention, August 7th, 1909.] 11028 Langhaar: Bearings. 11049 Houdaille: Shock-absorbing devices. [Date applied for under International Convention, October 12th, 1909. Application for Patent of Addition to 9193, 1910.] 11056 Landau and Co., and Kreidl: Loading of silk. [Date applied for under International Convention, June 15th, 1909.]

11121 Challen: Power presses.

This invention relates to power presses such as are employed in the production of coins or for services necessitating the imposition by the press of an intense pressure upon the dies or operating tools. The invention comprises the provision with the toggle members, knuckle blocks, or similar parts of the press between which relative movements occur whilst such parts are exerting or transmitting the maximum pressure aforesaid, of means for circulating water therethrough for the dissipation of the heat generated by such relative movements under the pressure. The water-circulating means may be conveniently circulated by means of a water tank mounted upon or above the press. From such tank the water is drawn by a belt-driven circulating pump of any suitable

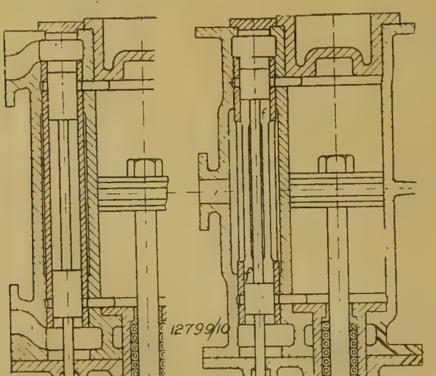


type forced through the knuckle blocks or like elements and returned to the tank from whence it is again drawn by the pump. The connections between the pump and the parts to be cooled by the circulating water comprise flexible pipes, or pipes or conduits so arranged as to automatically adjust themselves to the reciprocatory movements of the press parts. The union of the pipes or conduits with the press parts to be cooled can be conveniently effected by cup-like attachments forming the lower terminals of the pipes and adapted to be bolted or otherwise secured to the press parts. Those parts are provided with suitable through way passages to permit of the circulation of the water.

11143 Meyer and Klein: Drill sockets. 11152 Bale: Adjustable holder for chalk and other marking substances. 11456 Kochling: Turnover moulding machine for the manf. of kitchen basins and the like with a high rear wall. 11506 Agsten: Trailer attachments for motor vehicles. 11561 Ralston: Apparatus for graphically ascertaining the stability and trim of ships under assumed loads. 11581 Heimann and Schaffer: Method of working arc lamps in series with incandescent lamps. [Date applied for under International Convention, August 2nd, 1909. Application for Patent of Addition to 747, 1910.] 11674 Hare: Conveyers for coal mines. [Application for Patent of Addition to 28570, 1909.] 11720 Thomson and FitzGerald: Rotary furnaces. [Date applied for under International Convention, May 13th, 1909.] 11961 Harrow: Multi-piston motors. 12046 Finlay: Manf. of beer, stout, and the like. 12061 Floch and Kohler: Roller skates. 12115 Harrap: Oil filters. 12164 Cooper: Airships for military use. 12229 Kaiser: Process of oxidising nitrogen by means of electric discharges. [Date applied for under International Convention, May 19th, 1909.] 12336 Kuhnigk: Device for filing letters and documents. 12441 Frahm: Means for damping the rolling motion of ships. 12489 Dey: Electric switches. [Date applied for under Rule 13, October 21st, 1909.] 12490 Dey: Electric switches. [Date applied for under Rule 13, October 21st, 1909.] 12523 Clark, Heinecke, and Winter-Irving: Cover for pneumatic tyres and method of manufacturing the same. 12581 Schneible: Preparation of brewers' mash and wort. 12640 Carver: Trivets for use in connection with firegrates. 12646 Bell and Dahl: Resilient tyres for wheels. [Date applied for under Rule 13, December 13th, 1909.]

12799 Jacobsen and Livens: Steam engine cylinders.

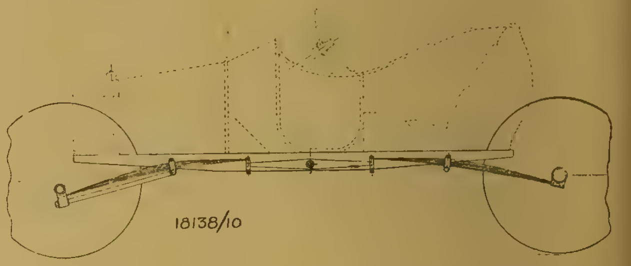
This invention relates to single or double-acting cylinders of reciprocating steam engines of the type in which the steam enters the cylinder, moves the piston, and is exhausted on the return stroke of same. The invention comprises two or more piston valves distributing the steam arranged as near as possible to the working barrel, leaving only the thickness of cylinder wall plus the thickness of piston valve bush between piston valve and engine piston, one or more of the piston valves being used for the inlet and outlet of steam, and one or more for the outlet of steam only, in such a manner that the clearance space is reduced, the radiating surface kept small, and the point of commencement of compression can be changed by altering the angle of advance of the eccentric actuating the outlet valve or valves.



12854 Sandganger: Roofing for buildings. 12913 Wood: Brushes, brooms, and the like. 13119. *See* 25116, 1909. 13162 Beers: Lock washers. 13384 Holterhoff: Manure-distributing machines. 13456 Kaye: Locking door and like latches. 13482 Brenner: Sanitary petticoat. [Date applied for under International Convention, June 29th, 1909.] 13564 Gillon: Platforms or stands for cinematographic apparatus. 13610 Hawes: Spectacle frames. 13729 Rolar and Stein: Roundabouts. 13765 Siemens and Halske Akt.-Ges.: Operating appliance for photographing and examining by means of Rontgen rays. [Date applied for under International Convention, June 19th, 1909.] 13819 Rowley and Coomber: Process and apparatus for vulcanising automobile and other vehicle tyres. 13933 Longstaff: Milk churns. 13979 Broome: Engineers' and like squares. 14102 Singh: Desks and other articles of furniture. 14241 Cowen and Laing: Composition for making knife handles, insulating materials, and other articles. 14270 Newton (R. Hoe and Co.): Folding delivery mechanism for printing machines. 14337 Sweeney: Fastening device for securing covers to milk cans and the like. 14454 Duckett (Duckett and Duckett): Shuttle-checking appliances of looms for weaving. 14599 Knapp: Acetylene-generating apparatus. 14642 Hipkins and Burrows: Automatic weighing apparatus. 14802 Rosenstock: Feeding devices for liquids. 15148 Thorbecke: Cigar wrapper. 15216 Fried. Krupp Akt.-Ges. Germaniawerft: Piston-cooling devices for internal-combustion engines. [Date applied for under International Convention, November 22nd, 1909.] 15507 Beck: Pyrophoric metal alloys. [Date applied for under International Convention, July 1st, 1909. Application for Patent of Addition to 2876, 1910.] 15734 Montagna: Telegraphic and telephonic transmission of pictures. [Date applied for under International Convention, November 6th, 1909.] 15753 Allgemeine Elektricitats Ges.: Dynamo electric machines. [Date applied for under International Convention, July 1st, 1909.] 15754 Allgemeine Elektricitats Ges.: Systems of and apparatus for exhausting air and gases. [Date applied for under International Convention, July 1st, 1909.] 15815 Trepagne and Conti: Mechanical race game. [Date applied for under International Convention, July 15th, 1909.] 16133 Walbrunn: Combined braking and fuel-controlling device for motor cars and the like vehicles. 16348 Doherr: Clothes hangers. 16351 Plesch: Gullies. [Date applied for under International Convention, August 2nd, 1909.] 16475 Sorg: Printing machines. [Date applied for under International Convention, July 12th, 1909.] 16601 Entwistle and Kenyon Ltd., and Shorrock: Carpet sweepers. 16713 Fanning: Propelling means for vessels. [Date applied for under International Convention, July 26th, 1909.] 16975 Barker and Rippingille: Pipe fillers or chargers for use with tobacco cartridges. 17012 Rumpler: Letter sheets. [Date applied for under International Convention, April 2nd, 1910.] 17253 Mery: Controlling devices for the change-speed and reversing mechanism of automobiles. [Date applied for under International Convention, July 24th, 1909.] 17256 Ransomes, Sims, and Jefferies Ltd., and Garrard: Side delivery rakes. 17651 Greer: Nut locks. 17707 McDonald: Steering gear of motor vehicles and the like. 17724 Gammon: Resilient wheel. 17729 Staudinger: Road wheels for motor ploughs and the like.

18138 Crossley and Reeves: Auto-motor road vehicles.

This invention refers to auto-motor road vehicles, and consists essentially of a balancing or compensating lever at each side of the chassis pivoted at or about mid-length to the body frame and having its ends coupled to the inner ends of inverted plate or leaf springs, each carried at mid-length in a pivoted bracket and at its outer ends free to slide in clips or guides carried by the front and rear axles in conjunction with any suitable known arrangement of radius rods.



18303 Tyer: Apparatus for controlling the traffic on single-line railways. 18531 Meisser: Press buttons. 18542 Friedberger: Open-working embroidery. [Date applied for under International Convention, October 5th, 1909.] 18618 Temple: Means for suspending stockings and socks in wear. [Application for Patent of Addition to 18667, 1909. Date applied for under Rule 13, February 14th, 1910.] 18702 Firm Wolf, Netter, and Jacobi: Device for fixing shelves which are adjustable in height. [Date applied for under International Convention, August 7th, 1909.] 18853 Kanzler Schreibmaschinen Akt.-Ges.: Carriage feed mechanism for typewriters. [Date applied for under International Convention, August 10th, 1909.] 18978 Cochrane: Wound-cored golf balls. 19175 Patschke: Internal-combustion gas turbine. [Date applied for under International Convention, August 14th, 1909.] 19233 Sonntag and Sonntag: Process for enamelling metal. 19319 Stevens: Buckles and the like. [Date applied for under International Convention, August 20th, 1909.] 19399 Fried. Krupp Akt.-Ges.: Percussion fuses for projectiles. [Date applied for under International Convention, January 14th, 1910.] 19498 Schulhofer: Waistcoats. [Date applied for under International Convention, August 20th, 1909.] 19547 Garwood: Devices for cutting and trimming plants. [Date applied for under International Convention, August 26th, 1909.] 19613 Hall and Illius: Lubrication of internal-combustion engines. 20144 Koppers: Apparatus for levelling the charge in ovens for manufacturing gas and coke. [Date applied for under International Convention, September 30th, 1909.] 20345 Liebermann: Carriage jacks. 20364 Lafleur: Nut locks. [Date applied for under International Convention, September 22nd, 1909.] 21186 Clark: Shaving mugs and the like. [Application for Patent of Addition to 7914, 1910.] 21190 Partridge: Refrigerators or cold storage chambers. 21315 Soc. Thorrand Durandy et Cie.: Preparation of cement. [Date applied for under International Convention, October 15th, 1909.] 22330 Fairweather (Underwood Typewriter Co.): Money boxes of coin-freed apparatus. [Date applied for under Rule 13, October 26th, 1909.]

COMPLETE SPECIFICATIONS OPEN TO PUBLIC INSPECTION BEFORE ACCEPTANCE, UNDER THE PATENTS ACT, 1907.

1910.

5264 Henning Flodin and Co.: Method of treating material in so-called tangential furnaces and apparatus therefor. 9633 Farbwerke vorm. Meister, Lucius, and Bruning: Manf. of yellow monoazo dyestuffs. 10941 Thiele: Ticket holder or label carrier for cloth or the like. 10969 Herrburger: Repetition mechanism in pianos and like instruments. 11177 Cassereau: Preparation of coffee. 11492 Dixon and Lawrence: Aerating machine. 11508 Lotzkat: Bayonet lock for the upper part of vacuum bottles and the like. 12660 Hiltruper Terrazzo und Cement-Waaren Werke Akt.-Ges.: Method of sinking shafts in loose and watery strata. 13395 Plant: Ironing and dressing jacks for boots and shoes. 17089 Pawlikowski: Finishing machines for the treatment of quantities of materials in different fluids. 17784 Pemberton: Apparatus for making tapering plastic forms. 18661 De Marcay and Moonen: Aeroplanes and other machines. 18678 Viette: System of control and apparatus for indicating electric calls. 21297 Hamilton: Valve gears for power hammers. 21833 Felten and Guilleaume-Lahmeyerwerke Akt.-Ges.: Winches or the like. 21857 Greenway and Lavers: Concentration of ores. 22212 Farman: Devices for preventing damage to and stopping aeroplanes on coming to ground. 22263 Mannesmannrohren-Werke: Apparatus for perforating and rolling tubes. 22576 Blondel: Rapid photographic record of curves, oscillographs, rheographs, and the like. 22949 Blanchard: Trial frames for bi-focal glasses. 22950 Langlois: Means for stoppering bottles containing gaseous beverages and for delivering liquid from such bottles. 23058 Ives: Trichromatic photographic apparatus. 23458 Schubert and Salzer Maschinenfabrik Akt.-Ges.: Combing machines. 23560 Turlur: Compound buckets for centrifugal ventilators. 23662 Braasch: Process for improving inferior pressed yeast. 23671 Peterson: Manf. of insulating material. 23746 Forssell: Pontoon bridges with submerged pontoons. 23820 Brock: Machines and substances used in the manf. of boots and shoes. 23835 Molinder: Moulds for casting tubes and the like. 23923 Akt.-Ges. fur Anilin Fabrikation: Manf. of sulphuryl chloride. 23924 Akt.-Ges. fur Anilin Fabrikation: Manf. of acetic anhydride. 23927 Tomischka: Firearms. 23938 Geb. Korting Akt.-Ges.: Water-feed injectors. 23994 Kuttner and Lubecius: Veneer presses. 23996 Quinlivan: Motor cars and other like self-propelled vehicles. 24001 Tesla: Fuid propulsion. 24012 Stanbrough:

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The Patent covers an invention interesting to manufacturers of Shafts for Motor Propelled Vehicles and Makers of Machine or Hand Made Tools.

Detailed information as to the invention will be found in the Patent Specification, of which a copy will be supplied to any interested party on request.

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HERESY.

THE British manufacturer is constantly being blamed for sticking to his old-fashioned machinery in the face of new methods which claim to reduce the cost of production, this attitude being condemned with great vehemence by those interested in the manufacture and sale of electrical appliances. Other countries are held up as examples of the blessings following the employment of electric current, our backwardness in comparison being cited as a sign of decadence.

The impartial observer who comes in contact with the culprits in question will find that, taken as a whole, they know their business remarkably well, and that they are quite willing to adopt new machines or processes, provided that reliable evidence is forthcoming to prove their efficacy. No one can blame the machinery user for demanding independent and convincing testimony regarding the claims put forward for plant upon which he is asked to spend his money. He cannot be expected to experiment for the benefit of the machinery maker who ought to have proved the value of his appliances before placing them on the market; not only to his own satisfaction, but to that of some independent authority.

The evidence of the inventor or maker alone is not sufficient to inspire confidence, unfortunate users having been deceived so often by biased testimony of this nature that they rightly demand more reliable proof.

Now there are two ways in which confidence may be inspired—firstly, by independent expert evidence from an unimpeachable authority; secondly, by agreeing to allow payment to depend upon results. Difficulties have to be overcome in either case. With the exception of the National Physical Laboratory, the Royal Agricultural Society, and a few private experts, unbiased evidence is not easily obtained whilst deferred payment for costly plant means financial support—varying in degree with the magnitude of the work.

After certain machinery has been adopted by a number of firms of repute no further evidence should be needed regarding its efficiency, and payment can be demanded on the usual terms. On the other hand, the introduction of new processes involving expensive apparatus always includes deferred payment based upon results, and the lack of the financial support demanded by these conditions is one reason why improved methods are so slowly adopted in this country.

The prospective buyer of new machinery is often condemned for asking "what it will cost," instead of—or as well as—"what it will save"; and there is no doubt that were the latter question considered alone—regardless of capital charges—business propects in the electrical industry would be vastly improved. Electrical enthusiasts are apt to forget the difference—from a commercial point of view—between the adoption of electric power in a new factory and in an old one, and when the owner of the latter prefers to continue using his existing means of transmission he is held up as an example of pig-headed obstinacy and ignorance.

Yet a number of factories exist in which mechanical drives are so well laid out and efficient, and the work so continuous, that no saving could possibly follow the introduction of electric motors when capital charges are duly allowed for. The question of revising the means of transmission is a very different one to that of scrapping old machines engaged upon actual production. In the latter case the output is always so much increased or the labour so greatly reduced as to far more than cover the capital charges; in fact, unless this were so, no change would be made.

Electric transmission, on the other hand, has absolutely no effect upon output excepting where great evenness of turning allows of a higher speed than could otherwise be permitted; but this feature is confined to one or two industries, and it can only be achieved by direct coupling a separate motor to each machine.

If it be proposed merely to drive well laid out shafting by electric motors in place of ropes or belts, together with the installation of expensive generating plant, the cost of fuel will, in all probability, be actually higher than it was before, whilst the running costs must be greatly increased by heavy charges for interest and depreciation on the capital outlay.

Where current can be purchased from an outside source of supply at a low price, "motoring" the shafting of an old factory may be commercially successful, but the price must be very low to compete with a private power station if the demand be considerable. The figure charged by the smaller corporations and companies—usually about 1½d. a unit—being quite out of court in competition with moderate sized gas plant.

A new factory is altogether a different problem, and electric transmission has now demonstrated its superiority over other methods excepting for running inter-dependent machinery; but to be successful a separate motor to each machine is essential, as if line shafts are retained, extra power is consumed in driving them, the machines cannot be so advantageously placed, and the building has to be greatly strengthened to support the shaft hangers.

That some other countries are ahead of us regarding the use made of electricity cannot be disputed, but the blame for this state of things rests mainly with the suppliers, who charge an exorbitant price for energy. Where the large power companies are supplying electricity at a reasonable figure, its adoption is rapidly becoming universal, showing that the user is quite willing to revise his methods when the saving can be demonstrated.

As regards the smaller town supplies, it will probably be many years before the price is low enough to compete with private power plants, so that even if electric transmission be adopted current will be privately generated instead of being bought out.

As illustrating this contention, mention may be made of a proposal to motor the shafting in a factory requiring nearly 100 H.P. for ten hours a day, the existing source of power being a gas engine using town's gas. This proposition was made by a corporation electrical engineer, and his estimate of the cost of the current alone was 50 per cent more than the annual gas bill, the heavy capital charges being discreetly ignored. In this case even-turning was of no consequence, and if the output was to be increased, it could only be done by augmenting the speed. Naturally, the electric proposition was rejected in favour of a more powerful gas engine and larger driving pulleys.

The machines were all independent, and if a new factory had been contemplated a motor to each machine would undoubtedly have been the best solution, but even then current would have been generated privately in preference to buying it from the corporation at 1½d. a unit.

This example may be profitably contrasted with another in a district served by a large power company, but where no advantage obtains as regards the price of coal.

In this case, a maximum of 45 H.P. was required, but the average load did not exceed 15 H.P. for 10 hours a day. Here a town gas engine has been rightly replaced by electric motors, the latter being coupled to the shafting, as the machinery consists of inter-dependent groups. The price charged for current in spite of the poor load factor is only ⅝d. per unit, and a substantial saving has resulted after making ample allowance for capital charges.

If any lack of enterprise in electrical development exists in this country it must be looked for in the supply department, not amongst the users and makers of electrical apparatus. In districts where the demands for power outside of the towns are too meagre to induce the establishment of power companies, no relief can be expected, and a recent enactment has prohibited competing supply undertakings in the towns themselves.

No doubt the price will tend to decrease even under corporation control, but the process must be a slow one, as, until existing loans for extravagant capital expenditure are paid off and new modern machinery can be installed, the charges will necessarily remain high.

COMBINATION OF MALLET AND "PRAIRIE," TYPE ENGINES.—The *Railway News* states that the Chicago Great Western Railway has recently built a Mallet articulated compound engine, using one of its F—3, or "Prairie" type, 2—6—2, for the rear or high-pressure unit of the combination. The front unit was built by the Baldwin Locomotive Works, the details being made, as far as practicable, interchangeable with those of the rear section. The boiler extension forms a feed water heater, and the tender is fitted with an 8,000 gallon tank. According to reports, the converted engine is showing a considerable degree of economy, and greatly increased power, consequently it is probable that other conversions of a like nature will be made, particularly as the company's business is now making increased demands upon the mechanical department.

Norwich Electric Tramways.—According to the *Building News* over 470 yards of the double track of the Norwich electric tramways, from Orford Place to the War Memorial, which has been in progress for the last six weeks, has been finished. The joints used are the cast-welded type, and the roadway has been raised and drained. The designs for the work are by the consulting engineer, Mr. Wilmslow, of London, and the work has been carried out by the officials of the company.

The Pan-American Railway Scheme.—The British Minister at Buenos Ayres reports that the Pan-American Conference at that place has unanimously adopted a resolution to the effect that the construction of the Pan-American Railway should be left in the hands of the Pan-American Railway Committee at Washington, which should be recommended to prepare a definite plan in order that the railway may be completed at the earliest possible date. The total length of the projected railway—from New York to Buenos Ayres—is estimated at 10,116 miles. The length of line from New York to Mexico City already constructed is 3,026 miles, and from Mexico City to the northern frontier of Guatemala (also constructed) 843 miles. From this point to the Panama Canal zone the distance is 1,183 miles, of which 675 miles of line remain to be built. From the canal zone to Buenos Ayres the distance is 5,064 miles, of which it is said that 2,067 miles by rail and water are open to traffic, while 2,997 miles are in course of construction or projected. Thus it appears that of the total distance of the railway 6,444 miles are open to traffic and 3,672 miles are in course of construction or projected. Deducting from the amount open to traffic such sections as are at present only open to traffic by water, 3,700 miles of railway remain uncompleted.

The *Feuille Fédérale Suisse* contains the text of the budget of the Swiss Federal Railways for 1911. The sum provided for construction work during the year is 29,448,800 fr. (about £1,178,000); this includes work on the second gallery of the Simplon tunnel, 2,000,000 fr.; the Ricken railway, £300,000 fr.; the Lake Brienz railway, 1,000,000 fr.; doubling the track on long stretches of the existing lines; and important extension work on various stations. For the acquisition of rolling stock a sum of 6,657,550 fr. (about £266,000) is provided, including 2,401,000 fr. for 29 locomotives, 3,122,050 fr. for 121 passenger carriages, 917,500 fr. for 170 goods wagons, etc.—*Board of Trade Journal.*

Acetylene Gas as an Illuminant.—Acetylene gas is largely used as an illuminant in country houses, its simplicity of generation being a great recommendation. Acetylene generators are of two types. In the first the water rises on to the carbide and generates gas until there is more than is demanded, when the pressure of gas forces the water down and stops generation; in the second type the carbide is carried in a wire tray in the interior of the usual water-sealed gasometer, and as the gas accumulates it raises the holder and carries the tray out of the water. The apparatus is simple, and can be attended to by an intelligent boy. Acetylene gives a bright and smokeless light, a flame equal in area to a shilling piece giving an illumination of 20 to 25 candle power. The flame is so bright that globes and shades have always to be used. For country houses acetylene has the advantages of being simple to make, the output is copious from a small apparatus, and the light is brilliant. On the other hand, the gas is very poisonous, and has a very unpleasant odour, so that perfectly tight gas fittings are essential. Carbide is also dangerous to keep, unless it is absolutely dry. Acetylene gas can be produced at a low cost, one ton of carbide at £20 producing 11,000 cubic feet of gas, thus the cost per 1,000 cubic feet is £1 16s. 4d.

STEAM ENGINE DESIGN.—XXXI.

(*Continued from page 670.*)

In various parts of the preceding articles reference has been made to sundry auxiliary plants, and as some of these form an almost integral part of the steam engine, it will be the purpose of this article to describe and to connect them in their proper order in relation to the main engines. Firstly, with a condensing engine, whether stationary or on ship, the type and arrangement of many of the auxiliaries depends on the condenser, and if, in addition, a feed heater be installed, the complication is increased, but when the engine is non-condensing and only the heater is fitted, as it is often profitable to do, the arrangement is much simpler.

There will be no need to go into the question of the condensing plant itself—the usual forms have already been described in Articles XXIII. to XXVI. At the end of Article XXI. attention was directed to the necessity of the provision of grease extractors when superheated steam is used, although with saturated steam they are often advisable. There are three leading systems of removing the oil: (1) by extracting the oil before it reaches the condenser, (2) by filtering the feed water mechanically, and (3) by filtration with chemicals.

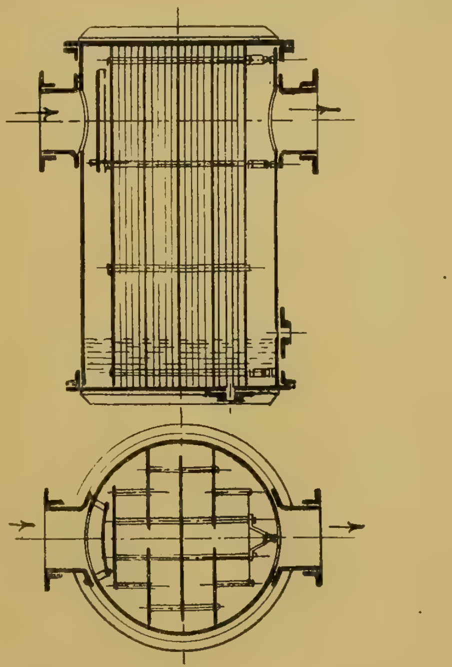

Fig. 166.

When the steam has to pass through or round tubes, as with surface condensers or tubular feed heaters, there can be no doubt that when possible the correct method is the extraction of the oil directly it leaves the cylinder, *i.e.*, by the first method. An extractor made by Messrs. Holden and Brooke Ltd., of Manchester, which has met with considerable success, is shown in fig. 166. The principle on which this and other types are designed is to split the steam up and to cause every particle of it to impinge against cooler metal sheets, in such a way that the oil is caught, dissociated, and deposited. From the sectional views it will be seen that the steam is led between the walls of a number of vertical passages in parallel. The total area of these passages is in all cases sufficient for the passage, without back pressure, of the total volume of steam for which the apparatus is designed. These walls, which form the depositing surfaces, and which are provided at frequent intervals with vertical channels to catch and lead the water and grease downwards to the collecting chamber, are continuous, and consequently also keep the steam under a continuous cleansing process. As a vacuum exists in the separator, a special form of pump must be provided to withdraw the condensed steam and oil. A very compact discharger, by the same makers, is shown in fig. 167, its chief advantages being that it is automatic and requires no external power. Referring to the drawing, the following explanation will illustrate its action. As the discharger fills up the float D rises, gradually lifting the falling weight E until it falls over from one side to the other. This action instantly closes the vacuum connection C and opens the air valve F. The interior of the discharger being now filled with air, the valve A is held tight on to its seat by atmospheric pressure, and the contents of the discharger (*i.e.*, the water and oil) flow freely away by gravity through the outlet valve B.

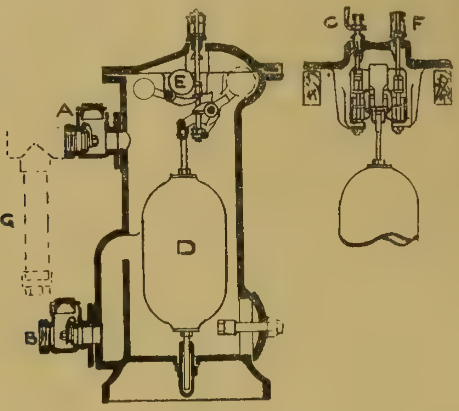

Fig. 167.

As soon as the discharger is empty, the float sinks, and the weight E in consequence falls back to its original position, and, in doing so, closes the valve F and opens the vacuum connection C. The air is then exhausted from the discharger by means of the small pipe from the vacuum connection C to an air pump or main exhaust pipe. The exhausting, however, is performed so gradually that it makes no perceptible difference to the vacuum.

The rate at which the air is exhausted can be regulated by the cock C, but the opening is so small an area that it will generally be found convenient to have the cock full open. As the air is exhausted the valve B is closed by atmospheric pressure, and when the vacuum is again equal to that in the separator, valve A opens and a cycle of operations begins again. When once adjusted the discharger need not be again touched. With the above type of extractor, in practice there is about 75 per cent of the oil removed from the steam. In order to hasten the dissociation of very hot steam, a small cold water jet may be fitted.

While this kind of extractor is quite suitable for stationary engines, it will be recognised when it is stated that for a duty of 10,000 lbs. of steam per hour the size would be about 4 ft. diameter by 7 ft. high, they are too unwieldy for marine use. On ship the almost universal method is that included in class 2. The filter itself is composed of a cast or wrought iron tank provided with a false bottom, on which is fitted a number of concentric perforated metal cylinders, around which is wrapped some filtering medium; the dirty water entering from the outside passes through the filter and thence into the false bottom. Obviously the most successful system will be that which provides the largest time for oil to separate out. Gravitation filters, in which the water passes under its own head from the hotwell to the feed tank, satisfy this condition, but exigences of space and weight, as on light, fast-steaming craft, demand a more compact filter. In this case it is made specially strong, and the feed water forced through, but, of course, owing to its high velocity, the water cannot be thoroughly purified, and, as a middle course between these two extreme methods, the filter is often placed on the air pump discharge.

Filters of the third-class work on similar principles to water softeners, and the chemicals are introduced in the same way. Except to say that they can remove *all* the oil, a full description will not be given, as they hardly come within the range of the present discussion.

After the above explanation it may be taken that by some means of extraction, whichever is most appropriate, the feed water is free from oil, and that various systems of heating it may be described. Feed heaters may be used either in conjunction with condensing or non-condensing engines; they may be heated by either live or exhaust steam. In mercantile marine practice it is usual to fit the ordinary surface condenser to the main engines, but to utilise the auxiliary exhaust to heat the feed water. In this country and, indeed, on the Continent, the "Weir" heater is the most used. So well is it known, that in this article it has been considered unnecessary to illustrate it, but rather to show a somewhat similar one by the Worthington Pump Co. Ltd. Referring to fig. 168, it will be seen that the apparatus is arranged in two sections. In the upper section the exhaust steam and feed water are brought together by means of a spray cone (which is adjustable from the outside), and the heat of the steam is thoroughly absorbed by the feed water. The water then gravitates to the receiver below, where it is allowed to accumulate only in sufficient quantity to operate the float D, which, by means of the levers, rods, etc., controls the steam throttle valve E that supplies steam to the feed pump. This valve is a balanced ("chronometer") valve, and controls the speed of the pump in the most positive manner. The feed water from the hot well tank is pumped up by a "lift pump" into the heater, entering through the feed water inlet C, the water spraying into the dome of the heater. After passing through the spray nozzle, the water is still further atomised by the two perforated baffle plates. The exhaust steam from the auxiliary engines, steam pumps, etc., enters the heater by the steam exhaust inlet A, passing through the automatic check valve, which is provided with a dashpot on its upper side. The amount of "cushion" for this dashpot is adjustable from the outside by means of the hand-wheels shown. The receiver acts as a reservoir, in which the air separates out and is removed through the small air valve F at the top which is connected to the main condenser. The action of the float regulates the speed of the feed pump and prevents it from draining the receiver. The usual practice is to have a branch pipe connecting the heater with the receiver of the low-pressure cylinder of the engine, so that any surplus of exhaust steam from the auxiliaries not condensed by the feed water will pass the engine.

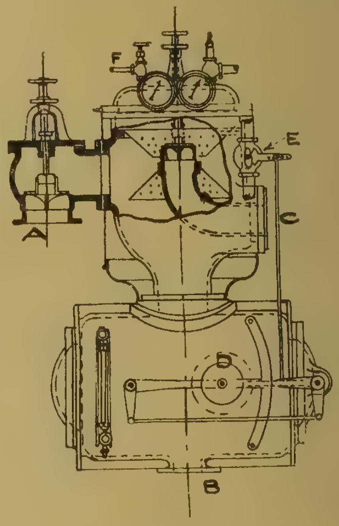

Fig. 168.

From the above description it will be seen that this type of heater entails the provision of an extra feed pump. A good plan is to use a main engine crosshead-driven pump to supply the heater and to use a separate one for the boiler feed, but it must be remembered that since pumps cannot suck very hot water, the heater must be elevated so as to prime the boiler feed pump. Feed heaters are seldom used in naval practice. In many cases on board ship it is inadvisable to fit two sets of pumps. In this case a heater is used like that described below, the steam from the auxiliaries passing through the tubes, which are placed in series with the main feed pump and on the boiler side. The system just mentioned is similar to that used in central stations, except in this case the whole of the exhaust steam from both main and auxiliary engines is passed through the tubes on its way to the condensers. The heater is constructed similarly to the ordinary surface condenser, having a cylindrical body with tube plates at either end, the tubes being expanded in. The apparatus can be placed either horizontally or vertically, as desired. When feed water heaters are connected in series with pumps it is advisable to fit an air vessel and a relief valve; the former acts as a cushion, while the latter, which should be loaded at about 20 per cent higher than the working pressure, protects the heater from damage.

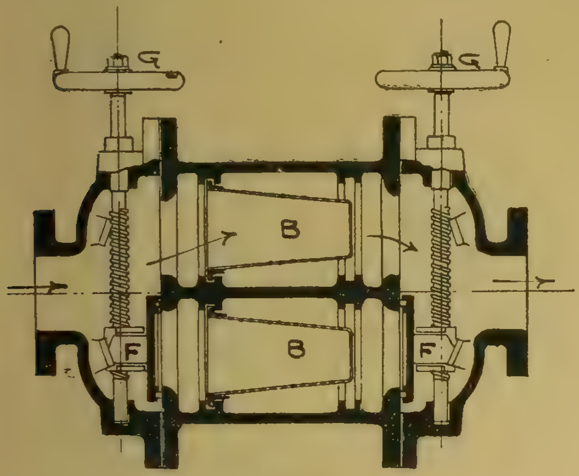

Fig. 169.

Surface condensing plants, when the circulating water is drawn from a dirty source, should have some kind of strainer fitted to the pump suction. In fig. 169 is shown a good arrangement made by Messrs. Royles. The drawing is almost self-explanatory. Water passes in the direction of the arrows through either of the perforated metal strainers B or C, according to the position of the valves F, F, which are controlled by the hand-wheels G, G. By the provision of a suitable cover, the strainer, when not in use, can be withdrawn for cleaning while the other is working. For the bilge suction on ship, a "mud box" on a similar principle is employed.

Steam Traps.

In Article XXI. mention was made of the necessity to fit steam traps to parts of the pipe line, etc., in which condensed water is likely to accumulate; an example of the fitting of traps can be seen in fig. 115. The "Lancaster" trap, made by Messrs. Lancaster and Tonge, of Manchester, represents a most successful type. Referring to fig. 170, the trap consists of a cast-iron box with the copper float E having a hole F in the bottom and a tubular valve N on the top, connected to a screwed spindle S, at the end of which is a loose valve, which is alternately opened and shut by the rising and falling of the float rotating the screwed spindle. The normal position of the trap is with the float at the bottom of the box and the valve full open. As the water to be drained passes through the hollow spindle into the float, the latter is water logged and stays at the bottom until all is discharged, when the steam following enters the float, drives out the water through the tubular valve N, and the float, becoming buoyant, rises and closes the valve. As the steam left in the float condenses, water from the box flows into it, until it falls again and opens the valve, when the same action ensues. So long as the steam or water flows to the trap it continues to work as above described, even if only one pint per hour of condensed water is discharged, unless the rate of condensation is extremely steady, in which case the float tends to set itself in such a position as to discharge the water in a steady stream.

These traps can be arranged to lift the discharge to any height, and as much as 2 ft. per 1 lb. of steam. The following table gives the capacity of traps of this type for 50 lbs. pressure; at higher pressures the discharge would be greater:—

Size of trap.	Discharge in gallons per hour.	Length of 1 in. dia. exposed pipe the trap will drain.
In. ⅜	30	100
¾	70	200 to 300
1	100	300 to 400
1¼	130	400 to 500
1½	200	500 to 600
2	300	800 to 1200

To ascertain the size of trap for pipes of larger diameters: Length in feet × diameter in inches = number of feet of 1 in. diameter pipe.

Auxiliary Machinery Arrangement on Ship.

Following the above descriptions of auxiliary apparatus, the arrangement of the engine room (fig. 171) of a modern twin-screw steamer will be of interest. The main engine and thrust block can be clearly seen; the valve F (type as fig. 114) receives steam along pipe E, to which a separator (type as fig. 116) is fitted just inside the boiler room bulkhead. On the boiler side another valve (type figs. 119 and 120) is arranged in such a way that it can be closed either from on deck or in the boiler room (see description in connection with fig. 121). After traversing the cylinders as indicated, or by any of the ways described in the last article, the steam passes to the fore and aft surface condensers (for details see XXIII. to XXVI.). The water-circulating pumps K are placed at the aft end of the engine room, while the two duplex air pumps N, N (fig. 128) are at the other end, their suction being along the pipe M, and the discharge through the grease extractors (type 2 above) to hotwell Q. As in this instance the feed

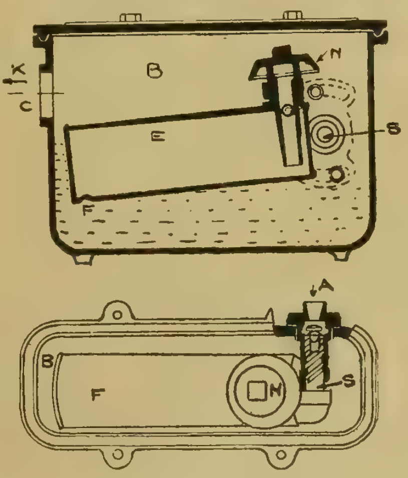

Fig. 170.

tank R was at a much higher level than the hotwell Q, a special pump P (see remarks in connection with surface condenser air pumps, Article XXIV.) was fitted to transfer the water. The other engine room would have a duplicate arrangement, a cross connection pipe being fitted between the various pumps and feed tanks, and the boiler feed pumps would be fitted in such a way that they could suck from either feed tank. Evaporatiors for supplying "make up" feed to the boilers and fresh water to the ship are fitted in duplicate at A, A. They include, beside the evaporator itself, a salt water feed pump, a small distilling condenser, and a circulating pump. Boiler pressure steam is used in the steam coils, the drains being carried to the hotwell. The evaporated steam required for make up is generated at 7 lbs. to 10 lbs. pressure, and can be led to either the L.P. receiver or the condenser. Some pumps are always required for service duties, such as fire, bilge, fresh water, latrine. The number of pumps will depend on the size of the ship, and in many cases the same pump will, by means of suitable direction valve boxes, be made to combine several duties. In the present illustration such pumps are indicated at B, C, and D. On modern naval vessels the auxiliary condenser has been crowded out, but in the mercantile marine, in which there is considerable machinery running when in port, it is generally fitted, the arrangement often being a combination one, after the manner of fig. 127. The electric generating plant nowadays occupies a prominent position of importance on any ship, and, while as far as possible it is located in the engine room, it is usual in warships to provide a special place, and, further, as donkey boilers are not fitted to the vessels, oil engines are preferred, those of the Diesel type being much used. The location of the feed pumps has no settled standard practice; in the merchant service some builders prefer to place all in the main engine room, on small ships driving from the crosshead like the air pump in fig. 126, while others, as in warships, place them in the boiler rooms. On all ships the feed pumps are invariably arranged so that they can feed any boiler, and have cross connected suctions to feed and reserve tanks, while many have a sea suction as well. Ash ejectors require a separate water pump, but these, with fans and blowers, would be in the boiler rooms. Referring to fig. 171 the steering engine is at G.

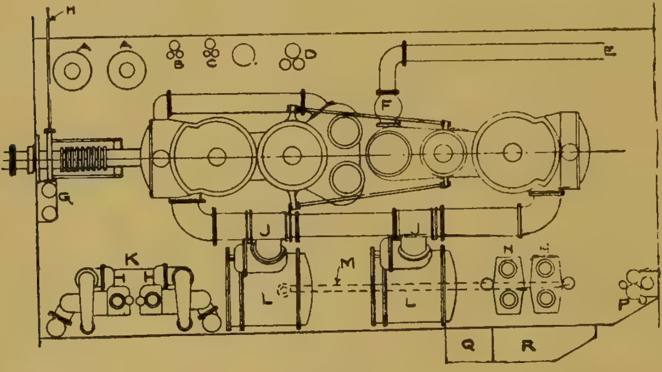

FIG. 171.

While the above example will suffice to indicate the trend of modern marine practice, some concrete cases may be of value.

(1) Cruiser: Collective H.P. = 23,000; two four-cylinder triple-expansion engines — cylinders, H.P. = 43½ in. diameter, I.P. = 69 in. diameter; two L.P. cylinders, each = 77 lbs. diameter; stroke = 42 in.; revolutions = 130 per minute; steam pressure = 210 lbs.; cylinder arrangement as fig. 161*b*; four condensers; 28,000 square feet cooling surface; four centrifugal circulating pumps capable at 125 lbs. steam pressure of delivering 1,400 tons of water from the bilges per hour; four twin air pumps, 31 in. diameter × 16 in. bucket stroke, delivery through grease extractors to the feed tank; four fire and bilge pumps of a total capacity of 500 tons per hour; four evaporators and two distilling condensers, having a capacity of evaporation of 10 tons per hour (at 25 lbs. steam pressure), while the distillers can provide 2½ tons of drinking water per hour. Electric power is provided from the 100-k.w. steam-driven dynamos, and among the machinery driven from these are the ventilating and the 18 boiler draught fans, the ash hoists, and air compressors. The boilers are water-tube type, and have heating and grate surfaces of 60,000 and 1,800 square feet respectively.

(2) Passenger steamer: Two three-cylinder triple-expansion engines, 6,000 I.H.P.; H.P. = 25 in. diameter, I.P. = 25 in. diameter, L.P. = 70 in. diameter; stroke = 48 in.; steam pressure = 200 lbs.; two main condensers, total 6,300 square feet cooling surface; two 15 in. diameter centrifugal pumps; from each L.P. crosshead (as in fig. 126) is driven one air pump 25 in. diameter, two bilge pumps 4½ in. diameter, two feed pumps 4½ in. diameter, all, of course, having the same stroke, viz., 24 in. There is also a small auxiliary condenser with air and circulating pumps; one donkey pump 6 in. diameter × 9 in. stroke; one ballast pump, 13½ in diameter × 10½ in. stroke; one fresh water pump 2 in. diameter × by 6 in. stroke; one 8 in. diameter × 10 in. stroke ash ejector pump. The feed water is heated by a Weir feed heater, a 10 in. diameter × 24 in. diameter pump being provided. There is one evaporator, capacity 40 tons per day, while the distiller can give 7,000 gallons of pure water in the same time.

In the above descriptions the size of the water ends of the pumps has been given, as the steam piston diameter is hardly of interest.

(*To be continued.*)

NOTICES OF MEETINGS, &c.

December 9th.—COVENTRY ENGINEERING SOCIETY. A paper will be read on "Case Hardening," by David Flather, Esq.

GLASGOW LOCAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS. Meeting of the Students' Section at the Glasgow Technical College, at 8 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS. The institute dinner will be held in the Great Hall, Armstrong College, Newcastle-upon-Tyne, at 7-15 p.m.

December 9th and 10th. — THE ASSOCIATION OF WATER ENGINEERS. Fifteenth winter meeting to be held at the Apartments of the Geological Society, Burlington House, W. The proceedings will commence on Friday at 2 p.m., and on Saturday at 10-30 a.m. The following papers are to be read and discussed: (1) "Guaging and Recording the Flow of Streams," by S. C. Chapman, A.M.Inst.C.E.; (2) "The Advantages of Co-operation in Rural Water Supplies," by F. Graham Fairbank, M.Inst.C.E.; (3) "The Eliminating Effect of Chlorine on the Bacteria of a River Water," by Leslie C. Walker, A.M.I.M.E.

December 10th.—NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS. General meeting at 2 p.m.

THE MANCHESTER ASSOCIATION OF ENGINEERS. Quarterly meeting. Election of members. A paper on "Motor Cars" will be read by Mr. J. L. Milligan, B.Sc., Coventry.

THE BRITISH FOUNDRYMEN'S ASSOCIATION. BIRMINGHAM BRANCH: Meeting will be held at the Technical School, Suffolk Street, Birmingham, at 7 p.m. There will be a general discussion on "Foundry Difficulties."

THE BRITISH FOUNDRYMEN'S ASSOCIATION. SCOTTISH BRANCH: Meeting to be held in the Technical College, George Street, Glasgow, at 4 p.m. A paper will be read on "Foundry Iron," by J. F. P. Lewis, Esq.

STEAM TURBINES REPLACED BY GAS ENGINES.—It is reported that two large 3,200 B.H.P. Nürnberg engines to be run on coke oven gas have been ordered for the generation of electricity at the Müke coal mines of Mitsui and Co., in Japan. The steam turbines formerly employed on this duty will, it is said, be retained as reserve units.

AN IMPROVED METHOD OF GEARING FOR TURBINES.

The improvements described below relate to turbine systems in which gearing is used to connect the various turbines between themselves or to common transmission means. It has already been proposed to divide the steam expansion over a number of turbine parts arranged on separate shafts to run at different speeds suited for their maximum efficiency, the several shafts being coupled either electrically or mechanically. The present object is to provide improved turbine systems of this type suitable for marine propulsion, and the improvements are the invention of the Honourable Charles Algernon Parsons, C.B., of Heaton Works, Newcastle-on-Tyne.

Our illustrations show diagrammatically in fig. 1 a plan of an illustration with single reduction; fig. 2 a similar arrangement with a cruising turbine partly of impulse and partly of reaction type; fig. 3 a similar arrangement, but with double reduction for cruising turbine; fig. 4 a four-shaft installation; fig. 5 a single-shaft arrangement with double reduction, and fig. 6 a three-shaft arrangement.

The improvements consist firstly in providing a marine propulsion system of differently speeded turbines driving a common shaft in which the main ahead and astern turbines are arranged direct on the propeller shafts or geared thereto by a single or double reduction gear, while the cruising turbines are similarly singly or doubly geared to the propeller shaft. The improvement is equally applicable to turbines of the Parsons impulse or mixed Parsons and impulse type, as by means of single or double reducing gear such turbines or turbine parts can be run at their most economical speed. Further, the turbine elements on one or more shafts may be cross coupled or bye-passed in whole or in part, and, if desired, clutches may be used to disconnect the cruising or astern turbines at high speeds or when not in operation. Secondly, in the improved arrangements of marine turbine systems hereinafter indicated, the words "turbine system" being understood to mean a number of turbines which are connected to a common shaft or other power transmission means, and not to include the whole of the turbine power installation driving the ship when more than one propeller shaft is employed.

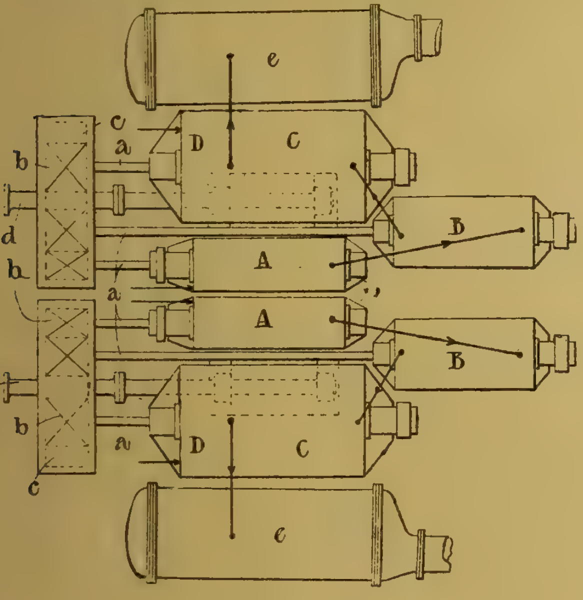

FIG. 1.

The pressure drop of the working fluid is so arranged that it will be distributed in a known manner over a number of turbines, for instance, as shown in fig. 1, over one high-pressure turbine A, one intermediate-pressure turbine B, and one low-pressure turbine C, the arrangement showing two such sets of turbines. Each turbine is mounted on a separate shaft *a*, each of which carries a pinion *b*, gearing with a large wheel *c*, which is mounted on the propeller shaft *d*. A condenser *e* is also provided for each set of turbines, and an astern turbine D is shown incorporated in the same casing with the low-pressure turbine C. In previous arrangements separate turbines had to be designed according to the speed at which they were required to run, and the best form of blading suitably modified for the speed, whilst this arangement admits of a turbine being designed with reference only to the most efficient form of blading, and to run them at their most economical speed, independent of the speed of the common shafts which they drive.

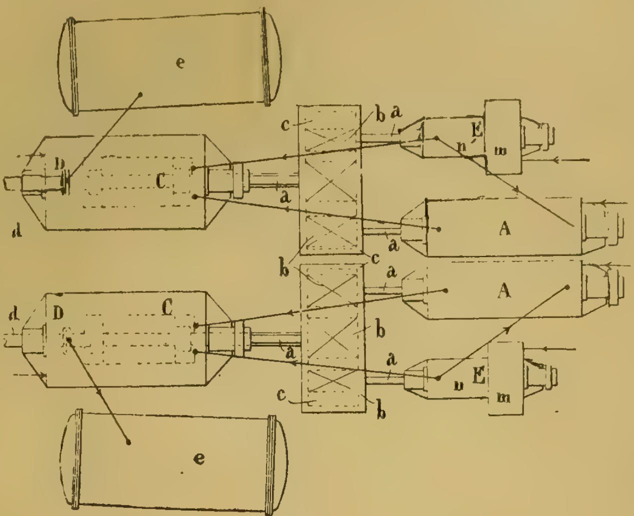

FIG. 2.

The three turbines A, B, and C may be grouped to drive the wheels *c* in any desired manner. In fig. 1 the two high-pressure turbines are arranged side by side, with the low-pressure turbines C on either side, beyond which is placed a condenser *e*. The intermediate-pressure turbines B are arranged forward of the other turbines in a position intermediate between them. The turbines can, however, be grouped in any other suitable manner.

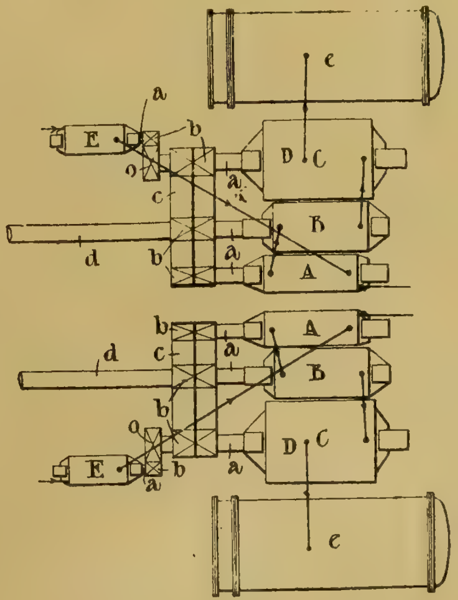

FIG. 3.

Another arrangement is shown in fig. 2, which represents a two-shaft installation, the turbines driving one shaft being a high-pressure turbine A and a low-pressure turbine C, and a cruising turbine E. Each turbine carries on its shaft *a* a pinion *b* gearing with a large wheel *c* on the propeller shaft *d*. For full power the steam is admitted in parallel to the high-pressure turbines A, from which it passes to the low-pressure turbines C, and from thence to the condensers *e* in the usual manner.

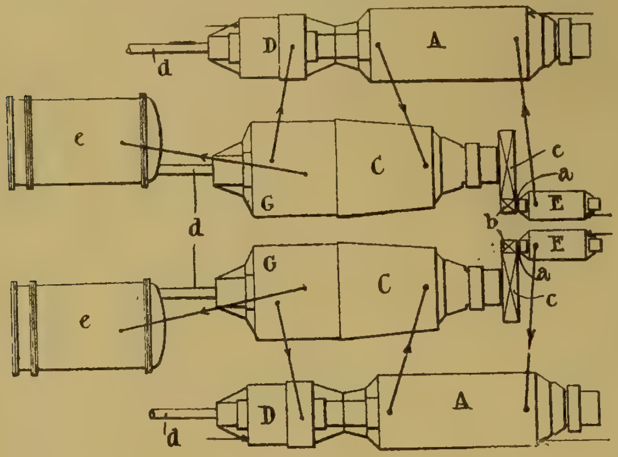

Fig. 4.

Under these conditions the cruising turbines would not be receiving steam, and are preferably connected to the condenser so as to run in vacuum. A suitable clutch may be arranged to disconnect the cruising turbine when not receiving steam, so that it is entirely disconnected, and is not rotated by the other turbines. If desired, however, steam may be admitted to the cruising turbine simultaneously with admission to the high-pressure turbine A, both turbines exhausting into the low-pressure turbine C. As shown in these figures, the crusing turbine is represented as having an impulse part *m* and a reaction part *n*. It may be, however, entirely impulse or entirely reaction type. The turbines may be, of course, grouped in any other suitable manner than that shown in these figures.

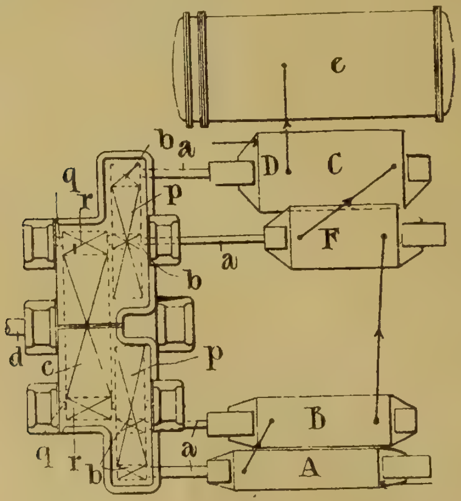

Fig. 5.

In some cases a high-pressure turbine A may also be of the mixed impulse and reaction type, or entirely impulse or entirely reaction. The impulse part, if any, of the cruising and high-pressure turbines are preferably provided with regulating valves to reduce the admission of steam at low powers. This arrangement can, of course, be applied to installations having any number of shafts, and is not in any way limited to the two-shaft installation shown.

In some cases, however, in order to allow the separate turbines to be run at their most economical speed, a larger ratio of reduction than can be conveniently provided by a single gear is required. It is then desirable to arrange that some or all of the turbines shall drive the propeller shaft through a double reduction. This is particularly applicable to cruising and to high-pressure turbines, and an arrangement in which a cruising turbine thus drives the propeller shaft through a double reduction is shown in fig. 3. This figure shows a two-shaft installation, the turbines driving each shaft being a high-pressure turbine A, an intermediate-pressure turbine B, and a low-pressure turbine C. Each of these turbines carries on its shaft *a* a pinion *b*, engaging with a large wheel *c* on the propeller shaft *d*. The cruising turbine E also carries on its shaft *a* a pinion *b*, which gears with a wheel *o*, which is shown provided on an extension of the shaft of the low-pressure turbine. The cruising turbine thus drives a propeller shaft through a double reduction. The cruising turbine may, however, be coupled to the shaft of any of the other turbines as may be desired. Similarly more than one cruising turbine may be provided, and these may be coupled to any of the shafts.

As mentioned, the cruising turbine may be of the combined impulse and reaction type or entirely impulse or reaction. The arrangement shown in fig. 4 represents a four-shaft installation in which a high-pressure turbine A is mounted on each of the side shafts, and a low-pressure turbine C upon the centre shafts. High and low-pressure astern turbines D and G are also provided, as shown on the side and centre shafts, both the ahead and the astern high and low-pressure turbines being mounted directly on the propeller shafts and therefore driving in the ordinary manner.

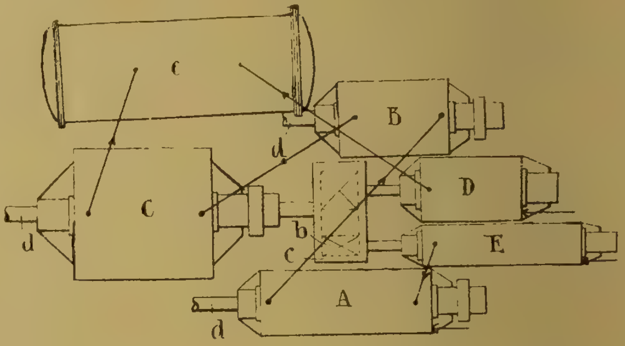

Fig. 6.

On an extension of the centre shafts is provided a gear wheel *c*, with which engage the pinions *b* on the shafts *a* of the cruising turbines E. By this means the cruising turbines can be made to rotate at their most efficient speed. As already mentioned, clutches may be provided to disconnect such cruising turbines when not in operation, thus avoiding any drag upon the propeller shafts *d*.

In some cases, however, as in low-speed cargo vessels having a single propeller, it is desirable to arrange that all the turbines should drive the propeller shaft *d* through a double reduction. Such an arrangement is shown in fig. 5, in which a high-pressure turbine A, an intermediate-pressure turbine B, and a second intermediate-pressure turbine F, and a low-pressure turbine C are provided, an astern turbine D being incorporated with this latter turbine. On the shaft *a* of each of these turbines is mounted a pinion *b* gearing with wheels *p*. On the shaft *q* of each of these wheels *p* a pinion *r* is provided, which engages the large wheel *c* mounted on the propeller shaft *d*. By this arrangement each of the four turbines drives the propeller shaft through a double reduction. A high speed of these turbines is therefore obtained without having too great reduction of speed in any gear, thus avoiding the use of very small pinions and of an inconveniently large wheel on the propeller shaft.

A three-shaft installation suitable for a torpedo boat is shown in fig. 6, in which the high-pressure turbine A and the intermediate-pressure turbine B are mounted direct on the wing propeller shafts, and a low-pressure turbine C is mounted direct on the centre shaft. A cruising turbine E and an astern turbine D are shown gearing with a wheel *c* mounted on the centre shaft. These latter turbines can be either permanently coupled to the centre shaft, or suitable clutches, as before mentioned, may be provided to disconnect them when not in operation. The power can be distributed over various shafts in any desired manner; for instance, the power developed on the centre shaft may be arranged to be about double that developed on each of the wing shafts.

The separate turbines may be grouped in parallel for full powers to give the necessary exhaust area, or in series for low powers, also any grouping in series-parallel on the same or different shafts may be arranged for. Further, turbines or parts on one or more shafts may be bye-passed. The larger the number of separate turbines the easier it is to obtain any desired grouping. The diameter of the pinions *b* is so chosen in relation to the diameter of the common wheel *c*, with which the pinions engage, and in relation to the speed of rotation of the common shaft, that each separate turbine shall run at its most economical speed of rotation. Thus the high-pressure turbines would generally be designed for a high speed of revolution and the low-pressure turbine for a low speed of revolution, while an intermediate-pressure turbine would be designed for an intermediate speed of revolution. The actual speed, however, as before mentioned, is such that the maximum efficiency possible is obtained from the turbine.

An astern turbine may be provided either separately mounted or incorporated with another turbine, and this astern turbine may be designed with reference to its most economical speed and suitably geared to the propeller shaft. Clutches, either mechanical or electrical, may be provided to disconnect the cruising or astern turbines when required.

The above arrangements are in no way limited to the number of turbines or to the number of shafts or to the manner in which the various turbines are grouped. Part or the whole of the cruising and high pressure turbines may be of either the impulse or reaction type or a combination of impulse and reaction. Suitable arrangements are also provided for absorbing the thrust on the turbine shafts, such as balancing or dummy pistons arranged within the turbine, or by providing suitable thrust blocks on the turbine shafts.

The improvements enable the highest economy for ships to be obtained under all conditions, and also facilitate the design and construction of a turbine to obtain the highest degree of efficiency.

TRADE CATALOGUES.

We have received from **Messrs. The Linolite Co.** 26, Victoria Street, Westminster, a leaflet giving particulars of "Tubolite" electric light fittings, and also a pamphlet, entitled "Lighting," also relating to the above.

We have received from **Messrs. McGowan, Wild, and Co.,** 266, Hurst Street, Birmingham, several leaflets descriptive of their oxy-acetylene welding plant.

We have received from **Messrs. The Eclipse Electric Co.,** 77, St. John's Road, Bootle, a leaflet of their vacuum cleaners.

A pamphlet received from the **Westinghouse Brake Co. Ltd.,** 82, York Road, King's Cross, London, N., draws attention to their high-speed oil engine which uses cheap grades of oils. It is simple in construction, the fuel is directly injected into the cylinder, and there is no electric ignition.

HUMPHREY PUMPS AND COMPRESSORS.*

(Continued from page 673.)

There are important differences to be noted between the action of this pump and of the single-barrel pump first described. To begin with, the new charge is taken in merely by water falling under the action of gravity, and does not depend upon the compression and expansion of an elastic cushion. The clearance spaces at the tops of the combustion chambers may therefore be reduced to the very small volume needed to bring easily to rest that portion only of the column which rises in the chamber; the main body of the column being brought to rest by the compression of the new charge. Again, for a given height of lift, the compression pressure attained is higher in the double-barrel pump, because the returning column gains speed while exhausting the last part of the burnt products, and has thus obtained a store of kinetic energy before starting the compression stroke proper.

The advantages of the two-barrel over the simplest of the single-barrel pumps may be briefly stated:—

1. Higher explosion pressure for the same water lift, due to (*a*) reduced clearance resulting in less contamination of the new charge by residual burnt products, and (*b*) higher compression pressure.
2. More cycles possible in unit time.
3. Greater output for a given total weight of pump and play pipe.

There are ways and means of making a single-barrel pump operate on a four-stroke gas and a two-stroke water cycle with many of the advantages pertaining to the two-barrel pump, and although interesting experiments have been made by running a single-barrel pump in such a manner, yet it is impossible to deal with them in this paper, and indeed, it is necessary to omit all reference to very many other types of pumps which the author has designed.

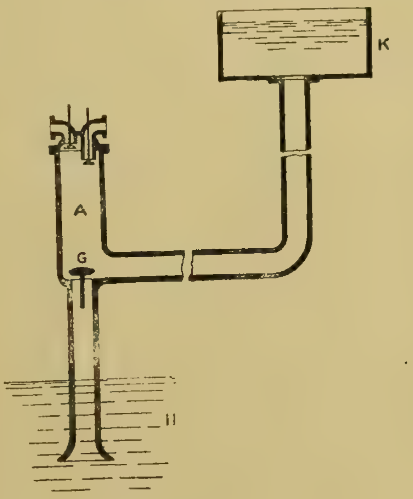

Fig. 12.

So far we have considered only those pumps which have a drowned suction and a limited lift of 40 ft. We will now take a brief glance at a few of the types of Humphrey pumps capable of working with a suction lift, and then we will come to high-lift pumps.

Fig. 12 is a diagram of one kind of suction lift pump, and the cycle is as follows:—

1. Explosion of compressed combustible charge in A, driving water to high-level tank K, continuation of expansion stroke below atmosphere owing to the existence of non-return valve in exhaust pipe.

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* Paper read by Mr. Herbert A. Humphrey, M.I.C.E., before the Manchester Association of Engineers.

Consequent lowering of pressure till water is raised from low-level tank H, past valve G, until water comes to rest and valve G shuts.

2. Return movement of water column towards chamber A, giving exhaust and cushion stroke.
3. Cushion expansion, and inlet of a measured combustible charge into A, and expansion of this charge below atmosphere.
4. Second return of water column towards A, giving compression stroke.

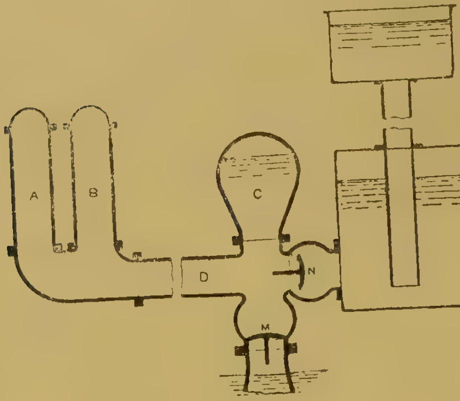


FIG. 13.

Some forms of suction pumps working on the above cycle were illustrated in the reply to the discussion at the Institution of Mechanical Engineers, and are therefore omitted from the present paper.

The measured charge involved in step 3 of the cycle may be obtained in many ways, one of the simplest being by the use of gas bags, the diaphragms of which are attached to valves, and on being drawn in actuate the valves to close the outlet. The use of a measuring device can, however, be obviated by employing the "rejected charge" device to be described in connection with air compressors.

Another suction pump is illustrated by diagram in fig. 13. The combustion chambers of A and B of a two-barrel pump are connected to the play pipe D, but the water suction pipe is at the opposite end of the play pipe, and in addition there is an air vessel C, and valves N and M, as shown. The cycle will be readily surmised. On explosion in A the water column moves outwardly from the chambers and compresses the air in C until the pressure is sufficient to lift valve N and pass water into the high-level tank. On the column coming to rest valve N shuts, and the compressed air in C expands again, imparting velocity to the column, and enabling the expansion to pass below atmosphere, and so lift water from the low-level tank at the same time that exhaust in A and compression of the new charge in B take place. The cycle is then repeated.

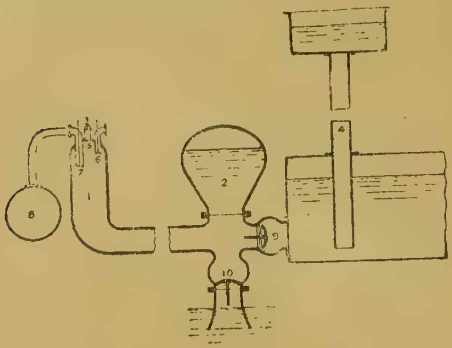


FIG. 14.

A single-barrel pump will operate in a similar manner, but the arrangement of fig. 14 necessitates two extra strokes, and the cycle is as follows:—

(*a*) refers to what occurs at pump.
(*b*) refers to what occurs at air vessel.

First outstroke (caused by explosion in 1).
(*a*) Explosion in 1 followed by expansion to atmospheric pressure, then continued movement taking in scavenging air till column comes to rest.
(*b*) Compression of air in 2 until delivery pressure is reached, then water is delivered through valve 9 until column comes to rest.

First instroke (caused by expansion in 2).
(*a*) Exhaust until valve 6 is shut by the water, then compression of cushion which remains.
(*b*) Expansion of air in 2 giving velocity to water column. When partial vacuum equal to suction lift is attained water is sucked up past valve 10 to follow moving water.

Second outstroke (caused by expansion of cushion in 1).
(*a*) Expansion of cushion in 1 and intake of combustible mixture in excess, the first portion being taken from 8 through valve 7, and the remainder through admission valve 5.
(*b*) Compression of air in 2, but no delivery of water.

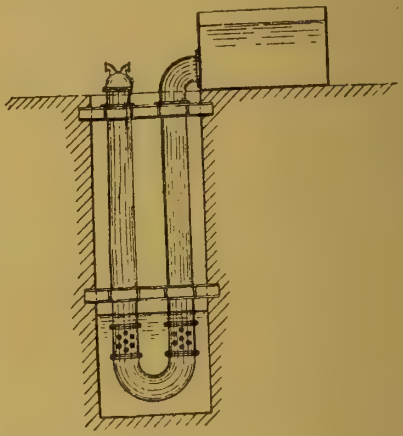


FIG. 15.

Second instroke (caused by expansion in 2).
(*a*) Rejection of surplus charge past valve 7 until water shuts this valve. Compression of charge which remains.
(*b*) Expansion of air in 2.

Note.—For clearness the usual scavenging valve on pump is not shown. Exhaust and scavenging valves are released (or locked shut) together. Admission and rejected-charge valves are released (or locked shut) together.

Yet another suction pump is shown in fig. 15, the arrangement being suitable for pumping from a well. Explosion in A drives the water down one leg of the U pipe and up the other leg into the delivery tank. Expansion below atmosphere causes an intake of water through the suction valves in the well, then the first return movement occurs, giving the exhaust and cushion stroke, followed by the cushion expansion and gas suction stroke, and lastly the compression stroke. Many other varieties will probably suggest themselves to you, but we must only stay to describe one more type, which is illustrated by fig. 16, and is interesting as giving the same high efficiency with a low lift as can be obtained with a high lift.

In this case the energy of water falling to a lower level is used to cause the intake of fresh water, and the pump barrel is placed at a low level to render this possible. Thus in the figure we have a single combustion chamber A, and upon explosion water is forced outwardly, the whole column from the pump to the high-level tank partaking of the motion. The two parts of the column *a*, from pump the valve V, and *b* from valve V to high-level tank E T, are so proportioned that the *a* portion loses its kinetic energy first, and is ready to return towards the pump before the *b* portion has come to rest. When the *a* portion flows back downhill fresh water is taken in at valve *v* between the two portions of the column, and the exhaust and cushion strokes occur in A. Expansion of the cushion in A gives the usual outstroke taking in gas and air, and the cycle is completed by a second instroke which compresses the combustible charge in A. In this last stroke either the *a* portion or the whole column may take part, depending on the proportions of *a* and *b* and the differences of levels. The chief point to observe is that while water is only raised from tank S T to tank E T, yet the fall to the pump may be sufficient to give a good compression pressure, and thus secure high efficiency.

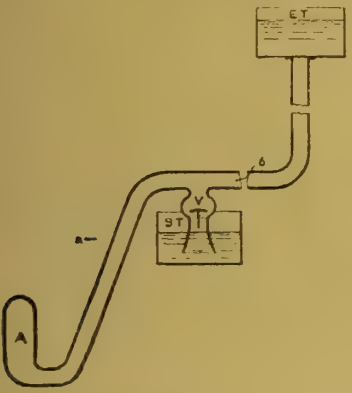


Fig. 16.

Coming now to high-lift pumps, any Humphrey pump, whether single or double barrel, may be converted into a high-lift pump by means of an air vessel fitted with valves and called an "intensifier." The idea is to first allow the water column to gain velocity and then to utilise its kinetic energy to (*a*) compress an elastic fluid, (*b*) deliver water under the pressure to which the elastic fluid has been compressed. Fig. 17 will serve to make the cycle clear.

A and B are the barrels of a two-barrel pump, and at the end of the play pipe D there are two air vessels E and F, the latter being large enough to give a continuous flow at outlet O, and to maintain a practically uniform pressure. The smaller air vessel E is fitted with a downwardly projecting pipe K, open to the atmosphere at the top and carrying a valve L at its lower extremity, arranged to close under the action of the rising water. The cycle starts with explosion, all valves except L being shut and the water level as shown. While the water level in E is rising to L air is merely being discharged into the atmosphere, and as no work is being done by the column of water, it gains speed until valve L is shut by impact. Imprisoned in E there is now a definite quantity of air, which suffers compression until its pressure reaches that at which the high-pressure water valves W can open and allow the remaining kinetic energy of the column to force water into F. Valves W close when the column comes to rest, but there remains enough energy in the compressed air in E to give, by expansion, the return flow, which causes exhaust in A and compression of the fresh charge in B to start a fresh cycle. When the water level falls below valve L this valve opens and air is admitted into E for the rest of the return stroke.

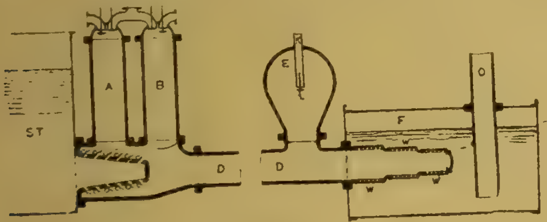


Fig. 17.

Now it is easy to see that if the pipe K is made vertically adjustable with regard to E, the point of the cycle at which L shuts can be varied, and more or less air entrapped in E at will. But the amount of energy stored in this air will also vary with its quantity, for we assume that the degree of compression remains constant, and is indeed fixed by the pressure maintained in F. Consequently the ratio of the total energy of the working stroke to the energy stored in the compressed air in E can be made anything desired, or, in other words, we can obtain any compression pressure of the new charge in B which we like, and this independent of the water lift. The advantage is obvious, for compression pressures equal to those in modern gas engines can be employed with a corresponding increase in thermal efficiency. Further, by manipulating the position of pipe K, a given pump can be made to meet any conditions as to height of lift, for if the lift increases, K can be raised, so that the energy stored in the air in E remains the same, there being now less air but at a higher pressure.

A short digression may now be made to describe an important development of the arrangement shown in fig. 17, and your notice is directed to the fact that at each cycle air is drawn into and rejected from the vessel E. Let us suppose K is connected to a supply of combustible mixture instead of opening into the atmosphere, we shall then have an automatic pump for taking in mixture and discharging it under pressure. If the discharge is into a reservoir from which combustion chambers A and B can be supplied, we have at once a means of quickening the cycles and greatly increasing the output of a given size apparatus. It is convenient to replace vessel E by two vessels, one for air and one for gas, so as to maintain the combustible constituents separate until they enter the combustion chambers. If the first portion of the outstroke of the water column is allowed to reject the surplus air and gas back to the sources of supply, then the action throughout the cycle is precisely that described when using the single vessel E, except that a larger proportion of the total energy is absorbed in the compression of air and gas, but the excess is given out again during the expansion of the pre-compressed charge in either A or B. The chief advantage arises from the more rapid working, as there is no longer any need to wait for the water level in A or B taken in. In fact, the apparatus becomes practically independent of the water level on the supply side. The 1,000 H.P. Humphrey pump now under construction in Germany will operate in the manner just described, the result being that the dimensions are very moderate, and the pump itself occupies no more space than a 1,000 H.P. tandem gas engine.

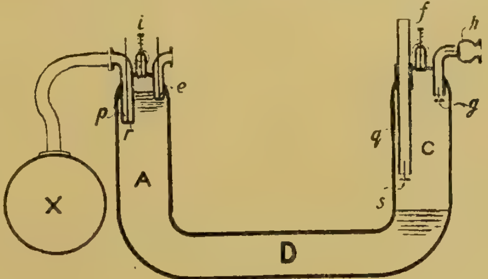


Fig. 18.

The limits of this paper preclude any reference to single-barrel high-lift pumps, other than that shown in fig. 14, or to other modifications of the double-barrel type to suit special conditions, as there still remains the important subject of air compressors to be considered.

If the column of water oscillating in the play pipe of a Humphrey pump is used as a water piston, and caused to rise and fall in an air vessel fitted with suitable valves for the inlet and outlet of air, the combination constitutes an air compressor of a very efficient type and promising many advantages. Let us take the case of a single-barrel pump and a single air vessel, as illustrated in fig. 18. A is the ordinary pump chamber and C the air compressor chamber, and we may call them for convenience the "pump" and the "compressor" respectively. The inlet valve *i*, for gas and air, and the exhaust valve *e*, for burnt products, exist as before, but the exhaust pipe and valve are adjustable vertically so as to vary the cushion space in the top of A. There is another pipe *p* fitted with a valve *r*, and also adjustable vertically. A reservoir X, such as an old boiler shell, is connected by a flexible pipe to *p*. Corresponding parts are fitted to the compressor, thus *f* is an air inlet valve, *g* an outlet valve for air which is shut by the water, and *h* a non-return valve for the compressed air. The dip pipe *q*, with its valve *s*, gives communication between the atmosphere and the compressor. The outlet pipe and the dip pipe are vertically adjustable as in the pump. Lastly, suppose the play pipe D filled with water, then we have all the elements required for working under the most varied conditions.

The cycle can be explained by assuming the water level is well up in A and low in C, as shown in the figure, and that a compressed charge is ignited in A. Expansion occurs, driving down the water in A and up in C. At first air escapes from C through valve *s*, but when the water reaches this valve it is shut and the remaining air is trapped, and suffers compression until the pressure of discharge is reached, when *h* opens and compressed air is delivered. Next the water reaches valve *g* and shuts it, so that no more air can escape, and the water column is brought to rest by the continued compression of the remaining air, which forms a cushion. Meanwhile in chamber A expansion to atmosphere allows the exhaust valve *e* to open, and the continued stroke draws in scavenging air (the scavenging valve being omitted from the figure for the sake of simplicity) but valves *i* and *r* remain locked. Now the column begins to return, due to the expansion of the compressed cushion in C, and this causes exhaust and cushion in A, and at the same time there is first a fall of pressure in C to atmosphere, then valve *f* is opened against a light spring and a fresh supply of air enters.

(*To be continued.*)

THE LATE Mr. GUSTAV BYNG.

The electrical world learnt with deep sorrow of the decease at his residence, Fitzjohn's Avenue, on the 23rd ult., at the early age of 55, of Mr. Gustav Byng. A few years since Mr. Byng's health became too impaired to allow of his taking much part in the administration of the great firm which, in conjunction with his great friend and co-worker, Mr. Hirst, he had been founder some 27 years ago. But he continued to take the deepest interest in the General Electric Company, in which as chairman he was no mere figure head.

The late Mr. Byng was born in Bavaria in 1855, and he received a sound German education at the Augsburg Polytechnikum, a school of higher general scientific instruction. Coming to this country in 1873 at the early age of 18, he elected to make it his home, and in 1879 he became a naturalised Englishman. It was about this time that he commenced business on his own account as an electrical engineer and manufacturer of electrical apparatus, and he found a kindred spirit and co-worker in Mr. Hirst, whose administrative talents and technical ability was of the utmost value to him in the building up and constant expansion of the General Electric Company. The works were originally at Manchester, and Peel-Connor telephones are still made at the old Peel Works, but the main works of the company were moved some years ago to Witton, near Birmingham, where 106 acres were purchased as the site of the necessary workshops and other buildings. The late Mr. Byng took the keenest interest in this great work of development, and supervised with the greatest care the necessary financial arrangements. At Witton there are now, besides engineering shops for the manufacture of the largest electrical machinery, spacious arc lamp and switchboard shops, electrical carbon and chemical factories, steel and brass tube works, an iron foundry, and power house with a present capacity of 2,500 H.P. No less than 8,000 people are now employed in the various manufacturing and other establishments of the firm in this country alone. The General Electric Company is the parent from which the well-known Robertson Electric Lamps Ltd., Osram Lamp Co., Peel-Connor Telephone Co., and the other subsidiary companies have sprung. Mr. Byng was in his early days an indefatigable inventor. His name is associated with the improvement and development of telephony and electrical signalling, with the advance of electric lighting, heating, and cooking.

The late Mr. Gustav Byng.

Mr. Byng was an ardent Tariff Reformer, and long before that movement had reached its present development had placed his views on the necessity of protecting the economic life of the nation, by means of a scientific tariff, in a work entitled "Protection," a source from which such distinguished champions of tariff revision as Mr. Joseph Chamberlain and Mr. Bonar Law have publicly acknowledged having received much inspiration.

Mr. Byng was a strong advocate of combination and co-operation in industry, and chairman of the Manufacturers' Association of Great Britain. He was also a member of the Institute of Electrical Engineers and many other technical and public bodies.

ALTERNATING STRESS TESTS AND MACHINES.

By C. A. M. Smith, M.Sc.

It is a well-known fact that in practice certain parts of machines and structures are subjected to stresses which vary greatly in intensity, and in some cases actually alternate. This repetition and alternation of stress is a very frequent occurrence in engine and machine parts; indeed, it is difficult to select a moving part of almost any machine in which it does not take place to some extent. Some examples are the piston rod of a steam engine (alternate compression and tension), gas-engine crankshaft (torsional stresses of varying intensity), or the axle of a railway carriage (bending stresses in directions which are constantly changing).

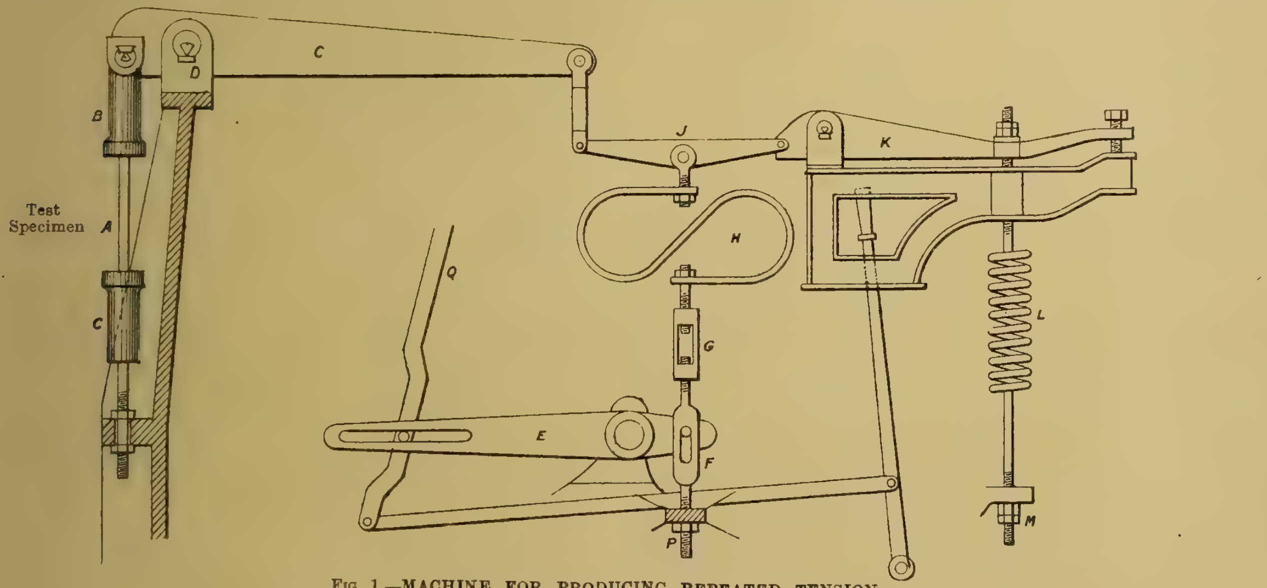


Fig. 1.—Machine for producing repeated tension.

The object of testing materials of construction under these conditions of stress is to gain some information as to the safe limits of stress that are permissible in such cases. In order to attain this end, and to obtain reliable results, it is necessary to arrange the experiments in such a way that the manner of loading approximates to the conditions existing in actual engineering practice

In spite, however, of the great value of these tests on alternating stresses, from both an experimental and a commercial point of view, such tests will probably never supplant those performed by the static methods. They are expensive to conduct, and the conditions under which they are made affect the results. Static tests will not be supplanted, in commercial practice, by alternating stress tests. At the same time, they will assist engineers very greatly in design problems.

The difficulty of the practical man at the present time is that, on some points, various experts disagree. It is impossible to say who is right and who is wrong. It is quite probable that when more work is done we shall find that, like the knights in the story who quarrelled about the colour of the shield, each combatant has been looking at a different side.

In a paper read before the Institution of Mechanical Engineers in 1904, Messrs. Seaton and Jude gave the following approximate analysis of the stresses to which the steel parts of a reciprocating steam engine are subjected:

	Per cent.
Constant tension	3·91
Constant tension and compression (range from 0 to a maximum)	1·30
Constant tension and shock	48·80
Alternating tension and compression with shock	2·81
Repeat tension (from a constant to a maximum) with shock	36·00
Miscellaneous and doubtful	7·18
Total	100·00

From this analysis it is quite clear that 87·6 per cent of the whole of the engine's stresses are more or less due to shock, and that the pure tension stresses form quite an insignificant percentage of the total stress. It seems fairly certain that if other machines were similarly analysed, nine out of ten would give similar results.

Quite early in engineering practice, engineers noticed that failure of materials takes place after fatigue. Bauschinger suggested an ingenious explanation, the chief result of which was that engineers were advised not to exceed the "primitive" elastic limit of the material, if it were to be used under an alternating stress. Wöhler and Bauschinger were the first two experimenters to draw the attention of engineers to the effect of a varying number of repetitions of a stress upon a material. Reynolds and J. H. Smith found that the *rate* of repetition of stress affected the problem, but upon this point experts at present differ. There is undoubtedly a great deal of work to be done in order to definitely prove certain obscure points, especially this one concerning the effect of the *rate* of repetition.

It sometimes happens that materials have to withstand stresses for very short intervals of time. It has been proved that the rate of loading a specimen in tension appreciably affects the record of the yield point. It is therefore a fair deduction to assume that time plays a very important part in the failure of materials.

Although a great deal of research work has been done, there has appeared, so far as the author is aware, no collected results of recent work. It is therefore proposed to mention the extensive work carried out by various investigators.

The first experimenter in this field of research was Herr Wöhler. He, in 1871, performed a remarkable series of tests on stresses of alternating and repeating natures. In order to carry out these investigations, he invented a number of ingenious machines for creating and measuring stresses of a periodic variation in tension, torsion, and bending.

Wohler's Machine for Repeated Tensions.

The accompanying diagram (fig. 1) shows in outline the machine used by Wöhler.

It consists of a bedplate (not shown), at one end of which is a cast-iron standard carrying a knife edge D, on which is pivoted the principal lever C. The shackle B in which the specimen A is gripped is suspended by a knife edge at the shorter arm of lever C. The lower shackle C can be adjusted in a vertical direction by means of nuts on a screwed tail rod. The longer arm of the beam C is connected by means of a short link to the horizontal lever J, the other end of which is attached to the shorter end of lever K. On the longer arm of the latter there is a boss through which passes a vertical rod attached to a spring L. By means of the nut M at the bottom end of this rod the tension of the spring can be varied.

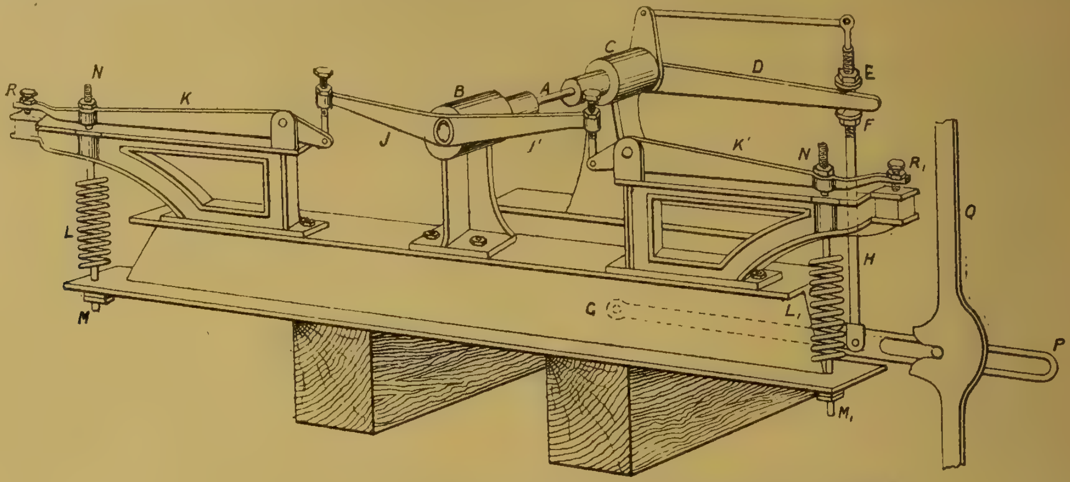


Fig. 2.—Wohler's Alternating Stress Machine for Torsion Tests.

Q is a vertical oscillating connecting rod which, by means of a slot and pin, gives an adjustable oscillating stroke to the lever E. The movements of the shorter end of this lever are transmitted, by means of a pin working in a slot F, to the spring H. The varying tension in this spring acts downward on the lever J, and in this manner the specimen A is subjected to a stress of varying amount.

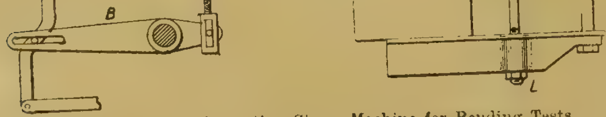


Fig. 3.—Wohler's Alternating Stress Machine for Bending Tests.

The procedure for setting the machine to give a stress alternating between two fixed limits is as follows:—The spring L is adjusted by means of the nut M so that the *minimum* stress just makes the lever R rise. The nut P and the turn-buckle G are then adjusted so that K just lifts. The spring L is now set to give the maximum stress, and the stroke of the lever E arranged until the maximum stress just causes the lever K to lift. All is now ready for a test.

Wohler's Machine for Testing Alternating Torsional Stresses.

This machine is shown in diagrammatic outline in fig. 2. B and C are two bearings which carry chucks by which the specimen A is held. The bearing C has a mandrel passing through it, to the end of which is attached a lever D, which carries knife edges near its longer end. E and F are adjustable collars on the vertical rod H, and which bear on the knife edges referred to. The rod H is attached at its lower end to the horizontal lever P. This lever is pivoted at G, and caused to oscillate by the connecting rod Q. By means of a slot the stroke of P can be varied, and the "gab" arrangement makes it possible to throw Q out of gear at any moment. It will be seen that the vertical oscillations of Q are transmitted through the rod H to the lever D, and are there converted into twisting oscillations of the specimen A. The reaction of the torque is taken by a system of levers J J$_1$, K K$_1$ to spring L L$_1$, which are similar to those used in the tension machine. Different stresses are obtained by varying the stroke of P.

Wohler's Bending Stress Machines.

There were two machines designed by Wöhler for giving periodic bending stresses to a specimen. The first, shown diagrammatically in fig. 3, is for varying the stress between a fixed maximum and minimum; while the second, shown in fig. 4, a much simpler arrangement, bends the specimen in opposite directions.

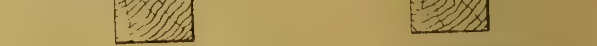


Fig. 4.—Bending Machine for Alternating Stress Tests.

In the first mentioned (fig. 3) A is the test bar supported on knife edges D and E carried by short links. One of these latter is suspended from a fixed bracket, while the other is attached to a similar lever and spring arrangement, as in the other machines of Wöhler. The lever B is caused to oscillate by means of a pin working in a slot, the pin being on the oscillating connecting rod C. The knife-edge M rests on the beam, and by means of the rod K, which is of adjustable length, the motion of the lever B is transmitted to M. The lever B is attached to K by means of a pin working in a slot, so that no upward push can be given to the beam A.

To set the machine to give a required variation of stress, the spring G is first adjusted by the nut L to such a load that the lever F just lifts when the minimum load required is applied to the beam. The screw J is then screwed down until F just lifts again. The spring C is now set to the maximum load, and the stroke of lever B adjusted until the lever F is just lifted at the end of the stroke.

In the second bending-stress machine, shown in fig. 4, two specimens are used. C is a mandrel running in bearings D and D_1, and the specimens A and A_1 are fixed in two chucks placed at either end of C. To the outer ends of the specimens, bearings E and E_1 are attached. It is necessary that the specimens are turned up beforehand, so that they run easily in the bearings. The bearings are pulled downwards by spring balances F F_1 which are of a special kind, the pull being adjustable by nuts G G_1.

When the mandrel is rotated by means of a belt round the pulley B, the specimens are subjected to a bending action which changes rapidly in direction. Although it is not distinctly stated, it appears that in Wöhler's tests the rate of the changes of stress was comparatively slow, and not more than about 100 per minute.

(To be continued.)

BALANCED SLIDE VALVES.

THE object of balanced slide valves is to avoid the friction and the consequent loss of power which occurs in the case of large D valves. By adopting the balanced valve this object has been most successfully achieved by the removal of the live steam from the back of the valve. Many various designs have been adopted, but all are covered by the same principle. The following sketches show two of the most common designs in use:—

Fig. 1—The Richardson balanced valve with strips and springs.

Fig. 2—The disc type of balanced valve with packing ring and spring.

The Richardson type is more suitable for rectangular valves; a circular disc in this case would leave a large proportion of the valve unbalanced, although two discs are sometimes fitted.

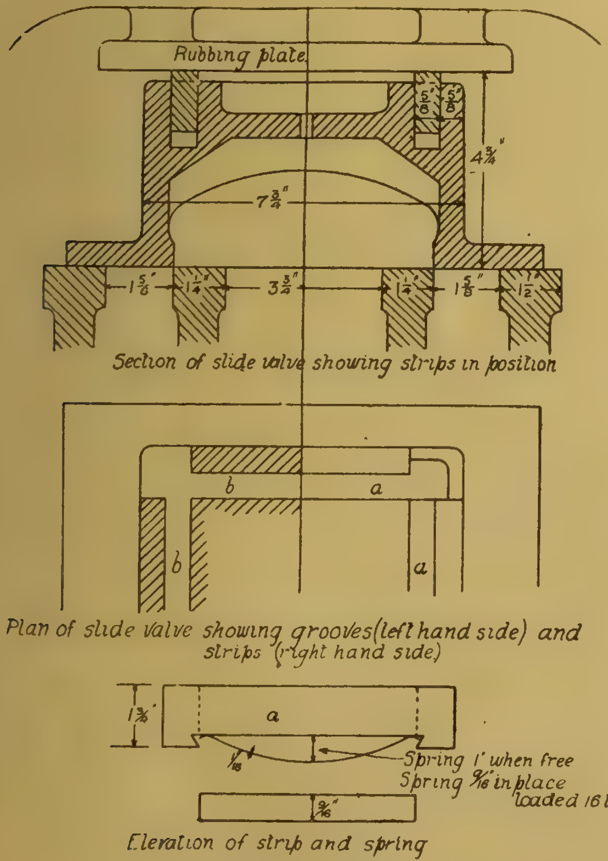

Rubbing plate
5/8"
5/8"
4 3/4"
7 3/4"
1 5/8"
1 1/4"
3 3/4"
1 1/4"
1 5/8"
1 1/2"
Section of slide valve showing strips in position
b
a
b
a
Plan of slide valve showing grooves (left hand side) and strips (right hand side)
1 3/8"
a
1/16
Spring 1" when free
Spring 9/16" in place loaded 16 lbs.
9/16"
Elevation of strip and spring

FIG. 1.—Richardson Type of Balanced Slide Valve.

Fig. 1 shows a sectional view of a Richardson valve in the steam chest. The balance is secured by four rectangular bars *a*, fitted in the grooves *b* on the top of the slide valve. These packing strips are held lightly against the rubbing plate (generally cast with the steam chest cover) by spiral or semi-elliptic springs, until steam is admitted in the chest, then steam pressure acts upon the packing pieces and holds them firmly against the rubbing plate, forming thereby a steam-tight joint, and excluding live steam from acting on the area of the valve included within the packing strips. The steam gets to the underside of the strips through openings at the ends.

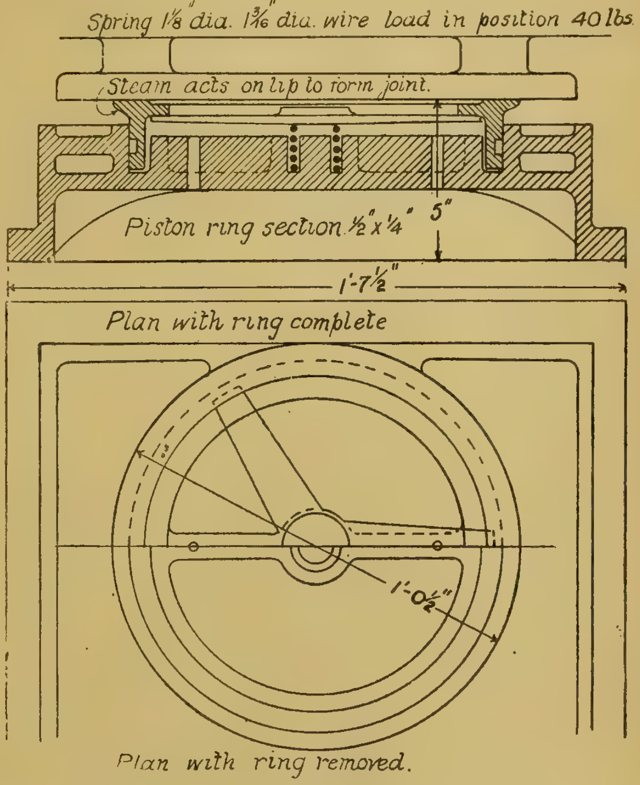

Spring 1 1/8" dia. 1 3/16" dia. wire load in position 40 lbs.
Steam acts on lip to form joint.
Piston ring section 1/2" x 1/4"
5"
1'-7 1/2"
Plan with ring complete
1 3/8
1'-0 1/2"
Plan with ring removed.

FIG. 2.—Disc Pattern of Ball Balanced Slide Valve.

A hole is always drilled in the top of the valve to allow any live steam which does happen to escape past the strips out of the exhaust passage.

In most cases it is usual to have a space between the rubbing plate and the cover itself to allow the steam a free passage to both ends of the steam chest.

FIG. 2 shows a common form of disc-balanced valve. The balance ring in this case also is held in position by a spring and formed steam-tight by means of a piston ring. When steam is admitted to the steam chest it acts on the lip of the balance ring, forces it against the rubbing plate, thereby forming a steam-tight joint. The area of balance ring less the area of this lip in this case forms the balance,

THE KERPELY GAS PRODUCER.

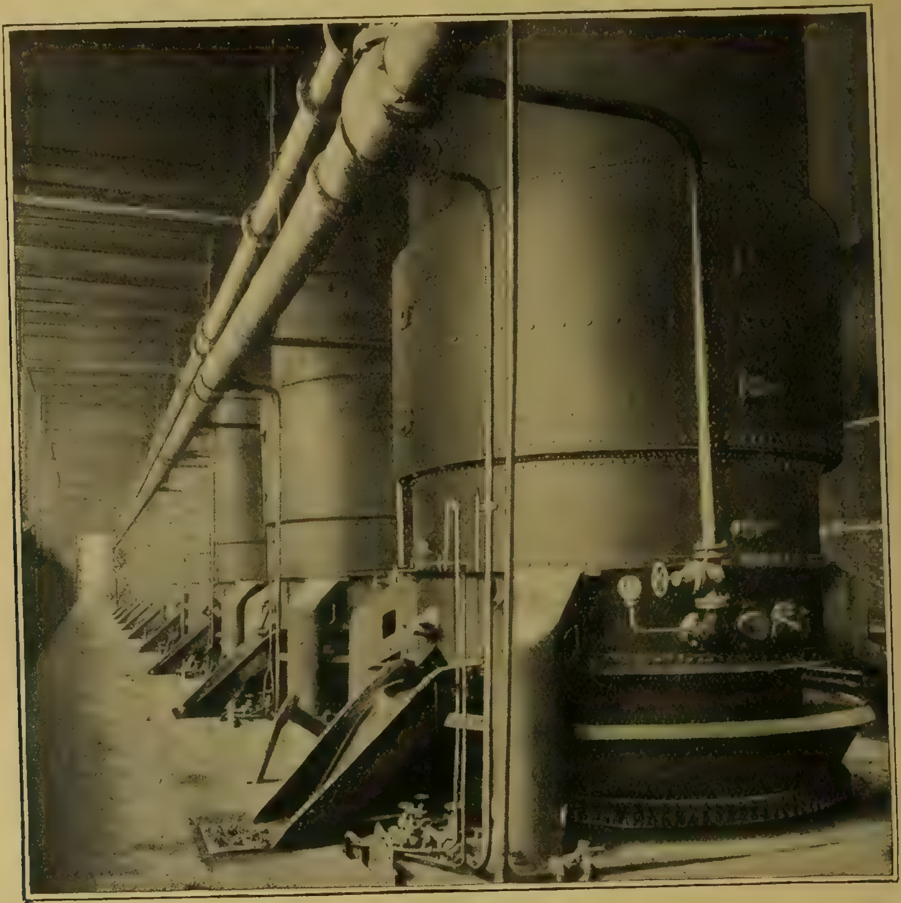
The Kerpely gas producer shown in our illustrations works continuously and automatically, and it is claimed for it that owing to the arrangement of revolving grate its gasifying power is greater, and at the same time a better quality of gas is greater, and at the same time a better quality of gas is produced. The apparatus gasifies effectively every kind of fuel, coking or non-coking, and works equally well with cinder-making coal, either in lumps, ordinary rough coal, fine coal, or even coal shine, a considerable economy on the cost of fuel gasified being thus obtained. The producer also gasifies the whole charge, without leaving a mixture of ashes with a great deal of coke. Another advantage is that owing to the water jacket preventing the formation of clinkers, any necessity for stoking is almost entirely obviated.

The construction of the gas producer will be understood from the sectional view; before proceeding with a specific description, however, we may mention that the three most interesting points are: The revolving mechanical grate; the water jacket, combined with the automatic ash discharge; and the duplex air supply.

Commencing with the revolving mechanical grate, this consists of a single cone fixed eccentrically upon the foundation and provided with a flat top. This cone comprises a number of plates, shown in the sectional view. Through these plates the air reaches the producer, and the supply of air is under the complete control of the operator, as explained later; it is dispersed over the whole area in the most efficient manner, enabling this producer to gasify more material in proportion to the area of the grate than can be obtained by any other system. The revolving mechanical grate is provided with a flat cone top in preference to the eccentric steep cone, which was formerly supplied to Kerpely producers, but has been found by experience to cause the ashes and clinkers to contain a quantity of incompletely burnt fuel. Another object in adopting the flat-coned top was to keep the CO_2 zone as low as possible, which is a very important feature that will be readily appreciated by gas-producer users.

The effect of the water-cooled jacket will be readily understood. It is a well-known fact that no cinders can cling to water-cooled plates, and in the Kerpely Producer water is kept continuously circulating through the jacket. In some installations on this system the heat absorbed by the water in passing through the jacket is utilised for the feed water of adjacent boilers; this, however, is a relatively unimportant feature, the main point being that the cinder-forming material, not being able to adhere to the water-cooled plates, is automatically disintegrated, completely gasified, and the ashes sink down into a water trough, which is being continuously rotated at a speed of about one revolution every two and a half to three hours. The slow speed at which this water trough is rotated requires only a small amount of power—not exceeding 2 H.P.—and the ashes accumulated in the bottom are automatically discharged by coming up against a scraper.

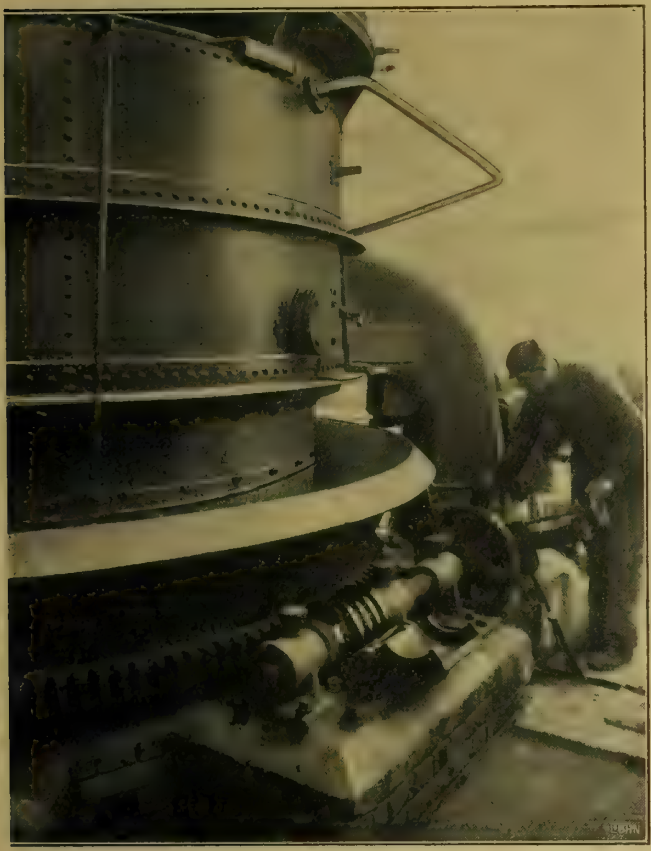
The third feature mentioned, viz., the duplex air supply, is another very valuable one, and the advantage of separate air currents is said not to be found in any other producer with mechanical revolving grate. The double air inlet is used in the following manner, viz., one for the inner part of the grate and one for the outer part, the object being to regulate the gasification, especially in large producers; thus, when the producer works too light at the edge and is too dark in the middle, the outer air pressure is reduced and the inner air pressure raised, until



INSTALLATION OF NINE KERPELY GAS PRODUCERS. LOOKING ALONG LOWER FLOOR.

an even glow is produced all over the surface, and *vice versa*.

The gasifying power of the Kerpely Gas Producer is claimed to be much greater than that of any gas producer without a revolving grate, it follows therefore that the initial cost of a battery of producers to secure a certain output will be less than the cost of the ordinary type of producers to produce the same output of gas; their number is proportionately less, and the space occupied is consequently reduced, the building, staging, coal bunkers, and tracks involving a relatively smaller outlay.



Driving Apparatus of a Kerpely Producer, internal diameter 10 ft., showing the Gear for Regulating the Speed of Rotation of the Ashpan.

What is perhaps a still more important claim is the reduction in operating expenses, because the cost of labour and of repairs upon the ordinary type of gas producer is a very serious and never-ending expense.

As regards the cost of labour, this must of course vary according to the nature of the fuel to be gasified; that is to say, whether it is of a coking or non-coking nature. Thus for instance, in a certain installation where free burning fuel is gasified, and the feed and ash delivery are both automatic, two men have been found to be amply sufficient for the service of eight gas producers; but, in another installation, where 22 producers are at work, all with ordinary hoppers, the coal being delivered into same by means of overhead crane from bunkers at the side of the installation, the ashes being removed by the same cranes from one continuous bunker, and loaded into small wagons, the following staff per shift is employed, viz.: One foreman, two chargers, two crane drivers, and one labourer to clean and lubricate the driving mechanism. This plant is capable of gasifying 380 tons of coal per 24 hours. In another installation where highly-coking fuel is gasified, as much as one man for each producer is required. Thus, it will be seen that the labour bill must vary in each installation, according to the local conditions.

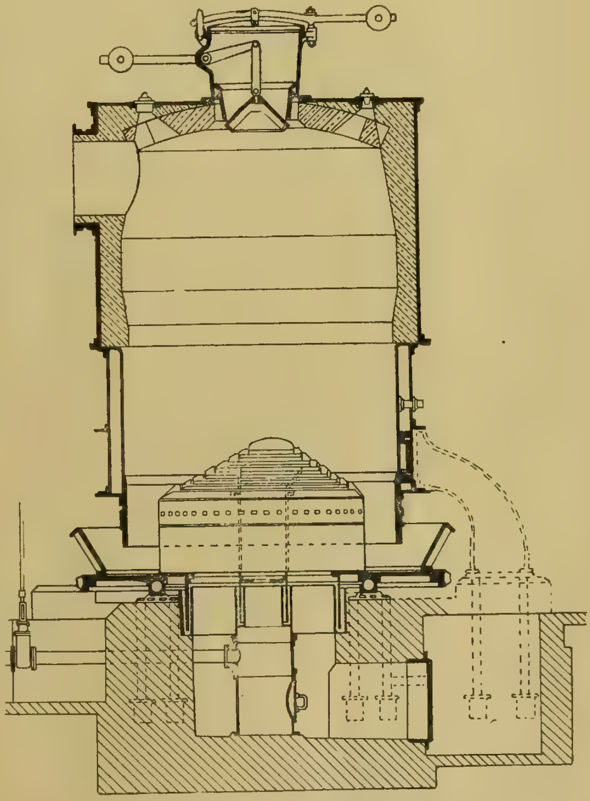
The cost of repairs is also stated to be exceptionally low. In one installation in this country of three of these gas producers, which have been running continuously since first installed now three years ago, the only repair that has been necessary has been the replacement of one conical top plate, which was inadvertently burnt soon after starting up the plant, owing to the fire having been allowed to fall too low. In this installation, for a period of three years, the daily average of gas analysis obtained is as follows:—

CO_2	3·8 per cent.
CO	27·2 „
H	9·7 „
CH_4	3·1 „
Total combustibles	40 „
Average moisture	29 grammes per cubic metre.

In this case the blast is saturated with live steam at 35 deg. Cen.

The cost of the coal consumed is also materially reduced, owing to the inferior nature of the coal that can be gasified, even the washings from coal in some cases being used to mix with the average fuel in order to reduce the coal bill. A case can be cited where inferior coal in medium-sized nuts of about 2 in. cube down to dust was used, of the following analysis:—

Fixed carbon	42·03 per cent.
Vol. hydro carbons	23·65 „
Sulphur	2·42 „
Ash	23·90 „
Moisture	8·00 „



Kerpely Producer. Sectional view.

The producer was a 10 ft. one, with a high water jacket, and the quantity of coal gasified per hour was approximately 15 cwt. The blast was saturated with steam at 35 deg. Cen. The pressure of blast at bottom of producer was 5 in. to 6 in. water. The pressure of gas in main was 1½ in. to 2 in. water. The depth of the bed of fuel was from 3 ft. to 3 ft. 6 in. The coal showed a tendency to clinker, but this clinker was well broken up by the revolving grate, and was taken out automatically without trouble. The analyses of the gas made are shown in the following table, and it is probable that better results would have been obtained by using a higher steam saturation of blast, say up to 45 deg. Cen.

Analyses of Gas obtained from the Kerpely Producer.

Showing their relation to the gas obtained from the same coal in the ordinary type of producer.

	1	2	3	4	5	A Average gas from the same coal (ordinary type of producer).
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Carbon dioxide (CO_2)	2·8	3·6	3·2	2·0	3·1	8 to 14
Carbon monoxide (CO)	26·8	23·2	25·6	24·4	27·1	15 to 20
Hydrogen (H)	8·8	9·6	9·6	8·0	8·3	8 to 10
Methane (CH_4)	3·6	3·2	3·2	3·2	3·1	2½ to 3
Nitrogen, by difference	58·0	60·4	58·4	62·4	58·4	....
Combustible gases	39·2	36·0	38·4	35·6	38·5	32
Moisture in grammes per cubic metre	29	39	35	34	32	45 to 48

From the above table it will be seen that very great economy in the fuel bill is effected by the use of the Kerpely Producers, and this economy increases as the men in charge become intimate with the handling of the producers and with the nature of the fuel employed. Thus, for instance, in one of the installations in this country a fairly good fuel was used to start with, but by degrees an inferior class of fuel was mixed with the better fuel in gradually increasing proportions, until the men in charge were getting equally good results with inferior and less costly fuel.

An authority upon producers observes, regarding the Kerpely Producers, that the fault of all producers without a mechanically-worked ash remover is that the gas quality depends on the human element, and owing to the irregular removal of ash, the ratio of the CO_2 zone varies, and the quality of the gas follows; in the Kerpely Producer this is constant, and therefore the quality is constant. The constant revolving of the ashpit prevents clinkering. The form of hood supplying the blast is such that the CO_2 zone is shallow, thus allowing the CO zone to be proportionately deeper, a feature which in the opinion of the authority in question is one of the most important points in favour of the Kerpely Producer.

The sale and manufacture of the Kerpely Gas Producer for this country are being controlled by Messrs. E. G. Appleby and Co., of 10, Victoria Street, London, S.W.

Railway Material.—The *Sole* (Milan) announces that the Italian Ministry of Public Works have granted to the "Societa di Ferrovie in Toscana" a concession for the construction and working of a standard gauge railway 34½ miles long between Siena, Bonconvento and Monteantico. The concession is for a period of 70 years. According to the local press a narrow gauge line is being planned from Kervo, about 18 miles north of Helsingfors, to Tusby, and thence to the village of Hyrylä, Russian Finland This route was surveyed some years ago, and the matter has now been taken up again. The length of the line will be about 7½ miles. The *Diario Official* (Brazil) publishes a decree approving the plans submitted by the "Companhia Mogyana de Estradas de Ferro" for the construction of a section of railway 29 miles long from Guaxupé to Monte Santo, the cost of the work being estimated at 2,832,000 milreis. The *Gaceta Oficial* (Cuba) contains a notice authorising the Secretary of Public Works to enter into a contract with the Cuban Central Railways Ltd. for the construction, with the aid of a State subsidy, of a section of railway from Sagua la Grande to Caguaguas, passing by way of Rancho Veloz.—*Board of Trade Journal.*

THE BRIQUETTING OF IRON ORES.*

(Concluded from page 715.)

Considering that the melting point, and therefore the sintering temperature, of magnetite is comparatively low, the briquettes made of "concentrates" (Fe_3O_4) begin to sinter and to harden at a temperature of from 800 deg. to 900 deg. Cen. However, as already mentioned, the temperature is raised to about 1,400 deg. Cen., in order to expel as much sulphur as possible. It may also be mentioned that the process of converting the Fe_3O_4 into Fe_2O_3, being an oxidation process, is accompanied by a development of heat, thus economising fuel to a certain extent.

The suggestion has been made of using briquettes made of "concentrates" directly in the open-hearth furnace as a decarburising and, at the same time, enriching addition to the metal bath.

The use of iron ore in the open-hearth furnace for that purpose is already well known, but such ore must be comparatively rich in iron, and it must not contain noxious substances to such an extent as to interfere with the quality of the steel produced. From the chemical analysis given in the comparative table it will be seen that the "concentrates" (and therefore the briquettes made therefrom)) quite fulfil these conditions, the percentage of sulphur in the "concentrates" varying, with the exception of those from Harräng, between 0·015 and 0·04 per cent. Considering, further, that, as a rule, only 25 per cent of iron ore is used in the open-hearth furnace, the contents of sulphur in the ore added will be indirectly reduced to one-fourth (0·004 per cent to 0·01 per cent) in the finished steel, which is not high enough to interfere with its quality. In the case of briquettes made, as suggested, from concentrates, for use in the open-hearth furnace, it would not be necessary to heat them up to 1,400 deg.; it would also not be necessary to oxidise them from Fe_3O_4 to Fe_2O_3, and to make them porous. For use in the open-hearth furnace they can be pressed at a considerably higher pressure whereby they would become more compact, which is more advantageous for use in the open-hearth furnace, because they will then be specifically heavier, and therefore sink deeper in the bath, instead of floating upon the surface for a long time, like red or brown iron ore, which, with the exception of specular, is comparatively much lighter in weight.

As Fe_3O_4 commences to sinter at a temperature of from 800 deg. to 900 deg. Cen., the briquettes made of "concentrates" will become hard at this temperature, and need not be heated above it. This advantage, together with the fact that they need not be porous (and therefore not changed from Fe_3O_4 to Fe_2O_3), makes the briquettes considerably cheaper and richer in iron when used in the open hearth instead of in the blast furnace.

In order to avoid the cost of briquetting, an attempt has been made to agglomerate the fine-grained ore in a rotary furnace. This method appears to be of special value in cases where the agglomeration can be combined with the roasting of the ore, should the latter be necessary or advantageous, as, for instance, when spathic ore, brown iron ore, or iron ore with a high percentage of sulphur is to be agglomerated.

The fine-grained ore to be agglomerated in a rotary kiln is mixed with coke dust (which can generally be procured very cheaply) in order to reduce the oxygen in the ore. The Fe_2O_3 in the ore can thus be partly changed into FeO, which would enrich the ore in Fe, and, at the same time, reduce the temperature necessary for agglomerating.

Considerable difficulties have, however, been experienced with this method of agglomeration. First, it has been difficult to regulate the temperature in the rotary furnace in such a way that the necessary sintering should take place without melting. Secondly, it has been found that the ore, as soon as it commences to agglomerate, adheres to the inner fireproof lining of the rotary furnace, thus causing scaffolds, which have to be removed at considerable expense.

These difficulties are more frequently experienced in cases where coal-dust firing is employed for heating the rotary furnace, because, in these cases, the ashes of the coal, consisting chiefly of silica and alumina, mix with the ore and cause scaffolds, besides indirectly reducing the contents of iron in the agglomerated ore. The use of gas instead of coal-dust firing may therefore prove advantageous in this case, partly because the temperature in the rotary furnace can be more easily regulated according to requirement, and partly because no ash becomes mixed with the ore.

Briquetting by Means of a Binding Medium.—The use of slaked lime as a binding medium for fine-grained ore has been known for many years, and it has also been found that briquettes quite suitable for blast-furnace use can be made when the slaked lime is mixed with some granulated basic slag. Compared with other methods this process of briquetting is rather expensive and also considerably reduces the percentage of iron in the briquettes, because from 7 to 8 per cent of binding material, containing no iron, has to be used. Besides this, the briquettes have to be exposed for a considerable time to fresh air in order that the calcium oxide in the briquette may absorb sufficient carbon dioxide, because hydrate of lime as such would lose its water in the upper portion of the blast furnace, and the briquettes would therefore crumble to dust. The transformation of CaO into $CaCo_3$ also means another indirect reduction of the percentage of iron in the ore, not to mention that a great amount of space and extra labour are required for stacking and for keeping the briquettes, in order that this transformation takes place. This method of briquetting ore has therefore not found extensive application.

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* Paper read by Chevalier C. de Schwarz at a meeting of the Iron and Steel Institute.

Burnt lime, either alone or mixed with clay or ashes, has also been tried, but without success. This may easily be understood from the fact that, owing to the presence of steam and carbonic acid in the upper portion of the blast furnace, burnt lime absorbs water and carbonic acid, thus changing into hydrate of lime. These reactions, being accompanied with a certain evolution of heat, cause " upper heat," a serious inconvenience known to every blast-furnace manager. Besides these there are other disadvantages attending the use of lime. Gypsum, as well as cement, has also been tried as a binding medium. The former contains too much sulphur, and neither resists the influence of heat, although the briquettes withstand humidity as well as mechanical influences.

More success has been achieved by using as a binding medium a mixture of sand and slaked lime. Equal parts of these materials are mixed and ground into fine powder, and then intimately mixed with the dust ore. After being moistened the mixture is pressed into briquettes, charged into boilers, and exposed for some hours to the influence of superheated steam under pressure, after which the briquettes are ready for the blast furnace. About 6 per cent of the above-mentioned binding medium is required.

This method of briquetting iron ores depends on the fact that the silica in the sand, owing to the influence of superheated steam, is converted from the insoluble into the soluble condition ready for combination. This method has given very good results in respect of the quality of the briquettes produced, but it has not found very general practice on account of its high working expenses as well as its high initial outlay.

Another method of briquetting, based on the same principle, consists in the use, as a binding medium, of basic blast-furnace slag, which was exposed to steam pressure as mentioned before. However, as nearly 10 per cent of this medium is required to obtain good briquettes, it has been found that the percentage of iron in the ore becomes too much reduced.

Spathic ore, mixed with lime, is also successfully used as a binding medium, provided that the briquettes are exposed to steam pressure for a certain time. This process is based on the fact that hydrate of lime and carbonate of iron (spathic ore), when intimately mixed and exposed to steam pressure, become converted into hydrated ferrous oxide and carbonate of lime (limestone). The former, being of a gelatinous nature, serves as a binding medium and changes later on into hydrated sesquioxide of iron. This process is carried out in the following manner: A mixture of two parts of spathic ore with one part of lime, reduced to powder, is prepared. Of this powder 15 per cent is added to the ore to be briquetted, the whole moistened, whereby the lime is converted into hydrate of lime, and made into briquettes under a pressure of about 6,000 lbs. per square inch. These briquettes are packed edgewise on wagons, after which they are charged into boilers where they are exposed to a steam pressure of eight atmospheres for a period of 4½ to 6½ hours. In case spathic ore alone is to be briquetted an addition of 6 per cent of lime is sufficient. In the latter case cylindrical briquettes of about 5½ in. diameter and 4½ in. in height are generally made.

The briquettes made according to this method are very good but expensive, besides which that plant requires a comparatively high initial outlay.

Great success has been obtained in briquetting blast-furnace flue dust, which is principally due to the fact that this by-product already possesses hydraulic properties, because, like cement, it contains lime, alumina, and soluble silica ready for combination. In addition to this it has been found that by adding certain salts, such as chloride of magnesium, chloride of calcium, green vitriol ($FeSO_4 + 7H_2O$), or acids, such as sulphuric or hydrochloric acid, those hydraulic properties can be raised to such a degree that very suitable briquettes can be made from the dust.

Of those additions chloride of magnesium ($MgCl_2$) has been found to be, generally speaking, the most suitable, because it is cheap (being a by-product in the manufacture of certain artificial manures), and because it does not contain any noxious substances. Owing to the high temperature in the blast furnace, the chloride of magnesium is decomposed into magnesium and chlorine. The former enters into the blast-furnace slag as MgO, and the later combines with hydrogen to form hydrochloric acid. The acid further combines with the free lime to form chloride of calcium, which is finally absorbed by the water used for washing the blast-furnace gases. In some instances it has been observed that the iron portions of the furnace top become slightly attacked, which is ascribed to the presence of hydrochloric acid not fully neutralised.

This process of briquetting, called after the inventor the "Schumacher" process, has given very satisfactory results, not only with reference to the quality of the briquettes produced, but also as far as cost of production and initial outlay are concerned. It must, however, be pointed out that the blast-furnace flue dust used for briquetting must be used almost immediately after having been removed from the catchers, and that, like cement, it must be protected against humidity before briquetting. The installation for briquetting flue dust should therefore be situated in the close proximity of the blast furnace from which the flue dust is taken.

It is to be regretted that this process can only be used for briquetting blast-furnace flue dust. With the exception that in some instances where the chemical composition of the flue dust is particularly favourable to the purpose, an addition of about 40 per cent of purple ore to the flue dust has been found to be admissible, the later thus acting, as it were, as a binding medium to the former.

Another method of briquetting flue dust consists in the use of basic blast-furnace slag after having been exposed to steam pressure. Owing to the influence of compressed steam, the silica in the slag changes from the insoluble to the soluble variety, and combines with the lime in the flue dust to a kind of cement which acts as a binding medium. If the lime in the flue dust is insufficient, another 4 to 4½ per cent is added. The briquettes made in this way are quite suitable, but taking into consideration that from 8 to 12 per cent of binding medium, containing no iron, has to be used, the contents of iron in the briquettes is too much reduced to make this method profitable.

Organic matters, such as the waste lye, resulting (as a by-product) from the manufacture of sulphide cellulose, and molasses have been used for briquetting flue dust as well as other iron ores. In the former case, the lye is concentrated to a syrup, thus constituting a kind of pitch, called "Zellpech" ("cellulose pitch") in Germany, where it is used. On an average about 6 per cent of this binding medium is intimately mixed with the flue dust or ore, and pressed into briquettes under a pressure of not less than 9,000 lbs. per square inch. The briquettes made with "cellulose pitch" are suitable, but as the binding medium is very expensive (40s. a ton), the financial success of this method is rather doubtful.

The use of molasses as a binding medium was tried for briquetting the ferriferous residues of the aniline manufacturing process, as well as for briquetting flue dust, this process being as follows: One part of cheap molasses by volume is mixed with two volumes of silicious sinter ("Kieselguhr"), 0·4 parts by volume of carnallite, and 100 parts by volume of the ore to be briquetted. The briquettes are allowed to dry in the open, after which they are charged into the chambers of an annular furnace, such as is used for burning ordinary bricks. Here they are heated up to 1,000 deg. Cen., when they begin to sinter and to harden.

This method of briquetting is accompanied by high working expenses and considerable initial outlay. The employment is therefore only justified when the by-produce of the aniline manufacturing process, containing about 67 per cent of iron, is to be made into briquettes.

As before mentioned, this process was also tried for briquetting blast-furnace flue dust, but it was abandoned, probably on account of the too high cost.

Besides the above-mentioned methods of briquetting fine-grained ores, or blast-furnace flue dust, etc., there are numerous other methods of briquetting with or without a binding medium. In the former case soluble glass (alkaline silicate), asbestos, basic slag, naphtalin, paraffin, resinous soap, as well as other inorganic and organic materials, are used, and in the latter case smelting is conducted in a reverberatory furnace. Treatment with liquid iron, or in an electric furnace, has been proposed and also tried in practice, but in all cases without result. As there is also no reason to believe that these methods will ever be tried again, the author does not consider it necessary to go into details about them.

Conclusions.—From what has been said it may appear that a universal method of briquetting fine iron ore, fulfilling the conditions enumerated, has not been invented as yet, and probably never will be.

Taking the financial results of the different methods of briquetting into consideration, it is found that the methods of briquetting practised at Kertsch, in Russia, and at Ilsede, in Germany, appear to be the most economic, the working expenses, as reported, amounting only to one shilling per ton of briquettes. As already previously mentioned, this method can, however, only be applied successfully when the ore contains sufficient hydrate of alumina to serve as a medium.

The manufacturing expenses of briquetting by the Gröndal process amount to 3s. 4d. per ton of briquettes, exclusive of general expenses, redemption, and royalties, for which at least 1s. 4d. will have to be added, thus resulting in a total expense of 4s. 8d. per ton of briquettes. This would be far too high to allow of the general introduction of this process. However, the Gröndal process is of particular value for Sweden, where its use has become almost unavoidable in order to be able to utilise the iron ore of that country; besides, its use is, in Sweden, combined with a saving of 6s. 6d. per ton briquettes in fuel, thus resulting in a final saving of 1s. 10d. (6s. 6d. − 4s. 8d.) per ton in favour of the Gröndal process. Similar results may also be obtained with this process where charcoal is used as fuel in the blast furnace.

Of all the different methods employed for briquetting blast-furnace flue dust, the "Schumacher" process has given the best financial results, the cost of briquetting according to that method amounting to 1s. 8d. per ton briquettes only, without royalty.

The other methods of briquetting iron ore flue dust and other ferruginous residues of other industries, as described before, have given less favourable financial results, the cost of briquetting amounting from 2s. 6d. to 3s. 9d. per ton briquettes. Besides this, it must be mentioned that where a binding medium is used on an average about 7 per cent is required to be added to the ore, thus reducing considerably the percentage of iron. In several cases it has also been found necessary to stack the briquettes for several weeks in the open before they could be used, thus requiring a good deal of space and extra labour for transporting and handling.

Finally, it may be mentioned that at present an establishment for making briquettes is being erected at a Belgian works according to a new process recently introduced. According to this method from 2½ to 4½ per cent of binding medium, costing about 16s. a ton, is used. The initial outlay for a plant turning out five tons of briquettes an hour amounts to about £2,500, and the manufacturing expenses, inclusive of general expenses, to 1s. 6d. per ton briquettes. The briquettes fulfil all the conditions enumerated, and can be used within 24 to 36 hours after having left the press, no heating or any additional work being necessary. By this method not only fine ore but also rolling mill and forge scale (Fe_3O_4) have been briquetted with success, the latter having been successfully used as an enriching and decarbonising addition in the open-hearth furnace.

THE ECONOMICAL PRODUCTION OF STEAM.

At a recent meeting of the Lancashire Branch of the British Association of Textile Managers a paper was read by Mr. G. B. Storey on "The Economical Production of Steam." The author devoted the first and major portion of the paper to a dissertation on the means for utilising to the fullest extent the calorific value of fuel. Mr. Storey considers that in time hand stoking would entirely disappear. The use of mechanical stokers obviated the necessity of the frequent opening of the furnace doors and the admission of cold air, secured a more regular distribution of fuel, and made the working of the boiler less dependent on the human element. The coking type of stoker he thought to be more economical than the sprinkling type and also more effective for the prevention of smoke. Although he intended to approach the question of smoke abatement entirely from the economic point of view, he could not refrain from recognising the good work done by some of the smoke abatement societies. These societies had gone to a great deal of trouble to awaken steam users to the fact that smoke was an indication that the fuel was not being used to the best advantage. Through the efforts of these societies many steam users had been compelled to work their boilers more economically. Smoke was caused in three ways. It might be produced immediately after fresh coal was thrown on the fire as a discharge of volatilised fuel; it might be caused by a supply of air insufficient to burn the carbonic oxide formed in the furnace, or by the sudden cooling of the gases in the furnace, or by an excessive air supply. In any case, of course, smoke was a direct loss of fuel. There was a further loss, often overlooked, arising from the accumulation of soot on the boiler plates and the flues. This was of great importance, because a slight coating of soot or "scale" was sufficient to affect seriously the efficiency of the boiler. Bad stoking and insufficient draught were the chief causes of smoke. A large number of appliances had been introduced for the prevention of smoke, some of which had met with considerable success, but he was of opinion that special appliances were not necessary. If the boiler plant was well arranged with mechanical stokers and sufficient induced draught, complete combustion could be obtained, and on complete combustion depended both economy in the production of steam and the prevention of smoke.

METAL MARKETS.

NOVEMBER.

Pig Iron.—The market for pig iron is quiet but steady, values all round being well maintained, and traders continuing to speak most hopefully of the future. A highly satisfactory feature of the market is that more has to be paid for forward than for early delivery. Shipments for the month have been excellent, the total despatches reaching 106,858 tons. At the end of the month Messrs. Connal and Co., the warrant store keepers, had in stock 506,965 tons of Cleveland pig iron composed of 458,142 tons of No. 3 Cleveland, 37,385 tons of other kinds of iron deliverable as standard, and 11,438 tons of other kinds of iron not deliverable as standard.

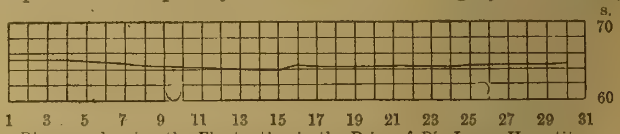

Diagram showing the Fluctuation in the Price of Pig Iron—Hematite.

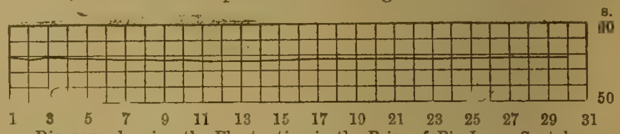

Diagram showing the Fluctuation in the Price of Pig Iron—Scotch.

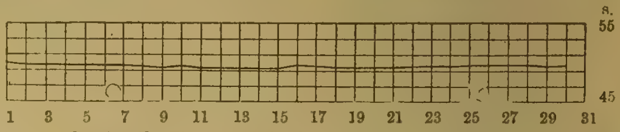

Diagram showing the Fluctuation in the Price of Pig Iron—London, Cleveland.

Copper.—The market for copper steadily rose during the first of the month, after which it gradually declined towards the middle of the month, when it again rose for a few days, and again falling, rose soon after and remained fairly constant until near the end of the month, when it gradually declined, closing at £57 5s. for cash.

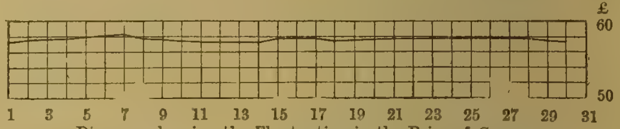

Diagram showing the Fluctuation in the Price of Copper.

Tin.—The market for tin began at the commencement of the month at £157 5s., dropping after the first fortnight to £152 15s., but rising again sharply to £156 10s. From the middle of the month the price fluctuated considerably with, however, a general upward tendency until it reached £170 10s., falling during the latter days of the month to £168 15s.

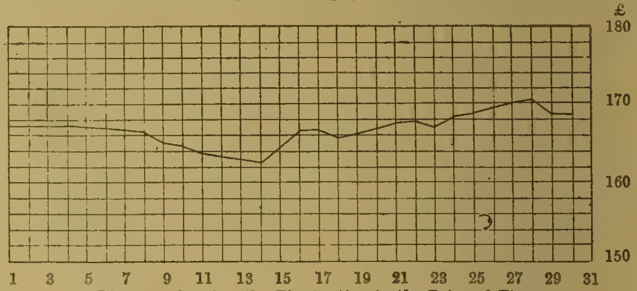

Diagram showing the Fluctuation in the Price of Tin.

Lead.—The market of this metal remained fairly constant during the month.

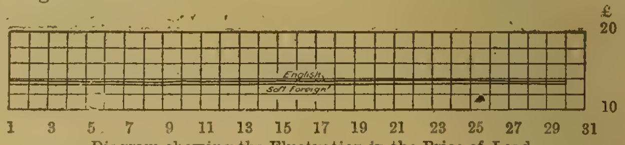

Diagram showing the Fluctuation in the Price of Lead.

Spelter.—The price of spelter g.o.b. remained fairly constant during the month, rising slightly until towards the end of the month and then falling.

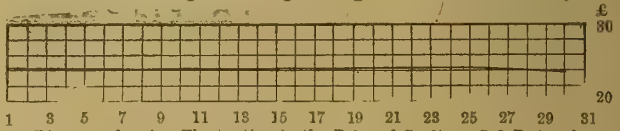

Diagram showing Fluctuation in the Price of Spelter—G.O.B. (good ordinary brand.

TRADE NOTES.

Messrs. Kermode's Liquid-Fuel System, Liverpool, are reported to have received the order from Messrs. Vickers, Sons, and Maxim for an outfit of their patent pressure jet liquid-fuel system for a cruiser of the Imperial Chinese Navy; also an order from Messrs. William Arnott, Coatbridge Ironworks, for their steam jet liquid-fuel system for 12 Lancashire boilers; further, an order from the Power-Gas Corporation Ltd., Stockton-on-Tees, for their liquid-fuel system for burning Mond gas tar.

Messrs. Willans and Robinson Ltd., of Rugby, England, for the past five years have manufactured Diesel engines for the Diesel Engine Co., of London. The company have now, however, made arrangements for placing the engine on the market themselves, and for dealing direct with customers, both in Great Britain and for export. The Diesel engines are made by them in sizes ranging from 120 B.H.P. up to 600 B.H.P.

We are asked by the **Lancashire Dynamo and Motor Co. Ltd.,** Trafford Park, Manchester, to state that the system of electrical drive as described in *The Practical Engineer* of November 18th in the article on "An Improved Planing Machine" is known as the "Lancashire" system, and is the firm's own design and manufacture.

Order for Motor Boats.—It is reported that **Messrs. John I. Thornycroft and Co. Ltd.,** Woolston Works, Southampton, have on hand three motor passenger boats, which have been ordered for service on the Euphrates and Tigris. The boats are 63 ft. long overall by 9 ft. 6 in. wide, and at full load and full speed draw 2 ft. 6 in. of water. The boats have twin screws driven by two sets of Thornycroft 47 B.H.P. paraffin motors, running normally at about 500 revolutions per minute, but capable of being accelerated up to 800 revolutions per minute, placed in the middle of the boat. A tank containing 60 gallons of paraffin is fitted in the steering platform. The first-class accommodation, for 30 passengers, is forward and the second class, for 20, aft. At the full-speed trials of the first of these boats, finished in eight weeks from the time of laying the keel plate, a speed of 13·4 knots, or 1·4 knot more than was guaranteed, was obtained, the total displacement at the time being 12½ tons.

Locomotives.—**Messrs. Robert Stephenson and Co. Ltd.,** Darlington, are said to have received an order from the Ottoman Railway Co. for 12 locomotives, required for service on the railway from Smyrna to Aidin. The order comprises three of the 0—6—2 type, with inside cylinders 18 in. by 26 in.; six with the 0—6—0 wheel arrangement, with six-wheeled tender, will be generally similar to those of the same type now in service on the Ottoman Railway; and three of the 0—8—2 tank type will be of a new design for this railway. The tanks in the last case will carry 1,900 gallons, and bunker space is provided for four tons of fuel, the weight of the engines in working order being about 80 tons. The Darlington works have on hand an order for heavy goods engines for the Madras and Southern Mahratta Railway. The first of these engines are of the Engineering Standards Committee 2—8—0 type, with six-wheeled tenders, modified to suit the Madras and Southern Mahratta Railway practice in regard to details. The cylinders are 20 in. in diameter by 26 in. stroke, coupled wheels 4 ft. 8½ in. diameter, heating surface 1,921·5 square feet, grate area 32 square feet, a working pressure of 180 lbs. per square inch, and a weight in working order of about 72 tons. The second batch will be fitted with Schmidt's superheaters, and have cylinders 22 in. in diameter, with a working pressure of 160 lbs. per square inch, but otherwise will be similar to those in the first batch.

Grand Prix Award.—We hear that **Messrs. Alfred Herbert Ltd.,** machine tool makers, Coventry, have been awarded the grand prix for their exhibit at the Buenos Ayres exhibition.

Prospective Orders for New Ships.—It is reported that if the shipbuilding lock-out is removed shipbuilders in the lower reach of the Clyde will at once fix orders for 15 large-sized vessels. Never before had Clyde shipbuilders so many orders on the tapis for large-sized cargo boats. The removal of the lock-out would lead to **Messrs. Caird and Co.,** Greenock, securing an order for a large armoured British cruiser of superior speed and gun power to any ship in the navy.

The New Cunard Liner.—The Cunard Co., of Liverpool, have invited tenders for the construction of the new 50,000 tons passenger steamer. The specifications are complete, and it is expected that the order will be placed before Christmas. Messrs. Swan, Hunter, and Wigham Richardson Ltd., Wallsend, are tendering for the hull of the vessel, the Wallsend Slipway and Engineering Co. for the engines, and Messrs. John Brown and Co., Clydebank, for both hull and engines.

LAUNCHES AND TRIAL TRIPS.

Kirkwood.—Messrs. Robert Thompson and Sons Ltd. have launched from their Southwick Yard, Sunderland, the finely-modelled self-trimming collier Kirkwood, built to the order of Messrs. Wm. France, Fenwick, and Co. Ltd., of London and Sunderland. The vessel is a sister ship to the Wedgwood, recently built by them for the same firm, and is of the raised quarter and well-deck type, and built to the highest class at Lloyd's. Her principal dimensions are: Length overall, 274 ft.; breadth, 38 ft.; depth moulded, 18 ft. She will carry about 2,310 tons dead weight on a light draught of water. She is fitted with bulb-angle framing, the holds being left clear of all obstructions. There are four very large hatchways arranged to make her perfectly up to date as a self-trimmer and to facilitate rapid loading. Four powerful steam winches with latest improvements are supplied, with steam from a large vertical donkey boiler, and in addition to the usual derricks four gaffs are fitted, the masts being strengthened for this purpose. To enable her to make quick return voyages, ample water ballast is provided throughout the cellular double bottom and in fore and after peaks, the former being divided longitudinally and athwartships for trimming purposes, and fitted with large tank suction pipes and extra large ballast donkey for quickly pumping out water ballast. The inside of holds, bunkers, and engine and boiler room tanks are coated with enamel. The engines, of the triple-expansion type, are by the North-Eastern Marine Engineering Co. Ltd., Sunderland, having cylinders 21½ in., 36 in., and 59 in., with a stroke of 39 in., steam being supplied by two extra large boilers working at 180 lbs. pressure.

Bury.—Dimensions: 265 ft. by 36 ft. by 18·6 ft. moulded. Built by Messrs. Earle's Shipbuilding and Engineering Co., Hull, to the order of the Great Central Railway Co., for passenger and cargo service between Grimsby and Hamburg. The vessel is of one deck type, with poop, long bridge, and topgallant forecastle. She will be provided with a special type of steam, hand, and telemotor steering gear. Steam heating, electric lighting, bells, and telephone will be fitted, as well as two sets of Welin quadrant davits. The machinery will consist of triple-expansion surface condensing engines having cylinders 22 in., 35 in., and 60 in., by 42 in. stroke, indicating about 2,000 H.P. Steam will be supplied by two cylindrical boilers working at 180 lbs. pressure.

Sachsene.—A steel screw steamer, built by Messrs. Harland and Wolff, Belfast, to the order of the Hamburg-American Line. The vessel has a tonnage of 8,000, and is intended for the Eastern cargo trade.

Anticosti.—Dimensions: 389 ft. by 52 ft. by 30·9 ft. Built by Messrs. Short Bros., Sunderland, to the order of Messrs. H. F. and W. Roberts, Liverpool. This steamer has been specially designed to be chartered for carrying coal for the Dominion Coal and Iron Co., Sydney (C.B.), and is so designed that the cargo and bunkers will be entirely self-trimming. She is built on the Isherwood system to take Lloyd's highest class. The propelling machinery will be fitted by the North-Eastern Marine Engineering Co., Sunderland, and consists of engines with cylinders 26 in., 44 in., and 73 in. diameter, with a stroke of 48 in., taking steam from three large multitubular boilers working at 160 lbs. pressure, and fitted with forced draught. To enable the large quantity of water ballast to be expeditiously handled, two large ballast pumps are fitted capable of discharging 300 tons per hour.

Cabral.—A steel screw steamer. Dimensions: 174·6 ft. by 35 ft. by 9 ft., with a gross tonnage of about 480 tons. Built by Messrs. Napier and Miller, Old Kilpatrick, to the order of Messrs. James Pollock, Sons, and Co., London. The vessel is rigged as a two-masted schooner, with main, promenade, and awning decks. The vessel, which is intended for passenger and cargo trade on the Amazon, has been fitted with refrigerating plant, with cold storage chamber, electric light, steam windlass, steam steering gear, and two steam winches. The machinery, which will be supplied by Messrs. Miller and Macfie, Glasgow, will consist of compound engines and one large main boiler and donkey boiler.

Escrick.—The steel screw steamer Escrick, which is the nineteenth vessel built by Messrs. Wm. Gray and Co. Ltd. to the order of the London and Northern Steamship Co. Ltd. (Messrs. Pyman Brothers, London, managers), was taken to sea for her trial trip on the 25th November. The Escrick has been built to Lloyd's highest class, and is of the following dimensions, viz.: Length over all, 395 ft.; breadth, 53 ft. 6 in.; and depth, 25 ft. 5 in. The hull is built with deep bulb-angle frames, dispensing with hold beams, and leaving large clear holds, cellular double bottom, and fore and aft peak ballast tanks. Ten steam winches are provided, as well as derrick tables and outriggers and double derricks, steam steering gear amidships, hand screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, fresh water distiller, steel grain divisions, stockless anchors, telescopic masts, boats on deck overhead, and all the requirements for a first-class cargo steamer. Triple-expansion engines have been supplied by the Central Marine Engine Works of the builders, having cylinders 25 in., 41 in., and 68 in. diameter, with a piston stroke of 48 in. The cylinders have very large port openings to ensure an easy passage of the steam and so obtain the maximum efficiency from it. The main condenser has also been designed to maintain a high vacuum in all seas, whilst special attention has been given to ensure a high temperature in the boiler feed water. During the trial a vacuum of 28¼ in. of mercury as measured by thermometer gauge was maintained. Steam is generated in two large steel boilers adapted for a working pressure of 180 lbs. per square inch. The engine room auxiliaries include a number of duplex pumps of the builders "C.M.E.W." type, and also one of their large "C.M.E.W." evaporators. Special attention has been paid in the design and construction of the vessel and machinery to ensure the utmost economy in fuel and upkeep, and the special features named above will enable the maximum amount of cargo to be carried at a fair average speed on a very low consumption of coal.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 1st December, 1910.

BELFAST.—*Second class :* R. Gamble, T. Williamson.

CARDIFF.—*First class :* R. R. Thomas, N. Grunnah, P. Harris, W. E. Harris. *Second class :* D. E. Johns, C. A. Johnson, W. M. Power, W. Richards, A. J. Shaw.

FALMOUTH.—*First class :* W. P. Rogers.

GLASGOW.—*First class :* J. A. M. Macdonald, C. E. Edridge, S. Nelson. *Second class :* J. G. Gray, J. Birrell, W. Milne, W. W. Neil, J. Wyllie, D. M. Cameron.

LEITH.—*First class :* D. Mackie, F. McL. Jupp, R. O. Rendall, J. Macdonald, F. M. McChesney, A. H. McIntosh, A. McLeod, P. Millar. *Second class :* R. Glass.

LIVERPOOL.—*First class :* W. Roberts, R. H. Jones, H. W. May, R. A. Patterson. *Second class :* G. Brownless, J. M. Shirley, L. J. Lee, J. E. Holland, S. J. Gidman, W. L. Hughes.

LONDON.—*First class :* S. De Ritter. *Second class :* D. F. McDougall, H. Peters, W. M. Craig, C. Willis.

NORTH SHIELDS.—*First class :* J. Hardy, L. C. Robson, S. Shaw. *Second class :* D. L. Havard, L. Maller, E. Scherffenberg-Moller.

SOUTHAMPTON.—*First class :* E. M. Eduljee. *Second class :* G. H. French, A. Forsyth.

PASSING IN STEAM.

LONDON.—C. Elliott.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2287. **Balance Ring Slide Valves.**—I should be glad if some reader would explain the nature, object, and applications of balance ring slide valves; what are the advantages and disadvantages of same, and how far are they used?—M. T.

[For an answer to this query "M. T." is referred to the article on the subject which will be found in the current issue.—ED.]

2293. **Cost of Engines and Boilers.**—I should be obliged if some of your readers would give me a few reliable figures on the cost of installing and maintaining various types of engines and boilers. Also the costs of fuel, wages, and supplies per annum (on a "per H.P." basis throughout).—MULTO.

2294. **Steel Chimney.**—State the advantages and disadvantages of steel chimneys; give notes on their proportions (including limiting height); give a rule for their weight, and express opinion as to their safety against wind and lightning.—STEEL

2295. **Inertia Governors.**—Would some reader kindly tell me where I can find descriptions of inertia type governors, *i.e.*, governors which are operated by the inertia forces called into play by imparting a reciprocating motion to a heavy mass. What are the advantages and limitations of this type of governor?—F. B.

MISCELLANEA.

COST OF RADIUM.—The 1·700 of an ounce of radium, which it is stated that Mr. J. W. Gifford, of Chard, intends presenting to the Middlesex hospital, is valued at £600.

PARIS MOTOR SHOW.—Special exhibition cars fitted with the Rudge-Whitworth detachable wheels will be on show at the stand of La Hispano Suiza, Salon de Paris Exhibition, opened December 3rd.

FLUX FOR BRAZING CAST IRON.—A good flux for use in brazing cast iron can be made by mixing 1 lb. of boric acid, 4 oz. of pulverised chlorate of potash, and 3 oz. of carbonate of iron. To make a good brazed joint the metal should be carefully cleaned and the pieces heated to a bright red before applying the flux.

THE West Ham Corporation Electricity Department issues quarterly a publication dealing with the industries of the district. The current issue deals with the flour mills of Silvertown, and the work of the West Ham Municipal Technical Institute is also noted. The publication should certainly interest any firm looking out for a site for works.

IN a paper presented before the Iron and Steel Institute, it is stated that almost any degree of refining can be economically carried out in the electric furnace, and the removal of sulphur, phosphorus, and oxygen is said to be extremely easy. It is therefore predicted that steel refined by electricity will largely replace ordinary crucible steel in comparatively few years.

CONDENSING engines which are liable to be lightly loaded for any length of time should be provided with a safety device that will break the vacuum when the water rises to a certain height in the condenser. Unless this is done the condenser may be flooded and the engine wrecked, should the speed of the air pump slacken enough to allow the water to back up in the cylinder.

TO OBTAIN TIGHT PIPE JOINT.—When as sometimes happens the threads on a pipe are cut slightly too small on a lathe and it screws right up to the shoulder, the *American Machinist* recommends the use of brass wire cloth 60 or 80 meshes to the inch. A piece of this cloth may be wrapped round the pipe and daubed with red lead or litharge, and the pipe screwed home with the wire cloth in the joint, and the latter will neither leak or come loose.

TO MARK ON STEEL OR IRON.—To make a good durable mark on smooth iron or steel without etching it or making any marks or scratches in it, dip your pencil or scriber in bluestone and make the marks you wish on the steel with it. These will, of course, be copper coloured, but black marks can be made by rubbing over with lead pencil while the marks are wet. These marks will stand all ordinary usage, but can be removed with emery cloth or scraper.

TRADE EXHIBITION.—A National Trades Exhibition is to be opened at Bingley Hall, Birmingham, from March 20th to May 27th, 1911, the proceeds to be devoted to establishing a new home for consumptives on Romsley Hill. The president is the Lord Mayor of Birmingham, and there is a strong list of vice-presidents. The exhibits will comprise electrical, engineering, trades, inventions and manufactures, scientific and educational exhibits, and objects of art.

LOOSENING TIGHT NUTS.—After the ordinary methods for removing stubborn nuts that have become tight from rust have failed the following is a very good and unique method of loosening it. Heat an open-end wrench that fits the nut and while hot place it on the nut and allow it to remain for two or three minutes. The heat will cause the nut to expand and it can then be taken off with ease. A heated wrench gives much better results than a blow torch, as the torch will heat the nut and bolt at the same time, where the hot wrench only heats the nut.

NEW PLATINUM ALLOY.—A manufacturing jeweller of Elizabeth, N.J., has patented a platinum alloy which, it is claimed, is a substitute for pure platinum for many purposes, and costs very much less. It melts at a temperature 600 deg. lower than platinum and does not corrode or tarnish under the influence of the atmosphere or acid fumes, but is slightly discoloured by sulphur. It is said to wear better than gold. It is being used for diamond mounting and jewellery, and it is believed will make good ignition points for sparking plugs, and possibly also may be available for use in cauterising instruments and wood-burning tools.

OSRAM·LAMPS

PATENTEES' CHRONICLE

of

Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

NOVEMBER 28th, 1910.

27582 Cocks. Marshall.
27583 Bottle. Peake.
27584 Sash bolt. Roach.
27585 Belt conveyor. Durant.
27586 Water closets. Thompson.
27587 Fire places. Musgrove.
27588 Drains, etc. Musgrove.
27589 Shutters. Moyses.
27590 Boot trees. Malkin.
27591 Valves. Hitchins.
27592 Carriage windows. Garland.
27593 Medicator. Verity.
27594 Switchback. Taylor
27595 *Incubators. Miller.
27596 Road wagons. Barr.
27597 Valves. Tibbetts.
27598 Shade support. Aspden.
27599 *Safety razor. Kampfe.
27600 *Recovery of copper. Vereinigte.
27601 Shirt cuffs, etc. Sharp.
27602 Petrol cans. Lindblom.
27603 Hand warmer. Harmer.
27604 Tyres. Wynne.
27605 Ratchet. Thomas.
27606 Motor starters. Pyatt.
27607 Tin opener. McKimm.
27608 Hay presses. Gaskill.
27609 Pump. Poynton.
27610 *Aerial machine. Montgolfier.
27611 Road vehicles. Royce
27612 Turbines. May.
27613 Golf clubs, etc. Cole.
27614 Railways. Chapman.
27615 Cycle frame. Robb.
27616 Moulds. Sellars.
27617 Horse shoe frost clogs. Barker.
27618 *Looms. Comellas.
27619 Under garment. Wilde.
27620 *Garden shears. Clark.
27621 Issuing metal tickets. Hassam.
27622 Saw setting. Lambley.
27623 Match striker. Hodson.
27624 Speed gear. Wirtz.
27625 Blankets, etc. Gibson.
27626 Cycle dress guard. Sargent.
27627 Dye manf. Newton.
27628 Hinges. Beste.
27629 *Folding mechanism. Newton.
27630 *Screw thread taps. Minne.
27631 *Billiard table. Scott.
27632 Stoppers. Towersey.
27633 *Model building. Pousset.
27634 *Cycle. Ehrenberg.
27635 Rails. Thomson.
27636 *Dye manf. Lucius.
27637 *Dye manf. Lucius.
27638 Guns. Völler.
27639 *Dye manf. Bloxam.
27640 *Dust pans. Drechsler.
27641 Lamps. Oldham.
27642 Billiard table. Crabb.
27643 *Bottle. Ward.
27644 *Mail delivering device. Middlebrook.
27645 *Furnace. Muller.
27646 *Utilising power of the surf. Zammeris.
27647 Treatment of zinc. Cowper-Coles.
27648 Treatment of iron, etc. Cowper-Coles.
27649 Clips. Whiteley.
27650 *Pneumatic tool. McDonald.
27651 *Small arms. Mauser.
27652 *Electric train indicator. Alwies.
27653 *Production of solids. Storti.
27654 *Torpedoes. Whitehead.
27655 *Preserving fish, etc. Hanssen.
27656 *Flushing apparatus. Marks.
27657 *Cooling apparatus. Prat.
27658 *Internal-combustion engine. Jörgensen.
27659 *Internal-combustion engine. Pengeot.
27660 *Internal-combustion engine. Pengeot.
27661 *Internal-combustion engine. Pengeot.
27662 *Internal-combustion engine. Pengeot.
27663 *Looms. Frank.
27664 Treatment of gas. Barry.
27665 *Clips. Dieckmann.
27666 *Boots, etc. Sengermann.
27667 Hose pipe. Koopman.
27668 Door handle. Koopman.
27669 Brooch pins. Broughton.
27670 Type casting machine. Grant.
27671 Infant bathing device. Witt.
27672 *Airships. Bradford.
27673 *Vehicle wheels. Barrett.
27674 Power transmission. Ryan.
27675 Door lock. Sinnberg.
27676 Coupling. Sinnberg.
27677 *Railway ties. Miller.
27678 *Furnace. Smith.
27679 Gas stoves. Barrett.
27680 *Tool holder. Becker.
27681 *Tyre. Braibant.
27682 Concrete. Cowper.
27683 Tobacco cartridges. Vogel.
27684 Metallic piling. Lebas.
27685 Internal-combustion engine. Russelt.
27686 *Pressure gauge. Faries.
27687 Valves. Boult.
27688 *Steel manf. Thiel.
27689 *Horse shoes. Bain.
27690 *Artificial emery. Decamps.
27691 Hooks. Smyth.
27692 *Motor vehicles. Cyklon.
27693 *Bread. Löhnert.
27694 Boots, etc. Wienskowitz.
27695 *Aeroplanes. Raiser.
27696 *Electrical device. Cabot.
27697 Treating coal, etc. Everett.
27698 Internal-combustion engine. Keiller.
27699 *Propellers. Fulda.
27700 Tube manf. Lloyd.
27701 *Drilling apparatus. Justice.
27702 *Fluid pressure regulator. Gay.
27703 *Fluid pressure regulator. Gay.
27704 *Bodkin. Houigmud.
27705 *Pen handles. Kehoe.
27706 Gas cookers. Meyer.
27707 *Novelty illusion. Black.
27708 *Surf pump. Snare.
27709 Book marker. Gurnsey.
27710 Electric lamp. Lichtwerke.

NOVEMBER 29th, 1910.

27711 Trolley wire coupling. Mather.
27712 *Cut-out. Dorman.
27713 *Weather protector. England.
27714 Camp bed. Taylor.
27715 Carburetter. Weller.
27716 Tobacco pipe. Short.
27717 Hair, etc., clippers. Smushall.
27718 Sand distributor. Symonds.
27719 Massage appliance. Levens.
27720 Wire mattress. Siddall.
27721 Motor vehicles. Fielding.
27722 Whistles. Hudson.
27723 Trams. Quibell.
27724 Spring shoes. Leech.
27725 Trucks. Leech.
27726 Motor vehicles. Standing.
27727 Cycle saddle cover. Quick.
27728 Condenser tube cleaner. Barron.
27729 Billiard table. Marshall.
27730 Soldering aluminium. Rae.
27731 Tyres. Webster.
27732 Graphical recorder. White.
27733 Bottle measure device. Chambers.
27734 Knife. Priestman.
27735 Bobbin. Hill.
27736 *Wire rope manf. Gore.
27737 Port light. Laverick.
27738 *Cooler. Levick.
27739 Carburetter. Wall.
27740 *Steam engine. Neukomm.
27741 *Treatment of ores. Gabrielle.
27742 Gas burner. Coventry.
27743 Bedstead. Crane.
27744 *Mosaic tiles. Kuttner.
27745 Table napkin. Mackarness.
27746 Ships' lights. McNeil.
27747 Pipe leak stopper. Cook.
27748 Boot manf. Roylance.
27749 Clamp. Moore.
27750 Advertising device. Purslow.
27751 Advertising device. Purslow.
27752 Railway signalling. Findon.
27753 *Engine. Kieffer.
27754 *Engine. Kieffer.
27755 Lamp manf. Edmundson.
27756 Door fastener.
27757 Cycles, etc. Kirk.
27758 Heating apparatus. Bell.
27759 *Buttons. Paret.
27760 Speed gear. Westaway.
27761 Filter. Westaway.
27762 Propeller. Westaway.
27763 Bank note, etc., securing. Bawtree.
27764 *Moulding device.
27765 Advertising device. Beville.
27766 *Calendar. Floessell.
27767 *Button setting machine. Lake.
27768 *Printing press. Crump.
27769 *Spur gear. Perrot.
27770 Bradawl. Harnden.
27771 Piano sound boards. Saville.
27772 Heat transmission. Still.
27773 Steam generator. Still.
27774 Tubes. Still.
27775 Heat transmission. Still.
27776 Ladders. Hammerston.
27777 *Warp thread placing machine. Hathaway.
27778 Turbine. Wood.
27779 Cash conveyor. Samson.
27780 *Saws. Kratzenberg.
27781 *Conveying table. Knacke.
27782 Treatment of fermentable substances. Stevenson.
27783 *Ball bearing. Barthel.
27784 *Cinematographs.
27785 *Cinematograph films.
27786 Cinematograph apparatus.
27787 Tyres. Cooke.
27788 Hat trimming. Gallatin.
27789 Boot manf. Boult.
27790 *Food cooker. Gonella.
27791 Lasting machine. Boult.
27792 *Aeroplane. Deperdussin.
27793 *Bits, etc. Robergee.
27794 Time recorder. Driel.
27795 Internal-combustion engine. Kirkcaldy.
27796 Liquid vaporiser. Kirkcaldy.
27797 Lamps. Partridge.
27798 *Tracks. Sefton-Jones.
27799 Heating apparatus. Woods.
27800 *Linoleum manf. Thompson.
27801 *Sewing machine. Thompson.
27802 *Sewing machine. Thompson.
27803 Folding steps. Oldbury.
27804 *Electrical insulators. Speakman.
27805 Ventilator. Reitz.

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27806 Steering, etc. Harper.
27807 Cement. Pennington.
27808 Utilisation of heat. Gilmour.
27809 Work basket. Shrubsole.
27810 Fluid meter. Shone.
27811 Treatment of fibrous substances. Birch.
27812 Collar stud. Warren.
27813 Tobacco cartridges. Garsed.
27814 Cranes, etc. Harlow.
27815 Looms. Conyers.
27816 Water purifying. Baldwin.
27817 Sample bag. Sweeney.
27818 Stone drying. Hill.
27819 Pulley. Rose.
27820 Ball and lever valve. Davies.
27821 Boot, etc., manf. Parkes.
27822 Clock. Crisp.
27823 Piano hammer. Duncan.
27824 Piano player. Asbury.
27825 Electric switch. McFarlane.
27826 Hat hanger. Preece.
27827 Water lifting. Gass.
27828 Stair rod. Hutton.
27829 Caps. Bliss.
27830 Box. Athey.
27831 Hair crimper. Taylor.
27832 Planing device. Brown.
27833 Iron manf., etc. Anderson.
27834 Stoves. Shorland.
27835 *Bayonet. King.
27836 *Engine. Foxlee.

27837 Engine. Meyerhofer.
27838 Spinning spindles. Clark.
27839 Window rod. Hill.
27840 Wheels. Forrester.
27841 Pipe. Provost.
27842 Reamer. Josh.
27843 Manf. of oil gas. Lamkin.
27844 Ladies' veil adjuster. Midgeley.
27845 *Yeast manf. Kruis.
27846 *Lubricators. Pedersen.
27847 Curtain rod. Perrett.
27848 *Gas generator. Lieblich.
27849 *Internal-combustion engine. Mikkelsen.
27850 Bullet. Bayliss.
27851 Ships' cargo battens. Dobson.
27852 *Table centre. Morris.
27853 *Tailors' measure. Dressel.
27854 Wheels. Starkloff.
27855 *Hand rammer. Kaye.
27856 Pipes. Schönewald.
27857 Telephone handle. Born.
27858 Sign painting. Werven.
27859 Pump. Buchenhain.
27860 *Telephone calls. Siemens.
27861 Dye manf. Newton.
27862 Door fastening. Kitteridge.
27863 Speed gear. London.
27864 Tyres. Barry.
27865 Mudguards. Birt.
27866 *Tube connecting. Milward.
27867 Lead oxide manf. Barton.
27868 *Camphor. Dupont.
27869 *Boat baths. Flechsenberger.
27870 *Paint brush. Olsen.
27871 *Steering aerial machines. Sparmann.
27872 *Pince-nez, etc. Imray.
27873 Gas producer. Weil.
27874 Golf clubs. Legh.
27875 Postcards. Harper.
27876 *Airships. Robiola.
27877 Shoes, etc. Payne.
27878 *Cellulose manf.
27879 *Flushing cistern. Smith.
27880 Stocks and dies. Manley.
27881 Soap holder. Lamb.
27882 Mirrors. Conczy.
27883 Engine valve. Shuman.
27884 Engine valve. Shuman.
27885 Engine valve. Shuman.
27886 Obstetric binders. Stockman.
27887 *Life saver. Bryant.
27888 *Safety device. Lannes.
27889 *Sound recording. Pintsch.
27890 *Keyboard instrument. Clutsan.
27891 Hat. Cash.
27892 *Tube polishing. Werth.
27893 Street gulleys. Amalric.
27894 Bottle stopper. Gracey.
27895 Locking nut.. Larmad.

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27896 Rivet. Wagner.
27897 Speed device. Thomas.
27898 Safety guard. Millar.
27899 Tobacco pipe cleaner. Holt.
27900 Hat spring. Eschweg.
27901 Box. Anton.
27902 Grinding machine. March.
27903 Switch. Tucker.
27904 Electrotyped plates. Nelson.
27905 Silencer. Jacks.
27906 Cycle wheels. Dawes.
27907 Flying machine. Gaunt.
27908 Gas stoves. Townsend.
27909 Bedstead. Winnard.
27910 Yarn curling. Field.
27911 Wheel. Wilkinson.
27912 Carbide sifter. Steadman.
27913 Ventilator. Geofries.
27914 *Boot manf. Sattler.
27915 Weighing machine. Benton.
27916 Clocks. Morse.
27917 Boiler. Currah.
27918 *Wheels. Byars.
27919 Bakers' oven. Callow.
27920 Cloth Waterproofing. Curbishley.
27921 Lamp fittings. Watson.
27922 Signalling device. Case.
27923 Door lock. Westley.
27924 *Spinning machine. Grahein.
27925 *Window blinds. Meijden.
27926 *Paper displaying. Oliver.
27927 Toaster. Stokes.
27928 Cork extractor. Schmidt.
27929 Walking sticks. Kast.
27930 Bottle protectors. Bucci.
27931 Envelopes. Floyd.
27932 Signals. Edmunds.
27933 Pince-nez. Enlenfeld.
27934 *Gas engine. Golly.
27935 Motors. Venner.
27936 Compounds. Borchardt.
27937 Gulleys. Browne.
27938 Carburetter. Ionides.
27939 *Jointed figures. Schoenhut.
27940 *Water heater. Hart.
27941 *Milk cans. Allese.
27942 *Arc lamp.
27943 Cigar case. Ronaldson.
27944 *Looms. Roma.
27945 *Acoustical instruments. Lumiére.
27946 Ground detectors. North.
27947 Tobacco pipes. Meza.
27948 Lamp. Cuninghame.
27949 Dye matter. Bloxam.
27950 Perforating paper. Gill.
27951 Telephone relays. Pritchard.
27952 *Whiffletrees. Davey.
27953 Aerating liquids. Lloyd.
27954 Electric heater. Read.
27956 *Flying machine. Goara.
27957 *Ships' moorings. Conoley.
27958 *Tweezers. Prankard.
27959 *Pencil. Levy.
27960 Advertising device. Dixon.
27961 *Humidity regulator. Lake.
27962 *Cuff holder. Baumann.
27963 *Armour plate. Spadoni.
27964 Internal-combustion engine. Lunes.
27965 *Injector. Meyer.
27966 Pipes. Clark.
27967 *Printing press. Justice.
27968 *Printing press. Justice.
27969 *Printing press. Justice.
27970 Printing press. Justice.
27971 Box. Moss.
27972 Bed. Fraser.
27973 Printing device. Hoddle.
27974 *Bracelet. Jaeger.
27975 Can lid. Waller.
27976 Fills. Peters.
27977 Rust preventative. Peters.
27978 Rust preventative. Peters.
27979 Motor. Collins.
27980 *Clothing. Altermatt.
27981 *Signs. Gaines.
27982 *Sewing machine. Schenck.
27983 *Arch supports. Smith.
27984 *Road beds. Mahurir.
27985 Batteries. Dickson.
27986 Gas lighting. Canning.
27987 Microphonic device. Fairbrother.
27988 Water purification. Power.
27989 *Arc lamp. Blondel.
27990 *Indicating fire-damp. Schroeder.
27991 *Sparking plug. Ginestes.
27992 Pumps. Needham.
27993 *Dynamo.
27994 Guns. Vickers.
27995 *Dark room. Macke.
27996 Box. Lewy.

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27997 Leather cutting. Brown.
27998 Gas generator. Lethbridge..
27999 Looms. Waterhouse.
28000 Cuffs. Parry.
28001 Sludge tanks. Adams.
28002 Mowing machine. Parker.
28003 Yarn winding. Smith.
28004 Acid manf. Green.
28005 Concrete piles. Campbell.
28006 Sewage tanks. Adams.
28007 Treatment of gas. Beard.
28008 Steel manf. Vaughan.
28009 Milling machine guard. Watson.
28010 Electric lamps. Guy.
28011 Stamp affixing machine. Alderton.
28012 Tobaco pipe. Powell.
28013 Tobacco pipe. Chadwick.
28014 Game. Thomas.
28015 *Tyre. Gibb.
28016 Machine tool. Robinson.
28017 Brake. Gresham.
28018 Wreath stand. Middleton.
28019 Hubs. Chambers.
28020 *Separators. Fitzpatric.
28021 Cot. Knight.
28022 *Telemeters. Zeiss.
28023 *Crane. Butlers.
28024 Toy. Moore.
28025 Windmills. Ironmonger.
28026 Pipe union. Chick.
28027 Pit cage. McGowan.
28028 Chimney. Lawrie.
28029 Tyres. Crockatt.
28030 Treatment of ores. Rutlenberg.
28031 *Air compressers. Voorhees.
28032 Fuel. Schaffer.
28033 Hoisting device. Tannett-Walker.
28034 Advertising device. Donlevy.
28035 Fluid levels. Marrian.
28036 Torpedoes. Roenne.
28037 Hats. Aylott.
28038 Ticket holder. Jeyes.
28039 Portage machine. Tuckfield.
28040 Injector. Müller.
28041 Box. Johns.
28042 *Game. Turner.
28043 Roller skates. Macintosh.
28044 *Internal-combustion engine. Walker.
28045 *Bottle manf. Murphy.
28046 Utilisation of hydrocarbon, etc. Lamplough.
28047 Ball bearings. Wood.
28048 Treating gases. Liebrecht.
28049 *Mercuric compound. Bayer.
28050 Tyres. Blaisdell.
28051 Wheels. Deasy.
28052 Drawing off liquid. Stevens.
28053 Waistband. Morgan.
28054 Embossing papers. Hempli.
28055 Wheel. Smith.
28056 Tobacco pipe. Chardtan..
28057 *Electric switch. Goodrum.
28058 *Calculating machine. Howieson.
28059 Advertisement. Huckli.
28060 *Motor starter. Mustad.
28061 Propeller. Booth.
28062 Suction dredgers. Howorth.
28063 *Motor cars. Dumont.
28064 *Breathing apparatus. Heinr.
28065 Curtain hanging. Johnson.
28066 Internal-combustion engine. Leitneel.
28067 Hoists. Wale.
28068 Train lighting. Craven.
28069 Insulating compound. Thomas.
28070 Internal-combustion engines. Coats.
28071 *Printing press. Tucker.
28072 *Printing press. Tucker.
28073 *Printing press. Tucker.
28074 *Printing press. Tucker.
28075 *Printing press. Tucker.
28076 *Valve. Nichols.
28077 *Solidifying liquids. Rosculet.
28078 Decoration device. Roats.
28079 *Electric lamp. Gottschalk.
28080 *Closing device. Loiseleur.
28081 *Electric motor. Siemens.
28082 Bricks. Homan.
28083 *Sack. Huard.
28084 *Embossing device. Boult.
28085 *Speed indicator.
28086 Condensing plant. Parsons.
28087 *Chaff separator. House.
28088 *Telephone system.
28089 Air flue. Southgate.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to January 9th, 1911, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

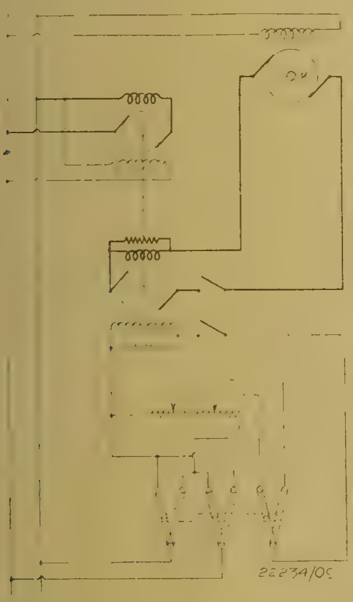
Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W C.

1909.

17495 Nasmith: Combing machines. 17617 Sterling: Apparatus for sealing newspapers, securing loose sheets of paper together, and for other similar purposes. [Application for Patent of Addition to 16002, 1908.] 17770 Kilroy, Needham, and Evershed Vignoles Ltd.: Means for producing sound waves for signalling and like purposes. 19743 Fawcett, Preston, and Co. (McIntire): Hydraulic rams. 19956 Fornaca: Two-cycle internal-combustion engines. 21333 Gillibrand: Valves and valve-operating mechanism of internal-explosion engines. [Post-dated March 18th, 1910.]

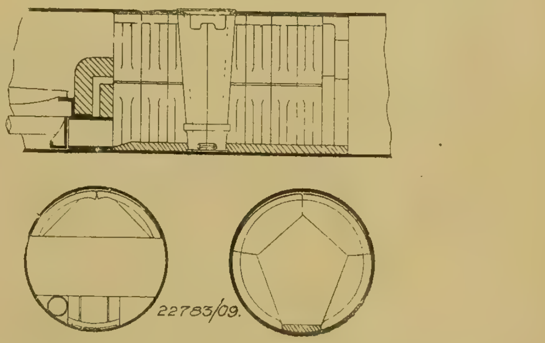
22234 Lancashire Dynamo and Motor Co., and Mason: Apparatus for electrically operating planing machines and the like reciprocating tools. [Cognate Application. 10749, 1910.]

This invention relates to apparatus for electrically operating planing machines and the like reciprocating tools, and the object is to overcome certain difficulties which are experienced when the driving motor is operated directly from the mains, and controlled by a reversing switch, motor starter, and resistance in series with the armature and by variation of the motor field strength. The invention comprises a driving motor geared to the reciprocating part of the tool, a generator driven by a motor, the armature of the generator being connected in series with the armature of the driving motor, the field of the generator being excited by a shunt winding with a resistance in parallel therewith, and a series winding with a diverting resistance in parallel therewith, and a switch actuated through adjustable tappet gear on the reciprocating part, and adapted at the end of each stroke to reverse the connections of the field winding of the generator and to so connect the winding to the mains through a series resistance, or to a potentiometer resistance, as to give during the return or idle stroke a greater speed than that of the working stroke.



22783 Cowper-Coles: Means for consuming smoke in boiler and other furnaces. [Post-dated April 6th, 1910.]

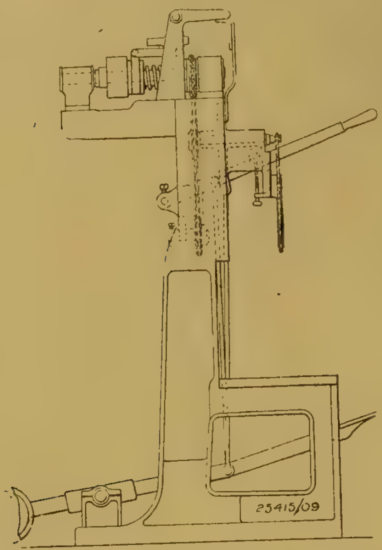
This invention relates to the consumption of smoke in the furnaces and flues of boilers of all types, more especially those having horizontal flues in which the fire-grates are placed, such as Galloway, Lancashire, and Cornish boilers. The invention consists in means for consuming smoke in boiler furnaces and the like, comprising a lining of refractory material at the rear of the usual fire bridge, with or without means for supplying air to same, the refractory lining consisting of a number of quadrant-shaped tiles placed in the flue and mutually supporting each other, with or without a bridge at the end of the lining.



23929 Firth and Leake: Railway signalling apparatus. [Post-dated April 19th, 1910.] 24607 Psarski: Dyeing machine. 24634 Salisbury: Changing motion for circular box loom. 24648 Hailwood: Furnace bridges of steam boilers and the like. 24749 Poate, and Fawcett, Preston, and Co.: Hydraulic valves or valvular apparatus of hydraulic presses. 24826 Rothe: Recoil mechanism for guns. 24883 Crudgington and Staples: Imitation lamps. 24890 Rose and Lawrence: Resilient tyres. 24918 Whale: Tables and book rests. 24980 Goodall: Bedsteads. 24981 Kent and Clayton: Gas burners for gassing frames. 25009 Galbraith: Crane. 25019 Richards and Pringle: Process for distilling or partially distilling coal and for the production of fuel. 25025 Freilich: Airing devices for bedding. 25032 Weir: Apparatus for heating or cooling oil or other viscous liquids. 25040 Royce and Sharp: Devices for automatically controlling electric circuits. 25058 Jerram, Gouldbourn, Bates, and British United Shoe Machinery Co.: Heel attaching or heel-nailing machines used in the manf. of boots and shoes. 25062 Darrah and Teer: Means for securing coffin lids and the like. 25076 Harris and Fox: Acetylene gas flare lamps. 25082 Gerrard: Method and process of treating salt and bye-products. 25102 Gowlland, Gowlland, and William Gowlland Ltd.: Opthalmometers. 25103 Muirhead, and Muirhead and Co.: Construction and manf. of condensers and artificial line for use in "duplex" telegraphy. 25136 Fottinger and Stettiner Maschinenbau Akt.-Ges. Vulcan: Hydraulic power transmission gears. [Application for Patent of Addition to 13864, 1906.] 25142 Hume: Gas controllers. 25145 Evers: Method of imparting suppleness to paper of all kinds, pasteboard, textile fabrics, yarn, cork, wood, tobacco, colours, linen goods, and gelatine bodies and the like. 25162 Trueman and Renouf: Two-way taps. 25168 Barker: Flying machine. 25170 Lake, Elliot, and Lake: Two-speed gears for motor cycles and the like. 25176 Wasdell: Construction of cycle or like mudguard. 25187 Newhouse, and Fitments Ltd.: Atmospheric gas burners. 25200 Cowburn: Locking device for the doors of carding engine cylinders. 25235 Scott: Means for suspending curtain poles and raising and lowering the same. 25289 Gregg: Turbines. 25296 Kratt: Method of and apparatus for heating water by electricity. 25297 Shepley Mills Linoleum Co., and Wigglesworth: Drawing rollers for machinery for preparing, spinning, and doubling cotton and other fibrous materials, and in coverings for use on such rollers. 25298 Chambers and Booth: Means for the production of gas from hydrocarbon oils. 25299 Pritchard: Apparatus for the contacting of vapours and gases with liquids and molten substances. 25343 Tighe: Hat pins. [Cognate Application. 10571, 1910.] 25354 Woitinek: Apparatus for teaching music. [Date applied for under International Convention, November 3rd, 1908.] 25355 Teske: Joints for tubular structures. [Request under Section 19 of the Act not granted.] 25370 Boldi: Building materials. 25373 Mensing: Electric arc lamps. [Application for Patent of Addition to 3243, 1904.] 25404 Blacklock: Wrist straps for watches. [Cognate Applications. 29047, 1909, and 9916 1910.] 25405 Vanston and Smith: Brakes for railway wagons [Cognate Application. 6228, 1910.] 25407 Von Kramer: Inductive wireless telephone systems.

25415 Murton: Wood and like mortising machines.

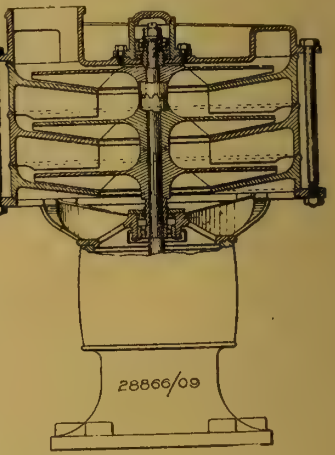
This invention relates to the type or class of machine for cutting or mortising wood known as "chain cutter" mortising machines. The invention consists in arranging the shaft or spindle which carries the sprocket wheel for transmitting motion to the rotary cutter so that it may slide vertically in its bearings or supports, and instead of using toothed gearing for transmitting motion to this rotary spindle, mounting thereon another sprocket wheel which is arranged to gear with a chain, this chain being actuated from one or other of the main shafts of the machine so that as it runs around its driver and driven sprocket wheels the sprocket wheel on the cutter shaft may gear with it by which means its motion may be thereby made use of. To prevent the chain from receding or being pressed out of its path by the force which it transmits to the sprocket wheel on the cutter shaft, guiding devices against or over which the chain may slide are employed, while the devices which guide the cutter shaft in its vertical path keep the sprocket wheel mounted upon it in the path desired.



25423 Wegrzecki: Closed business letter to be sent out without envelope. 25437 Cowper-Coles: Boiler and other furnaces. 25446 Evans, and George Mann and Co.: Lithographic transfer presses. 25454 Page: Shop blind. 25458 Scott: Reinforced concrete or brickwork. 25470 Einhorn: Manf. of benzoyl salicylic acid. [Date applied for under International Convention, November 13th, 1908.] 25476 Cloud: Fluid-pressure brake apparatus. 25488 Chalmers: Mount for printing and embossing surfaces. 25500 Rigby: Apparatus for the manf. of reinforced concrete props, columns, or posts. 25516 Worth, and Worth, Mackenzie, and Co.: Valve-controlling gear of winding engines for collieries or the like purposes. 25530 Schoenfeld: Driving mechanism of shuttle embroidery machines. 25584 S. Smith and Son, and Cahill: Liquid meters. 25617 Williams: Fluid motor or pump. 25639 Matthews: Means for effecting telephonic communication without connecting wires. [Cognate Application. 13299, 1910.] 25651 Parsons: Gearing for turbines and the like. 25663 George and Jobling: Flying machines. 25667 Wotton and Lassam: Manf. of fire-resisting glass for roofing, partitions, windows, and other purposes. 25692 Fletcher: Enamelling muffles. 25693 Alquist: Fluid-pressure turbines. 25698 Gladwyn: Apparatus for copying the sections of rails, structural steel work members, and like solids. 25721 Ewen: Prepared paper for the drafting of patterns of garments without the use of square or of tape measure. 25743 Brown: Liniment for rheumatism. 25756 Loughnan: Collapsible wardrobe. [Date applied for under International Convention, November 11th, 1908.] 25787 Le Maitre: Aeroplanes and the like. 25796 Greenwood, Hall, Hilton, and Kay: Spinning and like frames. 25801 Chipperfield: Device for composing and distributing type. 25802 Foreman: Machinery or apparatus for use in or in connection with "flat knocking" in the manf. of crockery. 25827 Walker (Mergenthaler Setzmaschinen-Fabrik Ges.): Means for controlling the adjustment for change of character or of face of the matrix or type bars or the matrices or type dies of a typographical composing machine. 25847 Masson: Wet process for the recovery of antimony in a pure state from ores, concentrates, tailings, and slimes containing it. 25889 Kuzel: Exhaustion of metallic filament lamps. [Date applied for under International Convention, December 21st, 1908.] 25896 American Automatic Telephone Co., and Goodrum: Electric selective devices, especially applicable to telephone systems and the like. 25914 Howard: Casting machines. 25925 Roberts, Morten, and Ripley: Internal-combustion engines of the type with revolving cylinders and crank case. 25932 Metzger and Smith: Electric and electro-pneumatic organs. 25955 Tindal: Measuring gauge for use on bowling greens and the like. 26011 Mitchell and Williams: Pneumatic elevators for grain and the like. 26226 Maccormac: Apparatus for spraying and distributing liquids. 26275 Charles: Locking devices for fixing the wind screens of motor vehicles at any desired angle and for similar purposes. 26279 Drummond: Grinding and other similar machines having a rotating cutting tool capable of being swivelled. 26298 McGowan: Calendars and the like. 26425 Hibberd: Gas meters. 26432 Pudney and Sadler: Incandescent gas mantles. 26584 Conner: Means for opening and closing and locking sliding doors. 26630 Martin: Miners' rotary hand drills. 26784 Smith: Telegraph strip feeds for use with typewriters and the like. 26856 McLeod: Metallic stuffing-box packing. 26864 Martin: Self-lubricating picker spindle for looms. 26919 Beard: Devices for facilitating rearward observation for use with cycles and other vehicles. 26963 Heenan and Froude Ltd., and Scholefield: Motor suspension apparatus applicable for tramcars. 27060 Payne and Warren: Valves for internal-combustion engines. [Cognate Application. 3891, 1910.] 27326 McCollum: Steam engines. 27378 Weeks: Collar-supporting devices. 27452 Travers: Internal-combustion engines. 27545 Chauviere: Construction of air propeller screws of wood with a plurality of blades. [Date applied for under International Convention, November 26th, 1908.] 27557 Cox: Apparatus for separating or grading metals, ores, and other substances. 27614 Wm Simons and Co., Brown and Brown: Dredging vessels. 27632 Aron: Curtain-barrel drop fittings. 27707 Graham, Graham, and Graham: Reducing valves. 27711 Dawes, Dawes, and Dawes: Application and attachment of rubber tyres to the wheels of roller skates. 27732 Bartlett and Bartlett: Bottle-cleaning brushes. 27816 Smith, Mitchell, Askham, and Hey: Electric irons. 27967 Hoare and Ackland: Stop cocks and valves for liquids, gases, and steam. 27970 Von Koppen: Construction of ships' hulls. [Cognate Application. 29943, 1909.] 28229 Hislop and Hislop: Heating furnaces. 28284 Matthews: Blocks for the manf. of leggings. 28320 Redfern: Perambulators, mailcarts, and the like. 28323 Ducros: Rear lights or danger signals for cycles. 28456 Argent: Hat pins. [Post-dated March 31st, 1910.] 28682 Enfield Cycle Co., and Smith: Spring forks or anti-vibration devices used on velocipedes, motor cycles, and the like.

28866 Allday: Multiple centrifugal fans.

This invention has reference to multiple centrifugal fans—that is, to centrifugal fans arranged in series, and comprises a cylindrical casing or body consisting of two or more sectional parts, each sectional part having an inwardly projecting flange with inlet opening for the fan wheel or runner situated adjacent thereto, the flange of the second and each succeeding sectional part of the casing having also the usual vanes for conducting the air to the inlet opening of the flange, the series of sectional parts being secured together and to an end closing disc with inverted annular trough of gradually increasing depth which terminates in or opens into the exit passage of the closing disc by screw bolts.

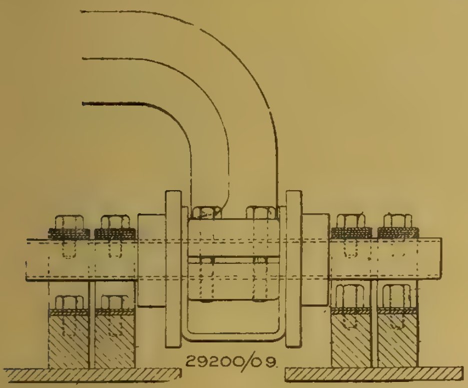


28874 Aitken: Window sashes. 28921 Geck: Wire-drawing bench with multiple series of drawing plates. 28963 Wilcox: Pocket stamp case. 29047. *See* 25404, 1909. 29059 Davies: Miners' picks and the like. 29093 Parkinson, and W. and B. Cowan Ltd., and Cheshire: Street and analogous lamps. 29152

Potter: Reinforcement of concrete beams, stanchions, columns, floors, and similar portions of buildings.

29200 Electric Construction Co., and Close: Controllers for electric motors.

This invention relates to controllers for electric motors. According to this invention a moving contact is carried and supported from the arm, bar, or other part which carries it entirely through the medium of a spring of the elliptic type, the length of which runs in the direction in which the rubbing takes place—that is to say, a spring having an upper member which is fixed to the arm, bar, or other part as aforesaid and runs in the direction aforesaid, and a lower member which is fixed to the contact and in which these members join or are joined together at their corresponding ends. The halves of the spring at opposite sides of the vertical axis are symmetrical and thus the contact will move with equal facility in either direction over the fixed contact or contacts, and the spring will readily yield also in all directions, thus allowing the contact to adjust itself to a proper bearing. Conveniently the spring is formed, or largely so, of a single strip which is fixed at its middle to the contact, and after passing endways in opposite directions curves over and has the two ends fixed in relation to the arm, bar, or other part as aforesaid, but preferably the upper member of the spring is strengthened by plates or laminations. The upper and lower members of the spring may be formed, if desired, however, each separately from the other, and these separately formed halves or members may be pivoted or otherwise fastened together at their ends, or the spring may be formed in halves divided vertically, each separately formed half being fixed at one end in relation to the arm, bar, or other part aforesaid, and at the other to the contact, and in either case the upper member may be strengthened by plates or laminations.


29200/09.

29276 Woof and Golding: Apparatus for automatically measuring and registering the supply of liquids and specially adapted for liquid fuel. 29313 Smith and Shaw: Vertical gas retorts. 29447 Hough and Owen: Gramophones and the like. 29493 Sanderson: Manf. of embossed wall papers and the like and apparatus to be used in such manf. 29598 George Jennings Ltd., and Morley: Apparatus for supplying hot and cold water. 29626 Muirhead: Stair carpet and like fasteners. 29720 Preston: Means for regulating the gas supply to burners. 29784 Nicholas, Kane, MacRae, and Gano: Apparatus for delivering measured quantities of liquid. 29875 Bloxam (Soc. Le Ferment): Preparation of dates or other like fruits for food. 29936 Kellermann: Pencil case with pyrophorous tinder box. [Date applied for under International Convention, August 3rd, 1909.] 29943. *See* 27970, 1909. 30102 Parish: Non-slipping wheel for roller skates. 30146 Smith: Non-skid devices for the tyres of road vehicles. 30215 Peters: Reversing gearing. 30216 Schroder: Electric time switches. 30271 Fletcher, Russell, and Co., Neil, Fletcher, and Russell: Gas and water valve. 30274 North British Rubber Co., and Baker: Valves for pneumatic tyres. 30276 Bradford: Arrangement of gearing for driving rotary washing or other similar machines. 30477 Byrne and Dunning: Apparatus for incinerating garbage and generating steam.

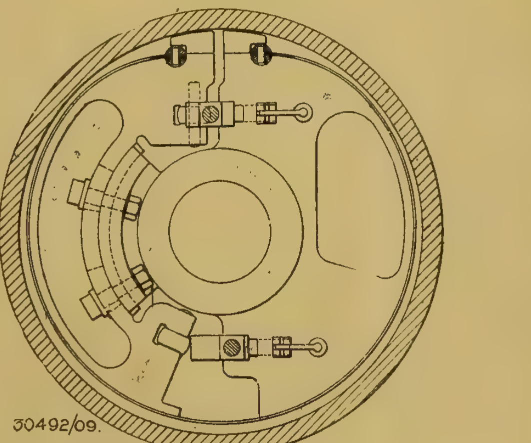
30492 Donovan: Friction clutches and brakes.

This invention relates to friction clutches and brakes such as are employed for various services, and has for its object to construct a reliable and durable clutch and brake of the flexible band type adapted for convenient operation and adjustment and capable of exerting a very powerful and effective clutch action. The invention consists in a combination comprised by the mounting of the flexible band upon a frame which forms a peripheral support extending around the band, and is made up of two or more elements with means for imparting relative circular movement thereto.

30542 Lake: Torpedo-discharging apparatus. 30543 Dutordoir: Speed alarm for vehicles. [Date applied for under International Convention, November 26th, 1909.] 30559 Page: Roundabouts. 30572 Rogge: Door and like checks. 30592 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new pharmaceutical compounds. [Application for Patent of Addition to 28166, 1909.]

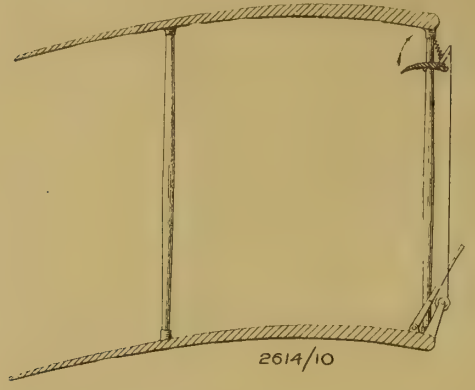
1910.

148 Kraft and Kraft: Concrete and like structures. [Rights under Section 91 of the Act not granted.] 206 Ansell: Apparatus for applying massage vibrations. 288 Erith: Means applicable for use in drying timber and other materials. 311 Prat: Apparatus for the production of artificial draught with a blower arranged outside the circuit. [Date applied for under International Convention, January 25th, 1909. Application for Patent of Addition to 13720, 1909.] 314 Pross: Steps for public entertainments. 320 Harding: Oil-vapour drain testing apparatus. 449 Lang: Method of forming horns or hollow horn pieces into flat sheets. 552 Lefevre: Rotary advertising device. [Date applied for under International Convention, January 9th, 1909. Application for Patent of Addition to 13148, 1909.] 579 Chambers, and H. B. Watson Ltd.: Method of and means for treating trade effluents. 650 Hick: Superheaters. 704 Martin and Martin: Draught excluders for hinged doors, windows, and the like. 747 Heimann and Schaffer: Method of working arc lamps in series with incandescent lamps. [Date applied for under International Convention, January 13th, 1909.] 829 Dreyfus: Expanding bracelet. 987 Brown: Wicket-keeping gloves. 1090 Earp-Thomas: Means for growing, preserving, and transporting cultures of micro organisms. [Date applied for under International Convention, January 15th, 1909.] 1157 Kelvin, and James White Ltd., and Clark: Navigational sounding machines. 1254 Lindsay: Portable bracket supports for wringing machines. 1335 Tarver: Manf. of articles from waste rubber, ebonite, vulcanite, or the like. 1425 Horner: Travelling trunks and similar receptacles. 1470 Tew, and Kynoch Ltd.: Fasteners for wire netting and the like. 1585 Exley: Manf. of barium sulphate. 1597 Siemens Bros. and Co., and Huddleston: Contacts for electric lamp holders and lamps. 1670 Chadburn's (Ship) Telegraph Co., and Le Feuvre: Apparatus for sounding depths of water. 1721 Parker and Hale: Back sights of bolt rifles. 1791 Sir W. G. Armstrong, Whitworth, and Co., and Wright: Lock and dock gates. 1950 Laycock: Means for operating ventilators. 2066 Sanderson: Anti-friction bearings for shafts. 2104 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new pharmaceutical compounds. [Application for Patent of Addition to 28045, 1909.] 2105 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of vat dyestuffs. [Application for Patent of Addition to 7819, 1909. 2374 Pattison: Magazine pistols. 2387 Tellerson: Dispensing receptacles, oil cans, and the like. 2389 Moog: Means for lighting and extinguishing candles. 2443 Jones, Davies, and Rhydderch: Trivets. 2444 Dunlop: Gas producers. 2455 Hateley: Internal fittings for fish kettles, saucepans, and the like. 2493 Fairweather (Selig Polyscope Co.): Adjusting mechanism for moving picture machines. 2504 Barratt: Device for distending the nostrils to improve respiration. 2574 Harrison and Peddie: Furnaces for steam boilers or other similar purposes.


30492/09.

2614 Short, Short, and Short: Mechanical flying machines.

The present invention relates to that type of mechanically-driven flying machine having an aeroplane or aeroplanes and driven through the air with the plane or planes at the requisite inclination or angle of incidence either by the application of mechanical power or the force of gravity, and in which machine there is provided a suitable rudder or rudders for lateral steering and a rudder or rudders or other device for steering in the vertical plane, and which machines also have been fitted with means for lateral balancing—that is, for controlling the position of the laterally extending planes about the longitudinal axis coincident with the direction of flight. According to this invention, and as, for example, applied to that class of machine known as a biplane flying machine, and in which each aeroplane is curved from its front edge to its rear edge, comparatively small shields are provided pivoted to the framework of the machine governed by suitable mechanical devices operable by the aviator, and normally located edgewise to the direction of motion of the flying machine, so that when in this position they are or may be substantially inoperative. These balancing shields are so located that when turned into what may be called a vertical position one of the edges of such balancing shields will approach near to or contact with the forward edge of the main aeroplane with which they co-act, while the other edge will extend slightly below a horizontal line cutting the rear edge of the main aeroplane, and when so located the lifting power of that aeroplane will be greatly decreased or comparatively nullified.



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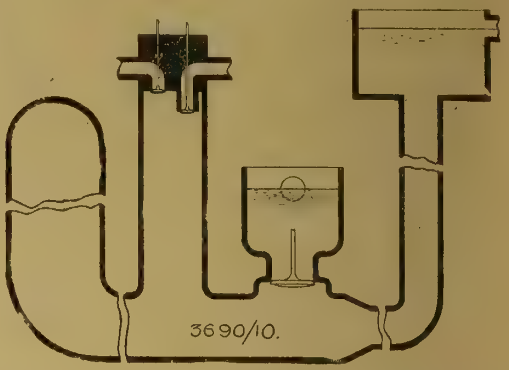
2615 Short, Short, and Short: Mechanical flying machines. 2695 Fox: Saddlery and harness bits. 2960 Marley and Carey: Devices for preventing road vehicles from slipping sidewise. 2992 Hilden: Process of repeated spinning of sliver or roving on self-acting mules. [Date applied for under International Convention, February 19th, 1909.] 3061 Reid: Processes of hardening metallic surfaces of iron or steel or alloys thereof. 3165 Wilson: Adjustable bonding stirrup and tie bar for use in reinforced concrete construction. 3173 Th. W. Petersen and Co. (Bousignac): Cocoa pickers and pruners. 3179 Nussbaum: Microphones. 3316 Hildebrandt: Method of and means for liquefying gases with a low boiling point. 3346 Cooper: Self-guiding toys. [Cognate Application. 7473, 1910.] 3489 Fletcher: Golf clubs, cricket and baseball bats, racquets, hockey sticks, croquet mallets, billiard cues, and similar sporting requisites. 3537 Wilton: Machines for moulding dough. 3553 Hancock and Hancock: Device for automatically locking the doors in the front casing of carding engine cylinders. 3615 Boosey (Grabow): Appliance for use in furnishing driving belts with wire staples for jointing purposes.

3690 Crossley and Atkinson: Methods of raising and forcing liquids and apparatus therefor.

This invention relates to a method of raising or forcing water or other liquids by means of the energy developed by the explosion of a combustible fluid mixture. The invention consists essentially in an explosion chamber automatically drawing in its own charges of combustible fluid mixture and directly connected to the delivery main, the use and application of an additional subsidiary main and air vessel connected to the explosion chamber and long delivery main, and operating in such a manner as to produce a two-stroke cycle in the long delivery main in conjunction with a four-stroke cycle in the subsidiary main, air vessel, and explosion chamber, such four-stroke cycle comprising an explosion, the exhaust of the waste products, suction of a fresh charge into the explosion chamber, and compression of the same once for every outward and return flow in the long delivery main.

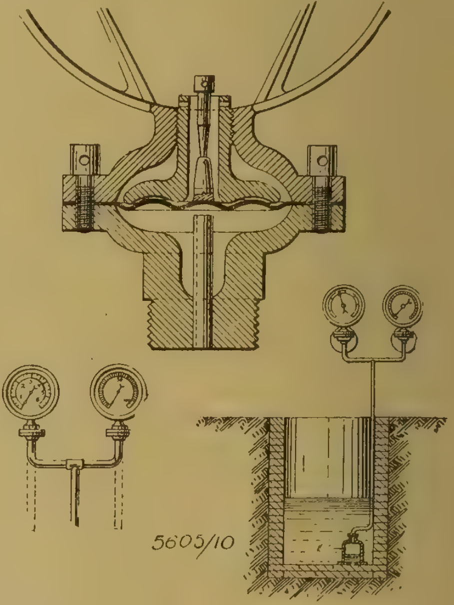
3725 Fredenstein: Inspection apertures for padded rooms. 3891. *See* 27060, 1909. 3945 Frost: Pumps particularly for inflating pneumatic tyres. 3991 Butterfield and Jones: Tyre for the wheels of automobiles and other vehicles. 4132 Towt: Wire strainers. 4146 Harms and Springer: Fitting for the joints of window frames, doors, and the like. 4157 Foley: Caps or hoods for valves for pneumatic tyres and the like. 4210 Meyer: Adding machines. 4270 Lumiere: Apparatus for exhibiting advertisements and for other like purposes. 4541 Walters Electrical Manufacturing Co., and Moore: Method of and apparatus for giving warning of the approach of a train on railways. 4627 Gas-Laternen-Fernzundung System Dr. Rostin, Ges.: Gas-lighting apparatus. [Date applied for under International Convention, February 24th, 1909. Application for Patent of Addition to 25081, 1909.] 4651 Muller: Advertising appliances. 4758 De Coster: Dynamos for lighting and other purposes. 4863 Moon and Moon: Film or ribbon adjustments as applicable to cinematographs and like purposes. 4975 Birawer: Method of and apparatus for compressing air, gases, and vapours. 5578 Sloan: Flush valves.



3690/10.

5605 Schaffer and Budenberg Ltd. (Schaffer and Budenberg Ges.): Pressure gauges.

This invention consists in the combination of a low-pressure gauge of the known Schaffer diaphragm type having, as is well known, a suitable support which operates to limit the movement of the diahpragm and support it and protect it from damage when it is strained or distorted above the normal amount for which it is constructed, with a gauge for indicating high pressures, for example in indicating water depths by means of air bells and pressure gauges in docks and the like. In such a use the wide or open graduation of the scale of the protected low-pressure gauge enables the low and initial pressures to be easily read, as they cannot be if a single gauge as ordinarily constructed for high pressures be employed alone, whilst, when the pressure for which the low-pressure gauge is constructed is exceeded, the diaphragm protector operates to protect it against the damaging effects of a rise in pressure, and the reading is then taken up by the high-



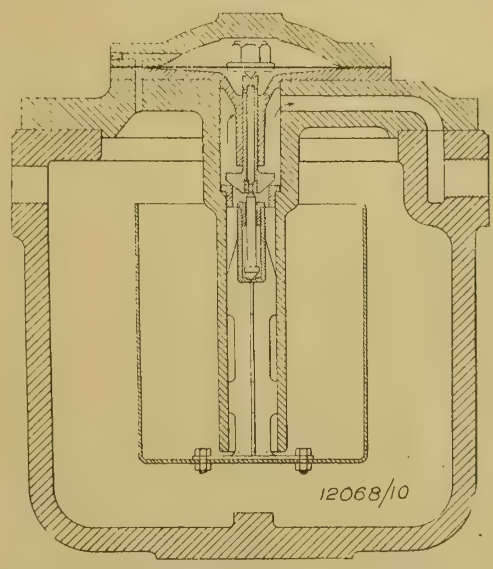
5605/10

pressure gauge which is also in communication with the source of pressure.

5675 Roberts and Gibson: Centrifugal machines. 5729 Finlay: Valve gear of direct-acting engines for actuating pumps and the like. 5753 Dufton: Stencil for use of students of conic sections and other branches of mathematics. 5808 Kalle and Co. Akt.-Ges.: Manf. of vat dyeing colouring matters. [Date applied for under International Convention, March 19th, 1909.] 5850 Clark: Tyres. 5867 Philipson, Philipson, and Philipson: Apparatus for stretching fabrics. 6031 Horsley, and United Alkali Co.: Manf. of mono-chloracetic acid. 6228. *See* 25405, 1909. 6300 Consolidated Brake and Engineering Co., and Luard: Locking device for securing piston rods to pistons. 6513 Smith: Tag-setting machine. 6548 Bolton: Fabric-cutting machines. [Date applied for under International Convention, April 9th, 1909.] 6587 Thomas: Coal-cutting machines. 6773 Mettler: Device for measuring and recording lengths of woven material. [Application for Patent of Addition to 15648, 1909.] 6829 Simpson: Self-acting mules. 6938 Wade, and Aublet, Harry, and Co.: Rotary gas or air compressor. 6946 Walker: Magazine tobacco pipe fillers. 7035 Day: Centrifugal pumps. 7066 Honig: Manf. of extracts for use in tanning. [Date applied for under International Convention, April 19th, 1909.] 7087 Planas and Planas: Machines for "gassing" threads. [Date applied for under International Convention, January 7th, 1910.] 7184 Jacoviello: Apparatus for producing high frequency oscillatory currents. 7326 Brown and Hickman: Internal-combustion engines. 7455 Ryan and Lake: Lubricating devices. 7473. *See* 3346, 1910. 7999 Watermann: Safety razors. [Date applied for under International Convention, April 8th, 1909.] 8059 Tacchi and Kirschbaum: Worm gearing. 8069 Mauderer: Steam engine cylinders. [Date applied for under International Convention, June 30th, 1909.] 8218 Howe: Vent valves for liquid-carrying pipes or vessels. 8221 Bergan: Supporting equipments for knapsacks, valises, or the like. 8294 L. Duthiel, B. Chalmers, and Co.: Magnetic clutch. [Date applied for under International Convention, April 6th, 1909.] 8306 Habel: Process and apparatus for the mercerisation of warp yarns and the like. [Date applied for under International Convention, April 8th, 1909.] 8399 Sickles, Millea, and Carroll: Carburetters for internal-combustion engines. 8470 Preston: Addition to planes and other similar tools. 8909 Frazier: Stretcher and presser particularly for trousers. 8938 Akt.-Ges. vorm. Seidel and Naumann: Typewriting machines. [Date applied for under International Convention, February 5th, 1910.] 9053 Schoenfeld: Embroidery machines. [Application for Patent of Addition to 25527, 1909.] 9257 Hoiland: Valves and valve gear for internal-combustion engines. 9335 Cook: Air pump particularly adapted for inflating the tyres of automobiles. 9338 Etablissements de Dion-Bouton (Soc. Anon.): Liquid level indicators. [Date applied for under International Convention, July 13th, 1909.] 9376 Ator and Ator: Wrenches. 9478 Lester: Mechanism for operating tool slides. 9486 Frenot: Nut locks. 9579 Van der Heyden and Jurgens: Process for the manf. of an elastic caoutchouc-like substance from animal materials. [Date applied for under International Convention, January 29th, 1910.] 9776 Schleuning: Manf. of hollow bricks. [Date applied for under International Convention, January 6th, 1910.] 9815 Verschuren: Automatic machine for watering, sweeping, and gathering dirt from streets. [Application for Patent of Addition to 5057, 1905.] 9854 Joyce, and Spagnoletti Ltd.: Mixing valves or cocks. 9916. *See* 25404, 1909. 10088 Hummel: Inverted incandescence gas, vapour, and the like lamps. 10097 Lofquist: Electric heating apparatus. 10368 Kohnle, Hunter, and Macmeikan: Machines for forming tags, tickets, and the like. 10377 Vandercook: Printing presses. [Date applied for under International Convention, September 9th, 1909.] 10438 Gombert: Reflecting devices for signs or other purposes. [Date applied for under International Convention, March 24th, 1910.] 10571. *See* 25343, 1909. 10676 Esparza: Reinforced concrete telegraph poles and the like. [Rights under Section 91 of the Act not granted.] 10749. *See* 22234, 1909. 10811 Flindt: Screew propellers. 11054 Siemens Schuckert-Werke Ges.: Searchlight apparatus. [Date applied for under International Convention, May 10th, 1909.] 11068 Brantingham and Brantingham: Advertising signs. 11125 Berger: Tobacco pipe fillers. 11178 Jefferies: Refuse destructors. 11237 Weill: Apparatus for manufacturing ceramic tiles. [Date applied for under International Convention, May 6th, 1909.] 11267 Kupke: Chucks. [Date applied for under International Convention, July 17th, 1909.] 11277 Evershed and Vignoles Ltd., Evershed and Payne: Binding screws or terminals for electrical purposes. 11416 Gregori: Hydraulic brakes for manually-operated hoisting apparatus, adapted also to be used as emergency brakes for rack railways, lifts, and the like, and as vehicle brakes. 11434 Preston: Dancing dolls. [Date applied for under International Convention, January 6th, 1910.] 11437 Van Daalen: Actuation of controllers for electric machinery particularly applicable to electric traction. [Application for Patent of Addition to 15203, 1909.] 11583 Heimann and Schaffer: Method of working arc lamps and incandescent lamps in common on an alternating-current circuit. [Date applied for under International Convention, January 10th, 1910. Application for Patent of Addition to 748, 1910.] 11616 Schreiber: Lamp protectors. 11673 Erlandsen: Rotary cutters, such as reamers, milling cutters, and similar tools. 11823 Anders: Device for showing the directions of roads, paths, and the like in the dark. 11889 Rowland, and Warne, Wright, and Rowland Ltd.: Security bolts for vehicle wheel tyres. 11894 Galea: Automatic balancing apparatus for aerial machines and vessels and the like. [Application for Patent of Addition to 9805, 1909.] 11928 Sanborn: Means for discharging coal or other material from barges. 11941 Guernsey and Libbey: Monkey wrenches. 12035 James (Compagnie Generale de Phonographes, Cinematographs, et Appareils de Precision): Manf. of phonographic discs.

12068 Davidson and Larmuth: Steam traps.

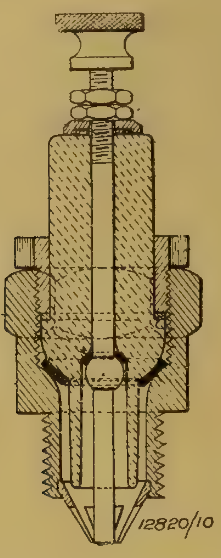
The improvements which form the subject of this invention relate to steam traps of the float type which are or may be employed for automatically draining the water of condensation from steam pipes and returning the same to the boiler. The invention comprises a main valve which is actuated by means of a relay valve held down by pressure on the diaphragm, the upper side of the diaphragm being always in communication with the inside of the trap by holes; the area of the diaphragm being larger than that of the main valve, the valve is always retained on its seat by the pressure of the steam or water that passes through holes to the space above the diaphragm. When the float fills and sinks as it nears the bottom of its travel, a collar comes in contact with a second collar drawing down the valve and opening the inlet in the main valve, allowing the steam and water which is under pressure to pass up the stem of the valve and through the holes to the underside of the diaphragm by which the pressure above and under the diaphragm is equalised.



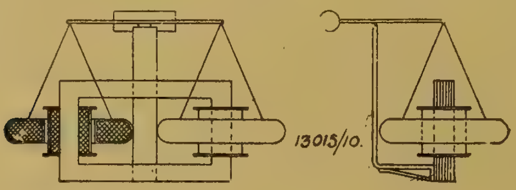
12152 White: Distributing valves of gas and gasoline engines. [Date applied for under International Convention, May 19th, 1909.] 12603 McKean: Driving arrangements of winding machines for yarns, threads, or the like. [Date applied for under Rule 13, December 28th, 1909.] 12730 Coindet: Windows of railway and other carriages. [Date applied for under International Convention, March 2nd, 1910.] 12789 Neesham: Moulding machines. [Post-dated December 21st, 1909. Originally included in 14468, 1909.]

12820 Brooks and Alston: Sparking plugs for internal-combustion engines.

This invention relates to sparking plugs for internal-combustion engines, and has for its object to provide improved and simiplified means for ensuring a perfect gas-tight joint between the different component parts of the plug, such as between the porcelain or other insulator and the outer metallic body, and between the insulator and the central metallic conductor rod. The invention comprises an insulator fitting within the outer metallic shell, bearing surfaces upon the parts, one being curved and the other flat or curved, a flat metallic washer interposed between the surfaces and engaged by one or both thereof along a single line only, an enlargement upon the central conductor rod, a co-operating bearing seating within the insulator, the surfaces of the enlargement and seating being both curved or one curved and the other flat, and a flat metallic facing washer surrounding the seating and engaged by one or both the bearing surfaces along a single line only.

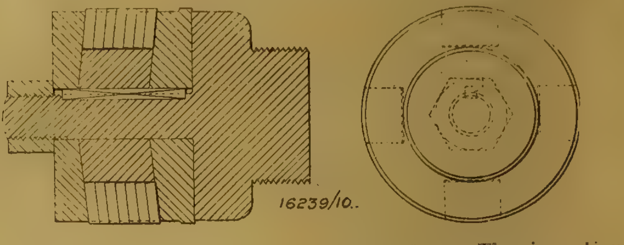


13015 Siemens Bros. Dynamo Works (Siemens Schuckertwerke Ges.): Movable coil alternating-current transformers for supplying currents of constant value. 13031 Skertchly: Trousers stretcher. 13096 Caird: Float feed regulators. 13184 Smith: Coin-freed gas meters. 13190 Bernhard and Niedermeyer: Crushers. [Date applied for under International Convention, August 2nd, 1909.] 13210 Velten: Mechanical staircases. 13299. *See* 25639, 1909. 13459 Hilliard: Skirt bands, waist bands, or the like. 13512 Smith, Bell, and Reed: Hand trucks. 13700 Pulvermacher and Bremermann Ges.: Machine for forming articles from plastic materials by means of templets. [Date applied for under International Convention, August 25th, 1909.] 13796 Petry: Method of forming dentures. 13824 Mez: Device for gripping or securing binding cords and the like. 13869 Aitken: Steam generators. 13881 Koefoed, Hauberg, Marstrand, and Helweg Aktieselskabet Titan and Gorm-Petersen: Grabs for coal-discharging apparatus and the like. 13998 Pape: Machinery for producing fibre from leaves and the like. 14023 Haber: Manufacture of ammonia. [Date applied for under International Convention, September 13th, 1909.] 14100 Viatour: Automatic regulation of gas producers working by suction. [Date applied for under International Convention, June 12th, 1909.] 14105 Shipton: Show cards and other display devices. 14397 Niditch: Railway signal fusees. [Date applied for under International Convention, December 16th, 1909.] 14518 Johnson (D'Aix): Type-line casting machines. 14545 Bruce and Downie: Feed-water service apparatus for steam generators. 14697 Smith: Sewing needles. 14801 Lancaster: Hose couplings. 14845 Hilling: Fastening for bags. 14880 Butterfield: Feeler or detector mechanism for use in connection with sheet feeding and like machines. 14943 Hillmer: Weighing apparatus for weighing liquids. [Application for Patent of Addition to 2812, 1909.] 14949 Berglund and S. J. W. Smith, administrator of the late H. Lindencrna: Automatic couplings for railway and the like vehicles. [Date applied for under International Convention, June 21st, 1909.] 15062 Upham: Method of bending flat printing plates to the desired curvature. 15110 Wolf: Device for trapping insects, vermin, and the like. 15175 Grupe: Railway signalling apparatus. 15195 Smith: Steam engines. 15304 Lobel: Dog leads and the like. 15525 Guye and Darier: Manf. of alkali nitrates and alkaline earth nitrates. [Date applied for under International Convention, July 5th, 1909.] 15698 Johnson: Fastener for doors and the like. 15711 Raschig: Tar paint or tar coatings. [Date applied for under International Convention, May 4th, 1910.] 15938 Hoskins: Electric rotary transformers.



16239 Pugh and Holroyd: Rotary cutting tools. [Post-dated February 7th, 1910. Originally included in 15878, 1909.]

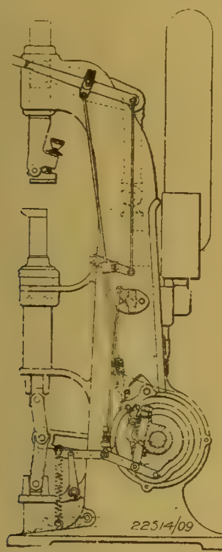
This invention relates to improvements in rotary cutting tools, such as are used in milling and hobbing machines and the like. The invention consists in providing cutting elements for use in rotary cutters having generated cutting edges produced by mounting the elements with their cutting faces at or substantially at right angles to the axis of a blank-carrying element of a gear hobbing machine and generating or hobbing the cutting edges. The invention also comprises a tool in which the separate cutting elements are positioned in the holding fixture by means of spirally faced plates, so that the cutting faces of these elements are made to form part of a spiral or spirals having the same pitch and the same number of starts as would the required hobbing tool of ordinary construction.



16524 Levy-Stein: Tobacco pipes. [Date applied for under International Convention, August 20th, 1909.] 16550 Spengel: Deep boring. 16564 Haddan (American Car and Foundry Co.): Machines for forming nut blanks. [Date applied for under Rule 13, October 28th, 1909.] 16768 Muchka: Steam separators. [Date applied for under International Convention, August 17th, 1909.] 16987 Carl Zeiss: Microscope condensers. [Date applied for under International Convention, March 18th, 1910.] 17053 Arnold: Twine cutters. 17056 Becker: Coffins. 17084 Ditter: Building blocks. 17184 Hoppe: Knife and fork cleaning machines. 17194 Bichel: Explosive charges. [Application for Patent of Addition to 19215, 1906.] 17444 Fiske: Manf. of boxes. 17524 Pocock: Concrete mixer. 17746 Allasia: Protecting covers for pneumatic tyres. 17887 Politz: Tube fastening for condensers, feed-water heaters, and other apparatus for absorbing heat. [Date applied for under International Convention, August 12th, 1909.] 18311 Glaser and Muller: Process of refining salt. [Date applied for under Rule 13, December 7th, 1909. Request under Section 19 of the Act not granted.] 18430 Jones: Shoe-cleaning brushes and pads. 18848 Siemens Bros. Dynamo Works (Siemens Schuckertwerke Ges.): Starting arrangements for single-phase alternating-current series motors. 18876 Grandclement: Tobacco pipes. [Date applied for under International Convention, January 15th, 1910.] 18973 Heywood: Pneumatic appliance for massage. 19084 Lange: Grinding mills. 19276 Wade: Dust shields for filling corner angles of rooms, corridors, and the like. 19429 Sprott: Pipe connections. 19800 Lake (Head and Goodall): Pipe couplings. 20722 Norman: Apparatus for moulding sand-faced roofing tiles with nibbs for retaining same in position on roof. 21283 Stiff: Bacterial filter beds and the like. 21323 Weinland: Rotary motors. 21328 Baehr: Telephone diaphragm. [Date applied for under International Convention, March 23rd, 1910.] 21381 Pessina: Resilient wheels for motor cars and other vehicles. 21406 Soc. Ribayron and Victor: Wood-working machines. [Date applied for under International Convention, September 29th, 1909. 21415 Barker (Barney and Berry Incorporated): Wheels for ball bearing roller skates. 21552 Tomlinson: Collapsible hampers or baskets. 21930 Jerram, Gouldbourn, Bates, and British United Shoe Machinery Co.: Heeling machines used in the manf, of boots or shoes. [Date applied for under Rule 13, November 1st, 1909.]

22514 Jerram, Gouldbourn, Bates, and British United Shoe Machinery Co.: Machines used for inserting nails or fasteners into boots or shoes. [Date applied for under Rule 13, November 1st, 1909.]

This invention relates to machines used for inserting nails or fasteners into boots and shoes, and more particularly to those used for loading heels with nails or other fasteners or for attaching heels to boots or shoes, and as regards its application to machines of the latter type, it is equally applicable to those in which nails are driven from inside the boot through the heel seat into the heel, as to those in which the nails are driven from outside the boot through the heel and into the heel seat. The invention comprises mechanism for obtaining the plurality of nail-driving strokes, consisting of a toggle or other equivalent mechanism that connects the drivers with a relatively stationary part, or a part that can be rendered stationary, of the machine and operative connections is arranged between the toggle and the shaft of the machine so as to break the toggle first on one side and then on the other side of the position occupied when in its straightened position. The arrangement is such that when a toggle is employed one of its members is coupled to the driver-carrying head and the other member to a plunger capable of sliding in bearings in the machine frame. The toggle or



other equivalent mechanism is continuously driven by connections from the driving shaft, and normally the plunger slides idly in its bearings so that no motion is imparted to the driver-carrying head. When, however, the nails are to be driven, the plunger is locked by a device against movement at the desired time in the operation of the machine, and this will cause the driver-carrying head to be set in motion to effect the driving of the nails and conveniently automatic mechanism may be employed to control or time the action of the device.

22708 Case: Control of electric motors. [Date applied for under International Convention, September 30th, 1909.]

COMPLETE SPECIFICATIONS OPEN TO PUBLIC INSPECTION BEFORE ACCEPTANCE, UNDER THE PATENTS ACT, 1907.

1910.

8341 Cervenka: Incandescence filament or body and process for manufacturing same. 12843 Firm Ludg. Heisse: Aerial traction. 13388 Fowler: Line checks. 13987 Goalard: Rotary engines. 14354 Siemens Schuckertwerke Ges.: Searchlights. 18276 Ganz es Tarsa Vasonto es Gepgyar Reszvenytarsulat: Combustion engines. 19102 Carpentier: Transmitter for transmitting telegrams composed in perforations on a band by the Baudot system. 19485 Stolte: Reinforced walls. 19552 Dr. C. Otto and Co. Ges.: Method of obtaining directly ammonia from hot tar-free gases of distillation from coal, brown coal, and the like. 20221 Mauser: Firing mechanism for recoil-loading pistol with fixed barrel. 20752 Stanbon: Machines for compressing top lifts. 21544 Colin: Card game for use in learning the piano. 22045 Becker: Speed meters for rotary movements. 22285 Ehrhart: Hydraulic apparatus for use in determining the developed horse power or torque of a motor or shaft. 22292 Leeds: Recording apparatus. 22308 Hohrath: Process for producing artificial granite from blast-furnace slag. 22931 Ellwood: Stop cocks. 23074 Ronjat: Treatment of hair for felting or like purposes. 23138 Spath: Process for the manf. of colour screens on celluloid films or coatings. 23142 Lakhovsky: Nut or locking device for screws. 23146 Guillemot: Bottle-manufacturing machines. 23563 Soc. Generale de Coutellerie et Orfevrerie: Safety razors. 23567 Pollet: Motive fluid distribution valve for explosion motors. 23669 Neuhold: Automatic telephone systems. 23765 Cothias: Manf. of the elements of fuses for projectiles. 23951 De Sennevoy: Brushes. 24014 Crown Cork Co.: Bottle caps or closures. 24020 Maschinenfabrik Rockstroh and Schneider Nachf. Akt.-Ges.: Device for the production of multi-colour prints on printing machines during a single operation. 24091 Forth: Pipe couplings. 24250 Liebgott: Hoisting apparatus. 24258 Jaeger: Extensible and retractable mast. 24389 Firm Th. Goldschmidt: Process for butt welding the ends of rails,

The Man who makes Decisions is the man who makes the Money.

The ability to make final decisions depends upon just one thing :—

The self-confidence that is born of *positively knowing that you DO know!*

To make decisions day after day, year after year, a man must have a *complete grasp* of the principles, the technique, the "ins-and-outs" of the theory of his vocation. *On no other foundation can a career be built to endure.*

Have you such a complete mastery of your business that you could assume an important post in your present firm, or another, at the moment the opportunity arrives? A post where you would be well paid for *making decisions?* Are you so trained as to be likely to be called upon any day to fill a more important post?

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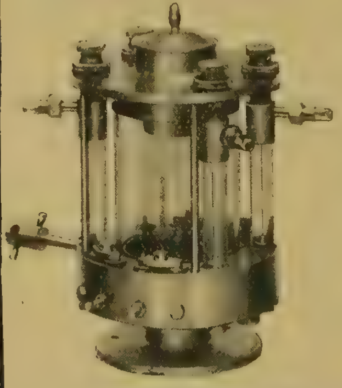

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THE PETROLEUM SUPPLY.

THE processes employed by nature for the extraction of petroleum from organic matter is known to be a slow one, so exceedingly slow indeed as to appear to be practically a useless one, so far as human purposes are concerned.

To the casual observer, therefore, it not unnaturally seems as if the rapid consumption of the stores of petroleum was greatly to be regretted, in view of the hopelessness of expecting nature to replace the wastage within any time appreciable to the human mind. In spite of this, however, there seems to be but little doubt that there still exists a supply sufficient to last for centuries to come.

In Russia, in Asia, in the region of the Caspian Sea to the south of the Caucasian Mountains, petroleum and natural gas have been obtained for thousands of years in larger or smaller quantities, and for some half century wells yielding vast supplies have been in operation; indeed, the supply of the Baku oil fields would seem practically to be inexhaustible. In addition to this immense source of supply in the Caspian Sea regions, moreover, there are the petroleum deposits of Burma, which are being utilised at the present time, and it is furthermore reported that Persia has also a large and productive oil region, tests and surveys made by experts having already located a petroleum deposit of at least a thousand miles in length, extending from the frontier of Turkey, near the head of the Persian Gulf, for a long distance to the north-east in Kurdistan.

In Mexico, again, there are a number of large oil wells at work, and from what is already being done in that country it seems probable that in the near future the petroleum fields there will be amongst the largest, if not the largest, in the world.

The present oil fields of the United States are well known as a vast source of supply, and from the success that has been met with by the oil pioneers in California, Texas, and Kansas, of recent years, it may reasonably be deduced that many other parts of the United States will be found to be equally rich in petroleum deposits; in fact, it would be hardly safe to assert that any district, not yet exhaustively tested, is not rich in petroleum deposits.

In South America, again, petroleum may be found in the future, and there also remains enormous regions in Asia and Africa, not to mention the possibilities of Australia and many islands of which little is now known; in fact, there is a probability of supplies of petroleum being discovered in over 90 per cent of the two largest continents, whilst in the New World alone the available supplies are sufficient to run into the distant future, and in all probability to last for many centuries even when worked on a very extensive scale.

WORKMEN'S COMPENSATION.

The workmen's compensation in Great Britain for the last year (1909) amounted to the sum of £2,274,238, exclusive of payments made under any contracting-out scheme, Employers Liability Act, etc. The cost for 1908 was £2,080,672, or £193,566 less than that for 1909, showing therefore a considerable increase for the latter year.

A decrease is again shown in the number of fatal cases brought under the Employers Liability Act, 1880. The cases of death for which claims were made numbered 3,341, and those for disablement amounted to 332,612. A comparison of these figures with those for 1908 shows that whilst there was a decrease in the number of deaths amounting to 132, on the other hand the cases of disablement show an increase of 7,128.

The total number of workpeople employed in the various industries is given as 6,560,745, and in factories employing 4,585,745 persons the fatal accidents numbered 744, and the cases of disablement 123,134, the amounts of compensation paid being respectively £104,039 and £64,431. The fatal cases resulting from industrial diseases numbered 33, and the disablement cases resulting from the same causes amounted to 3,313.

In factories the average cost per person employed is about 3s. 5d. As might be expected, coal mining shows the highest figure, being about 20s. 1d. per person employed, which comes to ·8 of a penny for each ton of coal raised.

As regards the duration of the cases, the greater number lasted for under 13 weeks, but those extendieg to over 12 months amounted to 4,798.

In an official volume of statistics upon the subject, which has been recently issued, it is stated that £403,775 was paid as lump sum compensation for industrial accidents in 14,924 cases, whilst a sum of £7,338 was paid in a similar way for 178 cases of industrial disease.

A satisfactory feature in the working of the Act is that only a comparatively small proportion of the Compensation Act claims went to litigation, viz., only one in every five cases of fatal accident, and under one in every two hundred cases of disablement being settled judicially.

Australia and the Vancouver Mail Service.—A deputation from the Melbourne Chamber of Commerce has lately urged upon Mr. Hughes, the acting Prime Minister, the advisability of stipulating that Melbourne should be a port of call for the Vancouver mail service. Mr. Hughes, in his reply, stated that the Government was in favour of the idea, but that the appearance of New Zealand in the negotiations had raised a new factor. The Commonwealth Ministry is whole-heartedly in favour of a reciprocity treaty with Canada, and doubtless an understanding on which legislation may be drafted will be arrived at when Mr. Fisher meets Sir Wilfrid Laurier in London next year.—Reuter.

Harbour Works.—The Russian *Official Messenger* notifies that the operations in connection with the deepening of the channel in Mariupol harbour to 24 ft. have been completed, and that the channel was opened for traffic on 30th November. It appears that this is one of the first attempts at deepening operations in the Sea of Azov, and that plans are at present being considered for channel works in other ports in the same locality, and for the further improvement of the Mariupol harbour. The *Journal de St. Pétersbourg* states that Bills will shortly be submitted to the Imperial Duma relative to harbour works in the Black Sea. These will include deepening the channels leading to Novorossisk to 30 ft., deepening the Kertch-Yenikale Sound, the construction of wharves at Rostov, and the construction of a harbour in Sudak Bay (Crimea).—*Board of Trade Journal.*

New York and Back in 12 Days.—The Cunard liner, Mauretania, is making an attempt to run from Liverpool to New York and back in 12 days, including two days at the latter port. The performance will be in reality as much a test of organisation as of speed. In order to accomplish it the Mauretania will have to maintain an average speed of 26 knots, or travel nearly 700 nautical miles per day. Something like 350 firemen, working in shifts, will be required to feed the furnaces. But it will be in New York, with only about 48 hours at her disposal, that the success of the run will be decided, and where the slightest hitch would result in unavoidable delay. The heavy Christmas mail, probably about 5,000 bags, will have first of all to be landed, and then the passengers with their baggage. The steamer will next be taken over by the shore staff for overhauling, and at the same time the cargo will be transferred and another consignment put on board. The bunkers have to be replenished with between 6,000 and 7,000 tons of coal by a small army of coal heavers, the Christmas mail for "this side" to be stowed away, fresh supplies of provisions put into the storerooms and refrigerators, and, finally, the passengers to be embarked.

The Panama Canal.—The plans for the construction of the spillway at Miraflores, on the Panama Canal, have, according to the *Times*, been approved. The spillway will consist of a straight concrete dam of ogee section connecting the east wall of Miraflores locks with the side hill; its length on the crest will be 432 ft., and about 75,000 cubic yards of concrete will be utilised. The crest, which will be 38½ ft. above mean sea level, 16 ft. below the ordinary level of Miraflores Lake, will be divided into eight bays each 45 ft. wide, each closed by rising gates of the Stoney type. The machinery for working these gates will probably be placed in a tunnel to run through the length of the dam. The object of the spillway is to regulate the water in Miraflores Lake, as proper control of the lake will involve dealing with not only the water from the Rio Grande, Rio Pedro Miguel, Rio Cocoli, and Rio Caimitillo, but also that from the higher level of the Gratun Lake should an accident to the locks at Pedro Miguel allow an unobstructed flow to take place. The height to which the Miraflores Lake may be permitted to rise is determined by the Miraflores lock walls, which have their copings at an elevation of 58·67 ft. above sea level. Therefore, if a freeboard of 1½ ft. is allowed, the maximum level for the lake is fixed at an elevation of 57·17 ft. The proposed spillway will have a capacity at this water level of about 92,000 sec. feet. The flow into the lake has not yet been precisely determined, but it is estimated that the true value is between 90,000 sec. feet and 100,000 sec. feet; should the capacity of the spillway be found insufficient, the culverts of the Miraflores locks will be utilised.

SMITHFIELD SHOW ENGINEERING EXHIBITS.

The machinery exhibits at the Smithfield Show this year are quite up to the average of recent years, the chief features, as might be expected, being road locomotives suitably adapted for use under the Light Locomotives Act.

Messrs. Davey, Paxman and Co., of Colchester, show a 7-N.H.P. general-purpose traction engine and an horizontal steam engine of 20 B.H.P. Another interesting exhibit is a 36-40-H.P. gas engine with suction plant. This engine is fitted with a throttle valve governor with variable lift inlet valve and a patent timing arrangement for the magneto.

Messrs. Aveling and Porter, of Rochester, show a compound steam tractor, which can be converted into a road roller of seven tons weight empty, and fitted with two travelling speeds. This tractor is capable of taking a trailer over an average road to the limits of weight and speed permitted by the Act, one man only being sufficient to control the engine. The engine can run up to 50 miles per working day at an approximate inclusive cost of 16s.

Messrs. Ransomes, Sims, and Jefferies, of Ipswich, have on view a 4-N.H.P. compound light steam tractor, mounted on springs to both axles and fitted with geared feed-pump, injector, and governors. The 6-N.H.P. compound and 7-N.H.P. single-cylinder traction engines of this firm are fitted with all the latest improvements, and are claimed to be simple, durable, and economical. A high-speed vertical engine of the "open" type is fitted with an automatic governor, which is adapted for driving a dynamo, fan, pump, or other high-speed machinery. This firm also exhibit a potato digger, the forks of which are kept in a hanging position, causing them to work parallel to each other and giving them an increased action when entering the ground.

Messrs. J. and H. MacLaren, of Leeds, show a five-ton steam traction engine having three speeds—two, four, and six miles an hour—and mounted on springs back and front. A superheater is provided which utilises the waste heat in the smoke-box, sending the steam into the cylinders dry and at a high temperature. The feed water is heated by the exhaust steam nearly to boiling point, effecting a further fuel economy of upwards of 12½ per cent. This tractor has hauled on the road a two-ton trailer carrying a net load of 6 tons 8 cwt. of coal 25 miles in three hours seven minutes, with a fuel consumption of only 214 lbs. of coal, and two 6-ft. binders at the rate of four miles an hour, which work is equal to reaping 45 acres of corn in a day of 10 hours.

Messrs. W. Tasker and Sons, of Andover, have on view a tractor designed to work on private roads which are incapable of bearing heavy traffic, a special valve being provided allowing of extra power being obtained when required.

Messrs. Wallis and Steevens, of Basingstoke, exhibit a tractor having the engine works enclosed and running in an oil bath, so that all dust and grit are excluded. Also a road locomotive fitted with expansion gear and specially adapted for general estate work, as also for lighter work, such as threshing and driving fixed machinery.

Messrs. James Coultas, of Grantham, exhibit a manure distributor fitted with an improved pattern in-and-out gear, and a disc drill specially adapted for use in "twitchy" ground.

THE PRINCIPLES OF IRONFOUNDING.

By Prof. A. Humboldt Sexton, F.C.S., F.I.C.

(Continued from page 700)

Cores.

In the casting of hollow-ware, a portion of the mould must be partially surrounded by metal, so as to form the interior hollow cavity of the article. Such a portion is called a core. In the casting of small articles the core does not need any special attention, except that it must be well vented and must be sufficiently "open" to allow of the ready escape of the mould gases, but with large articles the cores have to be specially prepared, and core making, therefore, needs some consideration.

The form of the core may, of course, vary indefinitely as the form of the cavity to be left in the casting varies, and therefore nothing but the general principles of core making can be discussed.

Core Sand.

The core will be almost completely surrounded by the metal, and will communicate with the mould by comparatively small areas. The sand, therefore, must be very porous to allow of the ready escape of the gas and to minimise the amount of gas given off; the core is almost invariably dried before use. The sand also must be sufficiently binding to hold together over the necessary area, and to withstand the wash of the metal, to resist the tendency to float due to its being surrounded by liquid metal much heavier than itself, and it must not become so coherent that it is not easily removed after the casting is complete. At the same time, in the case of large castings, the core must not be too solid, for it must be remembered that the core will be surrounded by liquid metal. As this solidifies and then cools it will contract, and thus will put great pressure on the core, and unless the core can yield the casting may fracture.

To secure free escape of the gases and, at the same time, to reduce the resistance to crushing by the cooling metal, the sand is usually mixed with some kind of organic matter which burns away, or at least is charred, by the heat of the metal. Chopped straw, horse dung and sawdust are the materials usually used, and these, of course, give off a considerable amount of gas.

The cohesion of the sand must be considerable, and if this be obtained by the use of a strong sand—that is, one rich in clay—after use it is likely to be too compact for ready removal. The cohesion is therefore obtained or increased by the use of organic binding materials of various kinds, which bind even when dry, but which are decomposed by the heat of the metal, leaving a more or less porous mass, which easily falls to pieces. Each core maker usually has his own pet mixture, *e.g.*, flour, oatmeal stirred up in hot water, starch, peameal, or crude treacle, are probably the most usually used, and there are on the market many core binders of special composition, such as glutrin, etc., which also answer the purpose admirably, giving off practically no gas, so that there is little danger of "blown" castings.

The core maker must, of course, adjust his mixture to the case in hand, and this is one of the things that can only be done by experience, guided by a knowledge of the principles involved, and also the various materials which are added. A very common proportion for general work is to thoroughly mix six parts of flour with 30 parts of sharp sand, and strengthen this with one part of boiled linseed oil.

Supports for Cores.

Small cores, such as core parts of the pattern, will often be strong enough to support themselves, but larger cores, and especially those which are separately made, dried and put in position, must usually be supported in some way, and the support is usually given by iron rods of suitable form. In straight cores, the rods will, of course, be straight, but for cores of more complex forms they will be bent or jointed in various ways, so as to give the required support. In the case of large castings it is sometimes necessary to cast special "core irons." These are, of course, designed to meet the case in hand, care being taken that they are so constructed as to give the necessary support to all parts of the core.

Cores may be used either green or dry, according to circumstances; as a rule, when the cores are made separately, they are dried, but this is not always the case, and owing to the more or less irregular shrinkage in drying, a "green sand" core is more likely to give a cavity of definite size than one which has been dried.

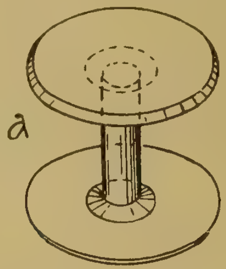


Fig. 104.—Stud Chaplet.

VENTING.

The core must, of course, be well vented. In the case of long, curved cores, the core is often made with a piece of string or even rope in the centre, which can be drawn out, and thus a vent passage is left. Tapers or flexible vent wicks, which consist of a cotton core surrounded by wax, may be used. In the case of straight cores, vent holes are more or less easily made, but good venting is essential to success, as if the gases cannot readily escape through the core they will rise up into the metal and cause serious defects.

PIPE CASTING.

In the casting of pipes special conditions are met with; the core is long, and is, of course, completely surrounded by metal. Such cores are usually made of loam, carried on strong core irons. The core irons are usually hollow; they are, in fact, pipes specially cast and perforated with a large number of holes about $^3/_{16}$ in. or more in diameter, the holes being drilled through the pipe. Such a core support is, of course, not only a support, but it permits the ready escape of the gases. The core iron will be of considerably less diameter than the core itself is to be, as it must be surrounded by the core covering, which, as a rule, will be from 1 in. to 2 in. in thickness if the cores are specially made, so that the diameter of the "core tube" will be from 2 in. to 4 in. less than that of the core being made, except in very small sizes, when, of course, the difference will be very much less.

In such a casting, where the core is absolutely surrounded by the metal, the pressure of the contracting metal will be very great, and the core must therefore be sufficiently compressible to prevent too great stress being thrown on to the freshly-solidified tube. This might produce fracture, and even if not cracked it might leave the metal in such a condition that it would be easily broken by subsequent handling. The usual method is to bind the core with hay band or straw rope, so as to give a yielding layer on which the loam covering is put. The hay or straw rope is carefully wound on so as to completely cover the core, the thickness depending on the diameter of the rope, which is varied to suit the diameter of the tube being made. The core iron is usually placed on trestles or horses with notches in which the ends rest, so that it can be rotated and thus the rope can be rapidly applied. The usual diameter of the "rope" is from ⅜ in. to 1½ in., and then the loam mixture is applied to the surface of the hay bands. It is quite obvious that in such a case as this porosity is of less moment than in the case of solid cores, because there will always be a ready escape for the gases inwards. The loam is carefully worked, so as to give a smooth surface, by means of a strake board, and the core is then dried.

For large cores the process is repeated; over the layer of loam another layer of straw or hay band is put, and then another layer of loam, so as to reach the required thickness. The layer of hay or straw must not be too thick, or it is too soft and "baggy," and the layers of loam must not be separated too widely, or they will not readily allow of the escape of gas, and may crack. When several layers are used the core is sometimes dried between the application of the various layers.

The outer layer of loam should be so thick that the hay or straw does not char, or if air finds access during drying it may so weaken the covering as to let the core collapse.

Where for any reason the thickness of hay band and loam has to be very great, the core may be strengthened by perforated iron plates fixed round the core tube, and various devices may be adopted to give the necessary strength. Collapsible core tubes are sometimes used where for any reason the removal might be difficult. Various designs have been made, but their use is quite exceptional.

The core having been dried, it is removed from the stove. The surface is rubbed over so as to remove any soot, and, at the same time, roughen it, so that the finishing layer may adhere. It is then moistened, and a layer or two of fine loam is put over to give a good surface. The surface is finally smoothed with a "board," the core being kept turning, and finally it is covered with blacking and made ready for use.

SUPPORTING CORES.

In some cases the core must be supported in position. It may be so long that it would tend to sag, or it may need supports to keep it central. This is usually done by means of pins called chaplets. The core may need support at the side if vertical, below or above if horizontal—below to prevent it from sagging by its own weight, above to prevent it from being floated up by the metal around it.

The chaplets will, of course, be surrounded by the liquid metal, and as the metal solidifies they will be incorporated in it. They must therefore obviously be of such a character as not to produce defects in the finished casting. The usual form of chaplet is a double-headed stud (fig. 104), the heads resting against the sand of the mould and the core, and by their comparatively large area giving a good bearing surface, but many forms may be used to meet the requirements of special work, the chief point to be considered being that the chaplet should thoroughly amalgamate with the metal. They must be large enough not to be melted by the surrounding metal, in which case, of course, their value would be lost, and they should not be larger than is necessary.

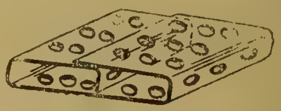


Fig. 105.—Perforated Sheet Metal Chaplet.

The chaplets may be of cast iron, malleable iron, or of steel, the first named being most usually used, although such chaplets are a frequent source of unsoundness in castings. The form shown in fig. 105 is advantageous in obviating this possibility, as the fluid metal gets through the holes in the stamped sheet metal, which is thus thoroughly incorporated.

MACHINE-MADE CORES.

Small cores are now frequently made by means of machines, such as illustrated in fig. 106, by which means they can be turned out very rapidly and of great uniformity. These machines are best actuated by hand power, although a belt drive is advantageous for the larger sizes. About 50 revolutions per minute is the best speed of working, and about 50 ft. can be produced for one penny.

FLOTATION OF CORES.

The core is made of sand which has a specific gravity of about 2·5, or partly of sand and partly of iron, and is surrounded by molten iron which has a specific gravity of about 7·5. It will therefore tend to float up, and must be so fixed as to resist the flotation.

The laws of flotation are very simple. Thus a body completely surounded by a liquid will displace an amount of liquid equal to its own volume, and it will be acted on by exactly the same forces as the volume of displaced liquid would have been. If it be heavier than the displaced liquid it will sink, because the surrounding pressures of the liquid, acting as they would on the lighter displaced liquid, will not be as great as the force of gravity acting downwards. If it be lighter than the liquid it will tend to rise, because the downward force of gravity will be less than the upward force of the surrounding liquid. Consider a vessel of water A (fig. 107) and consider a cubic foot of water B in the centre of it. Quite obviously that cubic foot of water will not either rise or sink. It weighs 62½ lbs. (1,000 ozs.), but the upward pressure of the surrounding liquid is exactly the same. Now suppose B to be replaced by a cubic foot of iron; the upward pressure of the water will be the same, but the iron, having a specific gravity of, say, 7·5, will be pulled down by gravity with a force equal to the weight of 7,500 ozs. If not supported it would sink, and if supported, say, by a spring balance, the balance would register a downward pressure of 6,500 ozs. On the other hand, if B be replaced by a cubic foot of wood having a specific gravity of 0·85, the downward pressure due to gravity will be only 850 ozs. The upward pressure due to the surrounding water will be as before, 1,000 ozs., and the piece of wood will float upwards, or if it were held in place by a spring balance this would indicate an upward pressure of 150 ozs.

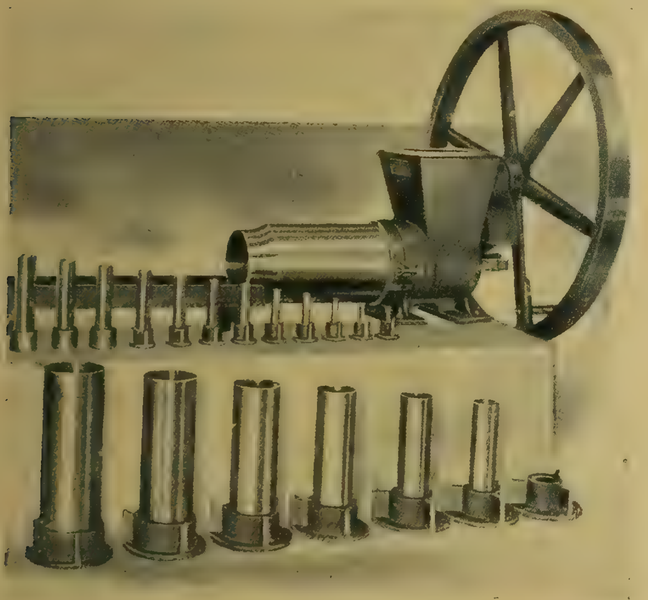


FIG. 106.—Core Making Machine (Wadsworth).

Now suppose the liquid, instead of being water, to be molten iron, the weight of a cubic foot will be as before, say, 7,500 ozs., and suppose B to be a cubic foot of sand having a specific gravity of 2·5, it will weigh 2,500 ozs., and the upward pressure will be force equal to the weight of 5,000 ozs., tending to float the core. In the case of a solid completely suronded by a liquid, the floating stress will be the difference between the weight of the liquid displaced and the weight of the solid. It must be added, however, that this only applies to a solid completely immersed, *i.e.*, surrounded on all sides by a liquid, a case which is never exactly met with in foundry practice.

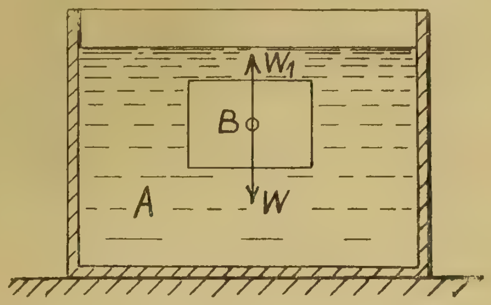


FIG. 107.—Diagram Illustrating Laws of Flotation.

W = weight of mass B.
W_1 = weight of fluid displaced by B.

Consider, however, the case which most nearly approaches it, viz., the casting of a tube placed horizontally. The core, fig. 108, will be completely surrounded, except at the ends, but the ends not being in contact with the liquid will make no difference, as the pressure there would be horizontal, Suppose the core to be 5 ft. long and 3 in. in diameter, then its volume in cubic feet will be 5 × ·1252 × 3·1416 = ·2455; that is, it will displace 0·2455 cubic feet of iron. We may assume this to weigh ·2455 × 7500 = 1,840 ozs. The weight of the core can only be estimated, unless it is weighed. It will consist of a hollow iron tube, the layer of hay band, and the layer of sand, and its average specific gravity may be taken quite nearly enough for our purpose as being = 3·0, so that it would weigh ·2455 × 3000 = 736 ozs., and the flotation stress would be 1840 − 736 = 1104 ozs., or about 69 lbs. This would not be likely to break the core loose or disturb the ends, but it may cause a distinct upward sag in the middle unless there be some support above.

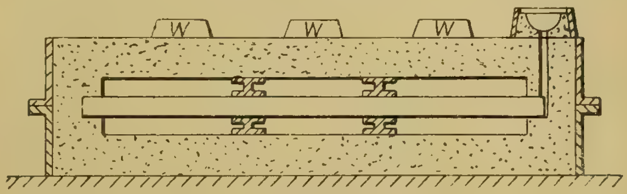


FIG. 108.—Flotation of Pipe Cores.

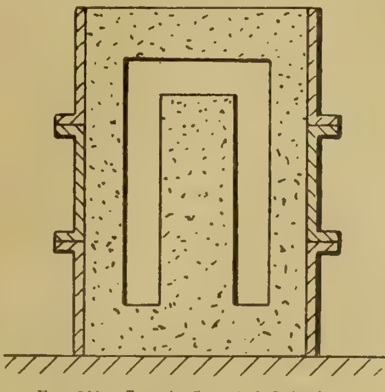


FIG. 109.—Core in Inverted Cylinder.

Consider now the case shown in fig. 109, in which a cylinder is cast vertically, the core being attached at the bottom. Quite obviously here the condition does not apply. The core is not surrounded by metal, for there is none underneath. The displaced metal can exert only a horizontal pressure on the sides, and there is no lift whatever. Unless metal gets under the core there will be no tendency for it to float up.

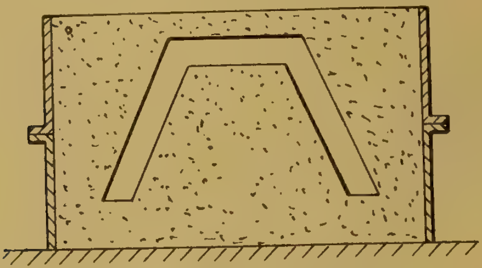


Fig. 110.—Core as Cone Frustrum.

Consider now a casting with a core the form of the frustrum of a core, cast face downwards, as in fig. 110. Here again it is quite obvious that, the core not being surrounded by metal, there is no upward lift whatever; but consider a case as shown in fig. 111, in which the core is the frustrum of an inverted core A B C D; the conditions are quite different. Now there will be an upward pressure. The imaginary cylinder A B E F, which forms the centre of the core, having no metal under it, will not be lifted, but the annular conical mass A E C, B F O has liquid metal under it; indeed, it will be exactly in the same condition as if A B E F were liquid, and the core will tend to be floated upwards with a lifting stress equal to the difference between the weight of the metal displaced and its own weight.

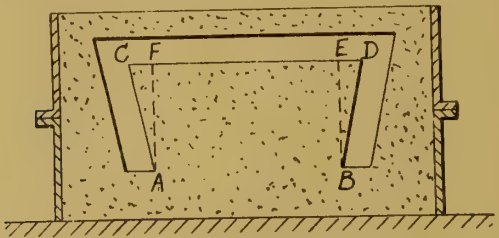


Fig. 111.—Core as Inverted Frustrum.

The principle is quite simple, and if the data are known the actual stress can easily be calculated. As in the case of other pressures produced under similar conditions, the actual maximum is of very short duration, as a skin of solid metal is soon formed.

(*To be continued.*)

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 8th December, 1910:—

Liverpool.—*First class:* R. C. Rogers, F. J. Parry, A. Nickson. *Second class:* S. T. Battersby, A. J. Burge, H. L. Rees, J. H. Weetman.

London.—*First class:* D. Russell, H. W. Taphouse. *Second class:* C. MacDonald, C. Newton.

North Shields.—*First class:* W. Ridley, G. J. Frederick, A. Peterson, V. Toward, H. R. Sutherland. *Second class:* J. T. Birkbeck, F. Bower, J. N. Gracey, A. W. Johnson, J. P. Johnson, J. S. Patrickson, J. Spence, B. Thompson, J. O. Thompson, R. W. Thompson.

The Gateshead and District Tramways Co's traffic receipts for the week ended December 2nd, 1910, were £946 2s. 8d.; corresponding week last year, £987 8s. 7d.; receipts from January 1st to December 2nd, 1910, £47,653 11s. 9d.; corresponding period 1909, £47,719 9s. 8d.

IMPROVEMENTS IN HYDRAULIC RAMS.

The following improvements in water raising apparatus, generally known as hydraulic rams or engines, which elevate a portion of the water or liquid that actuates them to an elevation greater than the fall that gives them impulse, are an invention of Mr. B. McIntire, of San Salvador, communicated to Messrs. Fawcett Preston and Co. Ltd., of York Street, Liverpool.

In experimenting with hydraulic rams and engines with respect to the relative area of the exhaust port and clearances on the waste valve, tension, and drop, also on the proportional area of the delivery valves to that of the delivery, due to the relation of fall to the elevation delivered at, it was found that the bottom discharge was useful. With this in view, a 3-in. ram was made and tested in conjunction with a known type of ram, and was found to give very satisfactory results after a considerable length of time of working, giving a greater lift in comparison to the fall than those of known types. With a small 1-in. ram, this was set to work with a fall of 70 ft. with its corresponding length of drive pipe, on which depends the perfect working of the ram and also its efficiency. With 70 ft. fall, the ram started and worked as easy as if it was working on a 10-ft. fall, elevating a little over 4 litres a minute to an elevation of 300 ft.

The necessities for 4-in. to 7-in. rams are accommodated by a double discharge, and that for 8 in. to 10 in. by a triple discharge, and that of 12 in. to 14 in. by a quadruple discharge, and continuous dimensions by the addition of further single discharge discs, or double discharge annular ring valves, the width of the ports generally varying from $1\frac{1}{4}$ in. to $1\frac{1}{2}$ in., the $1\frac{1}{4}$ in. admitting the use of a valve binding ring of approximately $1\frac{1}{8}$ in. wide, sufficient to stand $\frac{3}{8}$-in. binding bolts, which are required to keep the rubber seat in place, whether it be attached to a movable spider or the exhaust port seat, this being a very serviceable feature for large size rams, as it removes nearly half the weight from the movable spider.

The seated area of the waste valves may be limited to that of the rams, or be considerably under this for low elevations, the diameter of an equal circumferential area for a 24-in. ram of known construction, being 16 ft. 9 in., and this is reduced to 37 in., which represents the requirements for a heretofore impractical construction of a 24-in. ram, and this renders it within the limits of a most practical construction.

Rams of all sizes need several manipulations of the valve, or gate on the drive pipe, before setting down to their permanent stroke. This would be somewhat impractical on large machines, on considerable falls, but is provided for by the addition of an air pump to inject sufficient air to start the ram on the first opening of a quick-opening valve. This also serves a second and important function of providing the necessary elasticity for the beginning strokes; all features of large rams may be said to be due to lack of elasticity on starting, which throws the entire blow of the pressure corresponding to the fall of power water on to the entire ram structure. This happens also when delivery valve area is deficient, while with ample discharges the pressure is but slightly in excess of that of the elevation head.

The construction of the valve is such as to work as frictionless as convenient without increasing the weight. To this, and their divided limited area, is due to the necessity of employing other than heavy and strong retaining springs; apparently the spiders and plates are very weak and flimsy when the character of their duty is considered in combination with their construction and arrangement, but it will be understood that they are more than sufficiently strong to support their small section of unbalanced area; their seated section need no consideration, and their stems are made of pipe, upset at their threaded sections.

The improvements are more especially suitable for rams of large dimensions, as the exact proportional requirements of all their components and accessories are limited to the actual requirements of the areas of the rams.

Fig. 1 is a sectional side elevation. Fig. 2 is an end elevation, showing the waste valve chamber in section, and fig. 3 is a plan half in section, showing a ram comprising the present improvements. The main chamber is arranged in communication with an interposed waste valve chamber, both of which communicate with a continuation conduit, which terminates with a delivery valve plate, provided with one or more valve pockets and a delivery outlet, the waste valve chamber being provided with a waste valve seat, and the waste port being of a general similar character with the exception of the number thereof, and valve seats, the waste port and valve in one arrangement being of a rectangular form, and in another form annular, whilst a further arrangement consists of a combination of an annular port and a circular port, for a triple discharge or division of the waste water; and other arrangements are two annular ports for a quadruple discharge or division of the waste water, or further double or single division ports, such as eight divisions or discharges for the waste water through four annular ports.

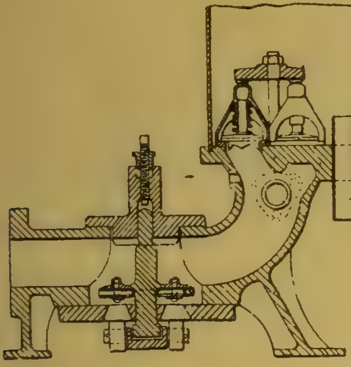


Fig. 1.

Referring to the nature and constructive improvements and arrangement of the waste valves, corresponding to the rams of single and multiple divisions or discharges of the waste water, which are distinguished from those of common rams, for their reduced unbalanced area, disposition, and arrangements of their accessories, their weight being reduced to a minimum, such as from one-fifth to one-tenth of that required for known ram constructions, the limited section of their waste ports requiring very light sections of metal—reduction in weight being a most valuable and necessary quality—the metal being preferably steel, brass or its alloys, or of the lighter alloys of aluminium or other metals.

The waste port and valve seat common to all dimensions of multiple divisions or discharges of the waste power water may be cast with the main ram chamber, or be a separate attachment thereto, and is provided with waste ports and valve seats, such as where two annular waste ports are provided, there are four seats, which are supported by arms connected with a central hub. Such hub is fitted with a foot guide for the waste valve stem to which is attached the waste valve, comprising a boss having extending arms, and valve plates which constitute a double discharge port between the said boss and one of the valve plates. To the annular valve plates are attached elastic seatings, for which rubber and leathers or their compounds are generally used, and the combined valve structure is supported by a vertical valve stem which may be preferably made of a metal tube for lightness, with a bottom and a top guide, the latter of which serves as a stroke stop, and is provided with a pocket to receive an elastic or cushioning packing to deaden the metal contact, and also serves as an abutment for a regulating or tension spring, which may be a spiral metallic spring, or may be of leather or its compounds, and is adjusted or given a required tension by a tension regulator, comprising an adjustable screw-threaded sleeve working in conjunction with the spring. The adjustment of this regulator is effected by the removal of a bonnet enclosing the upper end of the valve rod and sleeve, or by a pinion adapted to engage with teeth formed on the said sleeve, and to effect its rotation and adjustment.

A cover is provided for the waste valve chamber, which may be let into the waste valve chamber in such a manner that a considerable air space is avoided. To this cover is attached the before-mentioned bonnet, which serves as a stop cylinder guide to the valve rod, and also carries a stroke adjusting device, comprising a screw adjustment rod provided with a head, and is set or packed by a packing gland or nut. These means are those which are preferred for adjusting or regulating the stroke of and the tension on the valve rod, but it will be understood that other means may be employed for these purposes.

A simple and practical combination for the waste valve of small rams consists of a waste valve structure composed of two sections, a main section serving as an upper guide, a binding flange and guide wings, terminating in a cylindrical portion adapted to take in a bearing corresponding thereto. A top compression disc is provided on the elastic waste valve, or a solid waste valve may be used in place of the latter, such being serviceable for extreme elevations, the waste discharge port being arranged between the valve and the waste valve chamber. An oscillating arm supported on a suitably disposed pin between brackets is provided at one end with a pocket for the bearing of the cylindrical portion of the valve, and at the other end with an extension for retaining a tension spring whereby the oscillating arm is adjusted through a tension device similar to that previously referred to, and which works in a bracket attached to the casing of the valve. The valve stroke is regulated by a stroke adjuster provided with a head as mentioned above.

The waste valve may be of circular, elliptical, or of rectangular form with rounded ends, while the width of the waste port is preferably double that of the drop of the waste valve, as by this an approximate equality is secured between the rams and waste port, and is found to be a very practical construction.

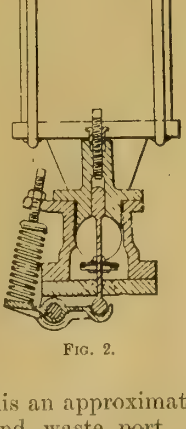


Fig. 2.

A separate outlet, channel, or port, is provided in all sizes of rams, when it is desired to elevate a distinct or separate source of water to that which gives impulse to the rams, and which may be of impure character, and that supplied to such outlet or channel pure and clean. A suitably arranged air inlet is provided for the supply of air to the air chamber.

Features in the delivery valves are the peculiarity of the ramming thrust, the variations in the potential energy, the duration of the effective ramming period beginning on its reaching the pressure of the elevating head, after which its effect is almost instantaneous, otherwise there would be no rebound of the drive pipe power column causing the stoppage of the ram. During the almost instantaneous ramming period a portion of the rammed water is jerked through, or passes through, the delivery valve to the air chamber, the quantity passing depending on the obstruction which it encounters in its passage, such as restricted delivery valve area; abrupt impingement against flat, or inverted valve surfaces; and torsional currents, which are the principal causes of low efficiency, rupture, and early destruction of the waste valve seating, while any feature that impedes or retards the instantaneous passage of the rammed water to the air chamber causes a corresponding elevation of the unutilised ramming pressure on the ram structure, the principal and most important being that of insufficent delivery valve area.

Large rams of practical constructions having the multiple divisions of the waste power water and required area of delivery valves can be constructed for using 5,000 gallons per minute of power water, while the structural material for rams of these sizes may be proportioned to elevate water to 200 or more feet without danger of rupture, providing that the damaging effect of the ramming thrust, serviceable in practice for elevating water to some 50 times that of the power fall. With a 30-ft. fall a ram will elevate a portion of its water to an elevation of 1,500 ft. with a corresponding pressure on the entire ram structure, while with a similar fall will exert a similar pressure, elevating to 60 ft. elevation, without air in the air chamber or from a stoppage of the delivery pipe, or its equivalent, to all of which rams are subjected; first, the back of a sufficient air cushion on first starting the rams to give a sufficient elasticity to the first ramming blows; second, and during the most dangerous periods when rams are stopped to repair or inspect their delivery, the air chamber pressure is released by means of check valves on the delivery pipes, thereby retaining the water in the delivery pipe at atmospheric pressure; on starting, this is compressed to the full energy of the ramming fall, the water in the delivery pipe forming a dead weight of probably many tons of wate[illegible] d forming a plug that is not started instantaneousl[illegible] the most instantaneous ramming period of the ra[illegible] roke; this is the principal cause of the rupture of all size rams, and is partially compensated for by the required strength in small and medium size rams.

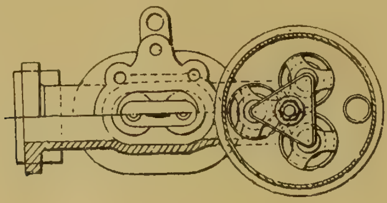


Fig. 3.

To provide large rams against the damaging effect of the ramming energy due to the power fall, an air pump is provided, and by this means air pressure is raised in the air chambers to place the structure beyond the danger point of the ramming energy, by which, in combination with a required delivery valve area, it is limited at all times to but slightly in excess of that due to the elevating head. This air pump may be of any suitable character or class, and may be operated by hand or power. Its delivery entrance may be at any point over the delivery valves connected to the air chamber.

The air pressure also provides means of creating a required pressure on the waste valves, and enables the rams to shoot on the first opening of the rapidly opening valve or gate of the drive pipes. To start all sizes of rams it is requisite that numerous openings of the drive pipe valves be provided to produce the required pressure in the delivery pipe to operate the waste valve.

The great pressure on large gates or valves will not admit of their being opened with sufficient rapidity to produce a ramming blow being produced, provided only with manual mechanism for opening them; therefore recourse is had to opening and closing them by hydraulic power, the most convenient being of limited proportions, and consists of a common weighted accumulator, operated by hand or power, in combination with a piston, on the valve or gate stem. This feature is only required for large size rams.

A further improvement consists in supplying hydraulic rams with shoot draft tubes. These are very serviceable with instantaneously operating hydraulic rams, and consist in suitably attaching a shoot draft tube to the under side of the waste discharge ports of all rams provided for dry ram rooms, and render these rams as accessible and convenient as any other class of machinery. This draft tube may be applied to all sizes of rams.

Referring to the operation of the improved hydraulic rams, especially to the larger sizes of rams and rams provided with a required length of drive pipe, in proportion to their fall, and an elevating head provided at a convenient distance from the ram with a sufficiently rapid opening gate or valve as will effect a ramming impact, this valve is partially opened, filling the air chamber and drive pipe to the level of the power fall. The drive pipe valve is now closed, and the air pump operated until a sufficient pressure is raised to give a required elasticity to the beginning of the ramming strokes, and to start the ram on the next or first opening of the drive pipe valve; small and moderate size rams being put in operation without air pressure being raised in their air chambers, by repeated openings of their drive pipe valve, these continuing automatically on reaching a required depressing pressure on their waste valve. When in operation they are given a required working stroke through the medium of the stroke adjuster or regulator and the tension regulator, and to which they are set, and at which the rams will work continuously for months, and only be interrupted on the appearance of some imperfection of the component parts.

The Kyl-Fyre Extinguisher.—The following results obtained from tests of the patent fire extinguisher "Kyl-Fyre," carried out at Kirkby Colliery, Nottingham, on Saturday, November 26th, 1910, before a large attendance, are given in the *Colliery Guardian*: The "Kyl-Fyre" Co. made several tests to extinguish large fires, and in all the extinguisher proved most successful. There were four tests in all, siz.: (1) One gallon of petrol poured on dry earth being ignited was extinguished instantaneously by two and a half tubes of "Kyl-Fyre"; (2) a bucket half full of petrol was extinguished by a handful of "Kyl-Fyre"; (3) a pool of boiling tar several inches deep and 4 ft. by 3 ft., containing petrol, was ignited and extinguished by half a tube of "Kyl-Fyre." The last and most effective test was one in which a stack of 1,000 ft. of timber was saturated with petrol and paraffin. The flames reached a great height. This was extinguished in a few seconds by one and a half tubes of "Kyl-Fyre." The inventor of "Kyl-Fyre" contends that the powder, when thrown with force into the base of the flames, will extinguish fires in mines, etc., without any injurious affect upon human beings. When the powder comes in contact with the flames the gas given off is a small percentage of CO_2.

THE ELEMENTS OF ENGINEERING ESTIMATING.

By A. Suggate, A.M.I.C.E.

(Continued from page 708.)

6. Need of Forecasting Probable Market Price.

As a rule, large contracts are not offered for competition till after the close of the financial year, sometimes about the end of the March month, or beginning of May, and in corporate bodies the accepted tender may not be known till a month or so later. Suppose a firm early in the year tender for an extra large quantity of cast-iron work when their stock of pig is only sufficient to keep their establishment going with its normal output, so that in the event of the firm being advised in the months of July or August of the acceptance of their tender they would have to buy, it is obvious that the firm's tendered price for the cast-iron work must be based upon the probable market price of pig in the month of August, when they must buy, or they run the risk of losing money, or else losing contract through tender being priced too high. The firm may know of competing establishment which, having plenty of stock in hand, will quote easy prices, but the firm in order to keep their books straight meet this contingency by pricing their tender with less profit. As an example, suppose the firm tendered for 500 ton of cast-iron work in the month of April of 1909, pricing their tender on the current quoted price of pig, if their tender is accepted and the firm has to buy pig in the month of August, it is obvious they drop some 3s. per ton, or £75 less profit than estimated. It may be contended that if, by the aid of a price diagram, they knew beforehand of the advance in price of pig iron, the firm would simply price their tender with less profit, and in securing the order, all that was desired has been obtained; this is admitted, but in the former case the estimate would be inaccurate to the extent of £75, and in the latter correct, which undoubtedly is the end to strive for.

Table No. 2.

Years.	Timber.				Cast Iron.			Wrought Iron.				Steel.						Copper.			Brass.			Tin.	
	Soft wood, cub. ft.	Hard wood, cub. ft.			No. 3 Cleveland quoted.	Scotch pig.		B B boiler plates.	Forgings.			Boiler plates.	Girder and tank plates.	Angles and tees.	Bars.	Forgings.	Castings.	Sheets.	Bars.	Tubes.					
1899					60·166																				
1900					69·083																				
1901					45·575																				
1902					49·186																				
1903					46·416																				
1904					43·75																				
1905					48·958																				
1906					55·458																				
1907					56·091																				
1908					50·716																				
1909																									
1910																									

By means of a price chart or diagram, the approximate prices of most raw materials may be known some months beforehand, and this knowledge is of greater advantage to the firm with small capital than one with plenty, for of course a firm well financed and with plenty of room to stock buy when the market is low, but this is not always convenient; besides, much stock in hand that is not used in a reasonable time is a dead loss.

Of course, labour, finance, and war scares may upset the most carefully-made forecasts, but firms must take their chance of such.

7. Private Prime Cost Book.

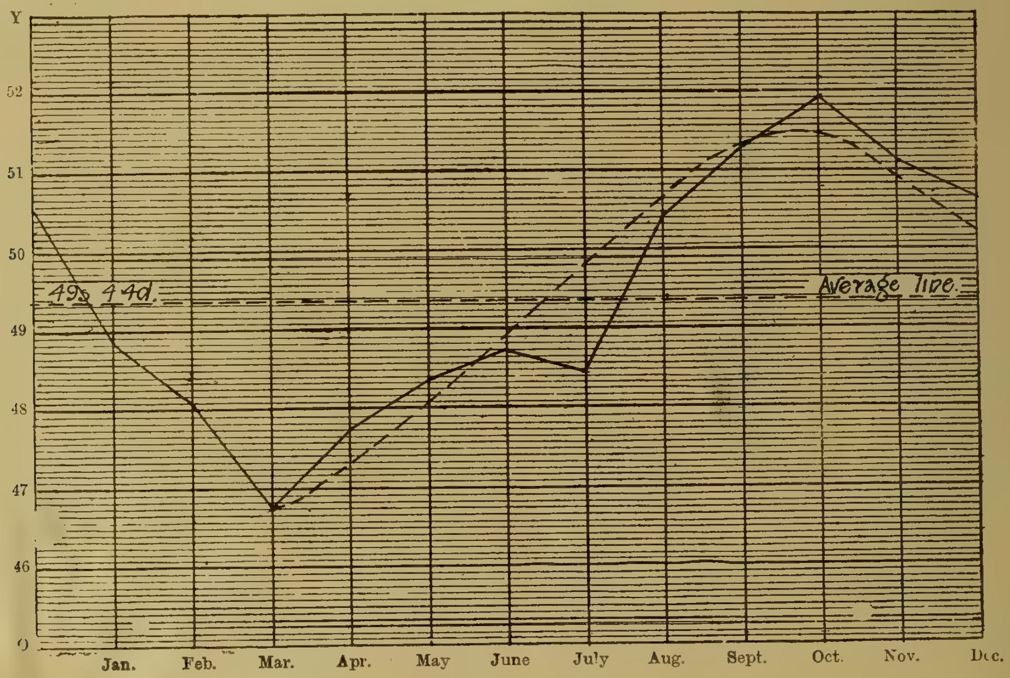
The engineer or clerk who intends to fully qualify as a competent estimator, would do well to provide himself with a book, something after the following description. As the book is intended to last a lifetime, as good a one as possible should be obtained. It matters little its exact size, but should not be less than 8 in. long by 6 in. wide, opening lengthwise, having some 120 leaves of good paper, and well bound with leather covers, so as to admit of lying when open quite flat on table or desk. It should have a pocket inside right-hand cover, for holding the tracing paper slips. The book requires to be lettered indexed at the beginning; a letter on one leaf will answer, thus giving two pages to each letter for index. The leaves require to be numbered, and about three-quarters of them ruled with faint blue lines $^5/_{16}$ in. apart lengthwise of the book. The remaining leaves should be ruled in a similar manner, but with the lines $^1/_{16}$in. or $^1/_{20}$in. apart; these latter are for making the market price or labour cost diagrams upon. Cross indexing should be adopted as far as possible; for example, suppose it is required to index up brasses for connecting rod, then these should be found indexed on the pages having the respective letters B. C. R., as follows:—

On page having letter B—Brasses for connecting rod... 93
On page having letter C—Connecting rod, brasses for... 93
On page having letter R—Rod, brasses for connecting... 93

It will be found convenient to have the past 10 or 12 years' average market prices of the raw materials chiefly in use by engineering firms, and for that purpose a list of same, similarly made out as per Table No. 2, should be entered in the prime cost book. Two pages can be made use of for the table, as that will give a few columns to spare for other kinds of raw material that may be wanted in the future, and the head lines can be filled in to suit the special kind of material in use by the firm. By consulting the bound-up back numbers of most of the trade journals, the average market price, quoted or realised, for the whole year of all the materials named in the table can be found, and this should be done for at least 10 years back, as data for forecasting probable market prices.

The advantage of having the pages simply ruled with lines $^1/_{16}$in. or $^1/_{20}$in. apart is in the convenience of adapting them to suit any kind of price chart it may be desired to make. Let it be desired to construct a price diagram or chart similar to that shown by sketch No. 1. Draw the lines O X and O Y at right angles to each other near to the bottom and left-hand side of the page respectively, the line O X being drawn over a blue line; also draw a line over every twelfth blue line to denote the price in shillings, and draw the 12 vertical lines at equal distances apart to indicate the months. Lay over the page a piece of good tracing paper and draw on same the horizontal and ines, figure in the shillings on the left hand, and write the months of the year at the bottom of their respective vertical lines on the tracing paper, all as per sketch No. 1. Title the tracing slip "Market-price Diagram or Chart of No. 3 Cleveland Pig Iron, 1909," give number of page of book on tracing, trim the same, and keep it in pocket attached to cover of book. When the price of the market is known, place the tracing slip over its skeleton copy on page in book, so that the lines O X and O Y on tracing lay exactly over the same lines on the page, and mark off on the vertical line the market price, and join it with the previous price by a straight line, thus constructing the diagram as before. After the month of March or April, when the curve commences to move upwards, calculate the probable average price for the whole year, plot it down in its correct position on the tracing, and complete the curve approximately by hand for the year upon the tracing slip, as detailed in Section 5. It is obvious that the same skeleton diagram drawn on leaf of cost book will serve for several kinds of materials, of course, using a separate tracing slip duly numbered and titled for each material. When the fluctuating prices of some materials, copper and tin, for instance, instead of being a matter of a few shillings, counts by pounds sterling, another skeleton diagram must be made on another leaf of the book, exactly similar to the one already described, with the one exception of drawing the horizontal money lines nearer each other, all depending on the value they represent. For instance, instead of the horizontal lines representing shillings, and every blue line a penny difference, as in the diagram of the Cleveland Pig Iron, let the horizontal lines represent pounds sterling, and be drawn on every 20th blue line, then these latter intermediate lines indicate shilling differences. But if the width of the leaf of the book is not sufficient to admit of this representation of the fluctuation in price, draw the pound lines on every 10, or if need be on every fifth blue line, then the intermediate lines will indicate a difference of 2s. and 4s. respectively. Thus half a dozen skeleton diagrams in book will suffice for making market price charts or diagrams on tracing slips of every material used in the engineering business, and the estimator, retaining his seat, can study the market prices and their effect on his quotations at his leisure, without the attendant labour of overhauling drawing boards or pinning sheets of squared paper to office wall.

Sketch No. 1.



MARKET-PRICE CHART OR DIAGRAM—No. 3 CLEVELAND PIG IRON, YEAR 1909.

8. Estimating Accessories.

No office can be regarded as complete with information for estimating without a collection of catalogues issued by engineering firms, as there are a large number of articles that a general engineering firm do not manufacture, and when specified in a contract or shown on a drawing are as a rule bought of an outside firm that lays itself out to make a speciality in the manufacture of such articles; and a few priced catalogues of engines, engine fittings, engine steam fittings, boilers, boiler mountings, boiler furnace fittings, boiler steam fittings, shafting, couplings, plummer blocks, wall boxes, hangers, cast and wrought iron belt pulleys (whole and in halves), rope pulleys (whole and in halves), iron and steel joists, channel, angle and tees, steam and hydraulic valves, iron and steel piping bends, elbows, unions, for gas, steam, and hydraulic work, cranks and forgings, indiarubber sheeting, leathers for hydraulic work, black and turned bolts and nuts, set screws, studs, etc., etc.

It is convenient to keep the price lists on shelves, divided by partitions into divisions, the latter denoted by letters of the alphabet. Roughly bind together the loose sheets in a thick paper cover, taking care to keep the catalogues, price lists, and bound sheets in that division, having its distinguishing letter or letters the same as the initial letter of the subject matter of the catalogues or sheets. Thus engine catalogues would be found in the division having the distinguishing letter E, and hydraulic, steam, gas, and water piping in the division having the letter P, and so on.

It is further convenient to separately index the various catalogues and sheets under the manufacturer's own name in a small lettered index memo book; then if it is required to look up some article under the manufacturer's name, say, for example, Messrs. Hopkinson, his name is found under H in the memo book entered as follows:—

Hopkinson—Steam and Water Valves, etc., Division V., or
Whitworth and Co., Sir J.—Heavy Shaft Forgings, Division F.

The latter name is cited because this firm do not send out catalogues, but previous quotations may have been received from them for a similar forging; make descriptive notes of same, giving weights and prices, and keep it in this division. From all catalogue prices a discount is allowed, the amount being stated when quotations are given. Discounts range from 1¼ to 75 per cent.

The estimating clerk will frequently be requiring the areas and circumferences of circles, strength and weight of materials; weight of flat, round, and square bar iron; also weight of angle and tee iron sheets and plates, cast-iron pipes, etc., etc. He will find all this information and much more tabulated in "*The Practical Engineer* Pocket Book" or "Molesworth's Pocket Book of Engineering Formulæ." It will be found convenient to gum on the edge of pages of book containing the tables small pieces of stiff paper, projecting beyond the edge upon which is written the name of the table on the page the paper is fastened upon. Thus, when the book is closed, the projecting slips with the names of the tables written upon them enables the book to be opened at the page required without loss of time.

(*To be continued.*)

NOTICES OF MEETINGS, &c.

December 16th.—The Institution of Mechanical Engineers. An ordinary general meeting will be held in the Institution House, Storey's Gate, St. James's Park, at 8 p.m. Papers to be read and discussed: "The Production of Castings to Withstand High Pressures," by Professor H. C. H. Carpenter, M.A., Ph D., and Mr. C. A. Edwards, M.Sc.; "The Constitution of Troostite and the Tempering of Steel," by Mr. Andrew McCance, A.R.S.M.

West of Scotland Iron and Steel Institute. The third meeting of the nineteenth session will be held in the rooms of the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, at 7-30 p.m. The Council will meet at 7 p.m. Paper to be read and discussed, "Carbon in Iron, and its Effects upon the Fracture of Pig," by Mr. W. J. Forster, ex-President of the Staffordshire Iron and Steel Institute.

The Institution of Civil Engineers. Students' Meeting at 8 p.m. Paper to be read: "Mathematical Deduction of the Most Economical Ratio of Reinforcement for Reinforced-concrete Structures."

The Aberdeen Mechanical Society. Paper to read: "Questions relating to the Disposal of Sewage," by Mr. Frederick R. Steuart, B.Sc., A.M.I.C.E.

December 17th.—Junior Institution of Engineers. Visit, 3 p.m., General Post Office New Power House, Upper Ground Street, Blackfriars, and sub-stations in connection.

December 20th.—Manchester Local Section of the Institution of Electrical Engineers. Meeting in the Physical Laboratory of the University of Manchester, at 7-30 p.m. Paper to be read: "Merz-Price and other Discriminative Protective Apparatus for A.C. Circuits," by Mr. K. Faye-Hansen, A.M.I.E.E., and Mr. G. Harlow, Student.

LITERATURE.

All books received or noticed in this column can be had through "The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"Practical Mathematics and Geometry." By E. L. Bates and F. Charlesworth. London: B. T. Batsford. Price 3s. net.

The advent of technical education on a large scale has created a demand for the teaching of theoretical subjects in a manner on entirely different lines from those previously thought to be essential. Practical attainments have taken a front place in the world of progress, and as life is too short for the majority—or even a fair proportion of them—to attempt academic study of all underlying principles, other means have had to be adopted. Much has to be taken for granted, and methods giving accurate results have to be accepted, in order to "push on."

These considerations apply perhaps more in the adaptation of mathematics to practice than to most other branches of science. Common sense is brought into account, and is now widely admitted as proof. It is a fitting method, and tends to rapid progress.

The book now before us is exemplary of the above, and is thus suited to the present requirements of the Board of Education by students in technical and trade schools. It covers a course of mathematics sufficiently advanced to assist at the higher stages of science and technical subjects, the examples selected being those of most common occurrence.

A few of the more prominent items may here be mentioned: Geometrical problems covering the first three books of Euclid, Algebra to quadratic equations, the use of squared paper, ratio and proportion, logarithms and variation, loci, and the elements of practical solid geometry. Many of the exercises are taken from the Board of Education examination papers.

The usefulness of the book is by no means limited to class students. It is a text book which will be found specially helpful to those who are at all backward in mathematics.

"The British Journal Photographic Almanac, 1911." (Jubilee issue.) Edited by G. E. Brown, F.I.C. London: Greenwood and Co. Price, cloth 1s. 6d., paper 1s.

This is a hardy annual now celebrating its jubilee. It is known to the photographic fraternity throughout the world, and is looked forward to at the season on account of the mass of interesting matter it contains. From a production of waistcoat pocket size, it has become a bulky volume of 1,346 pages, and weighs nearly 3 lbs. The chief items comprise: The story of the almanac, 12 pages; progress of the year in matters photographic, 143 pages; notices of apparatus introduced during last year, 87 pages; photographic formulæ, 68 pages; instructions for use of materials, 66 pages; tables of exposures, weights, etc., 44 pages; list of photographic societies and clubs, besides nearly 900 pages of advertisements.

As the almanac of the principal photographic journal, it can be relied upon thoroughly, and this fact, combined with the formidable dimensions, gives it a status which surely has no equal at the price.

"Ventilation and Dust Removal in Cotton Mills." By Marks and Clerk, London. Technical Publishing Co. Ltd. Price 2s. 6d.

The pressure which the Home Office are bringing to bear upon manufacturers to remove all impure atmosphere from their works, so that it shall not be inhaled by the operatives, has resulted in the case of the cotton industry in the introduction during the last two or three years of entirely new methods.

This work is intended to place before inventors, ventilating engineers, textile machinists, and manufacturers a full statement of the problem presented by carding and gassing machinery from a ventilation point of view, and to give an account of the means now available for meeting the special requirements.

The opening chapter deals exhaustively with the subject from a health point of view, pointing out the results of various investigations. Inefficient methods which some have adopted are discussed and the requirements of a satisfactory system set out. The second chapter discusses the qualities of efficient gassing machines, the various proposed systems of ventilation, and the advantages and disadvantages of same. The third chapter reviews the whole of the subject of the application of electricity to the singeing of threads, and outlines the requirements of electrical burners. The remaining two chapters deal with card rooms and contain a complete record of all efforts made to deal with the ventilation of same. Hints to intending buyers conclude a well-illustrated book, which should be in the hands of all interested in the problem of ventilation.

"The Construction of Graphical Charts." By J. B. Peddle. London: McGraw-Hill Book Co. Price 6s. 6d. net.

The employment of squared paper and charts in connection with engineering problems is becoming more and more popular. As a time saver the system is essential, and it has the advantage of giving visual relationship, a merit that was less important to the old school than to present-day technicians. The ordinary method of preparing graphical charts with rectangular co-ordinates is first explained, the connections between equations with various functions and co-ordinate readings being brought out. The next chart described is known as the alignment chart in which the co-ordinate axes, instead of being at right angles, may be parallel. This method has benefits in certain cases, and the reader will be interested in those which deal with areas, the collapsing pressure of turbine twisting moments, etc. A further case is explained for cases where there are more than three variables, and is applied to the helical compression spring, gear teeth, and strength of rectangular beams. In Chapter IV. the system is further developed by means of the hexagonal index chart. A family of chart forms is that known as the proportional or parallel alignment type. These are easily understood, and are applicaple in the case of centrifugal force, the polar moments of inertia, safe loads on case-iron columns.

The chapters up to here are concerned with the plotting of curves from formulæ, and in Chapter VI. the reverse process is explained, viz., the evolving of equations from plotted curves. The final chapter deals with stereographic charts, and what is more commonly understood as isometric projection. This form has special uses, the principle being employed by Prof. Thurston in his solid triaxial models for alloy work.

Naturally, for practical purposes, graphical charts are limited to the more simple mathematical expressions, and the author is to be thanked for bringing out such a clear exposition of the subject within reasonable limits. The book will be appreciated by a large body of students and others interested in solving engineering problems.

"The Young Electrician." By Hammond Hall. London: Methuen and Co. Ltd. Price 5s. net.

Every boy, once he has seen some of the effects produced by means of electricity, soon becomes fascinated with the subject, and is anxious to know more. If he is taking up the subject to study it thoroughly, he will read and work systematically from a text book. If his object is to get what pleasure and amusement he can, then this book will meet his requirements. It is written in simple language, and tells us how electricity in its various forms is produced, and the effects that can be obtained by the use of suitable apparatus. Some of the earliest observations of electric phenomena are touched upon, the effects produced upon light substances by electrified bodies, the gold leaf electroscope, Leyden jar, frictional machines, and such experiments are described. The more useful methods of producing electric energy by chemical and dynamical means are told in an interesting manner in dealing with primary and secondary batteries, electrotyping and plating, and in connection with magnetism, the telegraph, telephone, dynamos and motors, and wireless telegraphy. The large number of illustrations serve to lighten the reading and show how many of the experiments may be carried out.

The book is highly instructive, and is particularly recommended as a suitable present, especially at this time of the year.

BOOKS RECEIVED.

"Report of Analysis of Ores, Non-metallic Minerals, Fuels, etc., Made in Years 1906-8." By F. G. Wait. Department of Mines, Ottawa, Canada.

"Recent Advances in the Construction of Electric Furnaces for the Production of Pig Iron, Steel, and Zinc. By E. Haanel. Department of Mines, Ottawa, Canada.

"British Journal Photographic Almanac and Photographer's Daily Companion, 1911." Edited by G. E. Brown. Jubilee issue. London: Henry Greenwood and Co. Price 1s. net, cloth 1s. 6d.

"Heat Engines." By I. R. Allen and J. A. Bursley. London: McGraw-Hill Book Company. Price 12s. 6d. net.

"Official Gazette of the United States Patent Office." Vol. CLX., Nos. 3, 4, and 5. Published by authority of Congress, Washington.

THE DISTINGTON MULTIPLE BOILER EXPLOSION.

Multiple boiler explosions are fortunately of rare occurrence, but when they do happen the results are disastrous. Over a year ago such a disaster took place at the blast furnace works belonging to the Distington Hematite Iron Co. Ltd., Cumberland, when four boilers out of a range of eleven exploded. The case has been investigated by the Board of Trade, and has been carefully considered by the National Boiler and General Insurance Co. Ltd., Manchester. The range of boilers had safety valves loaded for a working pressure of 50 lbs. per square inch, Nos. 5, 6, 7, and 8 being those affected, of which No. 7 exploded first. The latter was laid off for cleaning, and the weight of evidence goes to show that a blank flange had been inserted on the boiler side of the main valve junction which had a branch to its safety valve. The evidence was not conclusive that this flange had been forgotten and left in, but the result demonstrated that this must have been the case, and therefore there was nothing to prevent the continual rise of pressure until explosion occurred. The boilers were all fired by blast furnace gases, and, following the high-pressure explosion of boiler No. 7, it is considered that gas explosion was the possible cause of the other succeeding failures.

The whole subject has been carefully collated and reproduced in book form, with illustrations and plates, by Mr. Edward G. Hiller, the chief engineer of the National Boiler and General Insurance Co. Ltd. Some brief accounts of previous multiple boiler explosions have been added, besides a table showing the number of boiler explosions and the loss of life resulting therefrom from the year 1866. The book is sold at one shilling.

TESTING OF ALTERNATORS, WITH RESULTS OF TESTS ON A THREE-PHASE MACHINE.

By J. W. Rogers.

(Concluded from page 581.)

Regulation and Efficiency Tests.—As is well known, the regulation of an alternator represents the percentage rise in voltage which takes place when full non-inductive load is thrown off, the speed and exciting current being held constant. The regulation also represents the "drop" in terminal voltage which takes place when full load is thrown on, and, as the terminal volts decrease with an increase in the load, a regulation curve would show a varying exciting current for a constant terminal voltage when the machine is running at a constant speed. The regulation of an alternator depends upon the power factor of its load, and increases rapidly as the power factor is decreased, due to lagging currents in the armature. When an alternator is supplying a leading current at a high power factor its regulation would be zero; that is to say, its terminal voltage would remain constant when the load was thrown off. On the other hand, when a leading current is supplied at a low power factor, the terminal voltage would be decreased when the load was thrown off, for the following reasons: When an alternator is supplying current in phase with its terminal voltage, the maximum value of the armature current occurs when its demagnetising action has but little effect on the alternator field. If the current lags behind the voltage it has a maximum value when the armature is in such a position that it can exert a powerful demagnetising action on the alternator field. The effect of a leading current in the armature is to increase the strength of the field, which causes an increase in the terminal voltage when the power factor is fairly high.

A regulation test is made by running the alternator on full load, either directly or by loading back on a similar machine. When a direct test is possible the machine is driven by a shunt motor and loaded up on a water rheostat, through step-down transformers if necessary. In the case of large machines, which it is impossible to run on full load, the regulation may be calculated from data to be obtained from the open and short-circuit curves in the following manner: First calculate the voltage drop in the armature for any particular value of load current, and add to it the terminal voltage on open circuit; then the exciting current required to give this total voltage is read off the open-circuit characteristic curve. A reference to the short-circuit current curve will show the field current required to give the same value of load current in the armature when short-circuited. The vectorial sum of these two values of exciting current is then found, and the voltage corresponding to this resultant field current is read off the open-circuit curve. The difference between this voltage and the terminal voltage expressed as a percentage will represent the regulation of the alternator for that particular value of load current.

The efficiency test of an alternator may be carried out (1) directly by measuring the input and output, the machine being run with the current in phase with the terminal voltage, *i.e.*, at unity power factor; (2) indirectly by calculation from the losses, which is generally the most convenient method and therefore most frequently used.

As is well known, the efficiency is the ratio of the power delivered to that received, the power received being equal to the sum of the power delivered and the losses. The losses occurring in an alternator are: (1) Armature copper loss, which varies as the square of the current; (2) copper loss in the field; (3) iron loss due to hysteresis and eddy currents, which is practically constant at all loads. Having briefly described the tests it is the custom to carry out on alternators, it will be of interest to consider the results of an efficiency and regulation test on a 150 k.w. 440-volt three-phase machine, and as it is only intended to give an example, the full-load point will alone be considered. The full-load armature current

$$C = \frac{150000}{440 \times 1{\cdot}73} = 197 \text{ amperes per phase,}$$

or 340 total amperes, which represents the current to be taken into account when calculating the total armature copper loss. The mean values of the resistances, after being corrected to a standard temperature of 50 deg. Cen., were found to be as follows:—

Armature resistance, $Ra = {\cdot}048$ ohm.

Therefore total armature resistance

$$= \frac{{\cdot}048}{2}.$$

Field resistance at 50 deg. Cen. = 2·155 ohms.

Now the armature copper loss

$$= \frac{C^2 R}{2}$$

$$= \frac{341^2 \times {\cdot}048}{2}$$

$$= 2790 \text{ watts.}$$

The copper loss in the field winding = field current^2 × resistance, and the value of the field current required to give a terminal voltage of 440 at full load was 47 amperes; therefore field copper loss $= 47^2 \times 2{\cdot}155$

$$= 4760 \text{ watts.}$$

The value of the iron loss at 440 volts as obtained from the open circuit saturation curve = 2736 watts.

Loss due to friction = 1518 watts.

Therefore total loss $= 2790 + 4760 + 2736 + 1518$

$$= 11804 \text{ watts.}$$

The output of the alternator at unity power factor

= terminal voltage × total amperes

$= 440 \times 341 = 150000$ watts.

Total input = output + losses

$= 150000 + 11804$

$= 161804.$

Therefore per cent efficiency

$$= \frac{150000}{161804} \times 100$$

$$= 92{\cdot}75 \text{ per cent.}$$

The efficiency has been worked out for different values of load current in the manner described above, the results being represented by the performance curves shown in fig. 1.

Commercial Testing.—The commercial tests carried out on alternators are made for the purpose of locating faults in manufacture due to defective material, bad workmanship, or faulty assembling. Any defect in the iron circuit of a machine would show itself in an iron loss or temperature test. In the case of an iron loss test, defects would be apparent from an excessive iron loss at normal excitation which would be accompanied by an excessive temperature of the iron circuit.

When several machines of the same design are to be tested, it is the custom to carry out the complete series of experimental tests, and also commercial tests consisting of a temperature run at full load and an insulation test, on the first machine. If the results of these tests are satisfactory, it is only necessary to carry out commercial tests consisting of (1) iron loss, (2) temperature run at full load, (3) insulation, on the other machines built to the same specification, the results of these tests being sufficient to guarantee the satisfactory performance of a machine under normal working conditions, assuming that the tests compare favourably with those made on the first machine. In the case of alternators having a large number of poles, mistakes in assembling the field coils are always liable to occur, which renders a polarity test necessary, as the effect of a reversed field coil is not so apparent as in the case of direct-current generators. The most satisfactory method of making a polarity test is to excite the field with a very small current and note the behaviour of a compass needle when passed near each pole face.

A temperature test is made by running the machine on full load, which is, of course, only possible with machines of moderate output. When it is not possible to run machines on full load, it is the custom to run them on open circuit with the field current necessary to give the normal terminal voltage at full load. Although the duration of temperature test varies slightly with different makers, it is the custom to run a machine until the temperature of its various parts has reached a steady value. The temperatures taken are those of (1) atmosphere, (2) armature windings, (3) armature core, (4) field windings, (5) collector rings. All temperatures are taken with mercury thermometers, the bulbs being placed in contact with the different parts of the machine and covered with cotton wool to prevent radiation of heat.

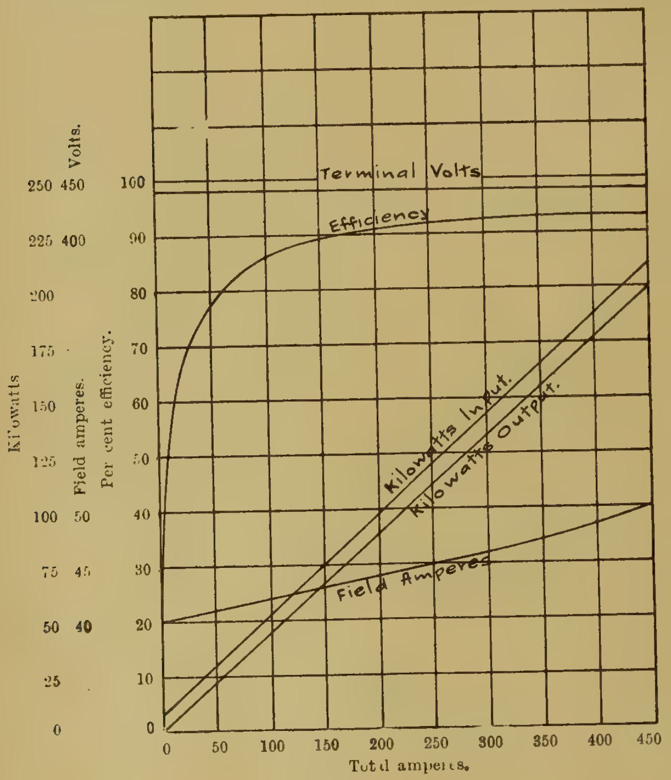


Fig. 1.

As regards the temperature of the armature and field windings, the thermometer readings may be checked by calculating the rise in temperature from the increase in their resistance.

The resistance of a copper conductor increases by ·428 per cent for each degree Cen. rise in temperature, so that the mean temperature of the windings may be calculated from

$$\frac{\text{hot resistance} - \text{cold resistance}}{\text{cold resistance} \times \cdot 00428}$$

The insulation test is always made at the conclusion of a temperature run, as the insulation is more liable to break down when a machine is hot. This test consists in applying a high alternating voltage between the armature and field windings and the frame of a machine. In the case of low voltage generators the testing pressure is generally double the working voltage, but, as the factor of safety with a low voltage winding is higher than that of a high voltage winding, the ratio of testing voltage to the working voltage should be less for high voltage machines to prevent the possibility of damaging the windings. Generally speaking, the testing pressure is double the working voltage up to 5,000 volts, but above this value the testing pressure should not exceed $1\frac{1}{2}$ times the working voltage. The capacity of the testing transformer used for making dielectric tests is a point which requires due consideration, as it is governed by conditions affecting the testing circuit as well as the apparatus to be tested, and this question may be considered as follows: In virtue of its static capacity, the apparatus to be tested may be considered as a condenser, the charging current of which may be represented by

$$C = 2\pi \times 10^{-6} \times V \times N \times K$$

(assuming a sine wave of E.M.F. applied to its terminals) where C = current in amperes, V = terminal voltage, N = frequency, and K = capacity in micro farads. It follows, therefore, that the charging current taken by the apparatus to be tested is proportional to its static capacity and varies directly as the frequency and testing voltage.

The apparent output of the testing transformer would be proportional to the square of the voltage, and may be calculated from the formula given above when the static capacity of the apparatus to be tested is known.

The C^2R losses in the insulation are generally very small compared with the charging current, and may, in the majority of cases, be neglected. The dielectric loss has, however, an appreciable effect on the output of the testing transformer when the testing pressure approaches the disruptive strength of the insulation, and, as this loss varies directly with the frequency, it should be taken into account when calculating the capacity of a testing transformer to be used for disruptive tests. The frequency of the testing circuit also governs the size of the transformer for a given output, which varies inversely as the frequency. It follows from the above remarks that (1) for a given output the lower the frequency the larger will be the transformer required; (2) for a dielectric test under given conditions the higher the frequency of the testing circuit the larger the capacity of the testing transformer.

BOILER EXPLOSIONS.

Abstracts from Recent Board of Trade Reports.

Explosion of Lancashire Boilers.

Report of Preliminary Inquiry No. 1,948.—The explosion occurred on the 18th September, 1909, at the works of the Distington Hematite Iron Co., Distington, Cumberland. No one was killed, and only one person was injured, John Briggs, a blast furnace filler employed on the works, having sustained a minor injury to his left arm by a piece of falling brick. The whole of the boilers in the group were of the Lancashire type; Nos. 1 to 9 were about 30 ft. long and from 7 ft. 9 in. to 7 ft. $10\frac{1}{2}$ in. diameter, and Nos. 10 and 11 were 32 ft. long and 7 ft. 6 in. diameter.

The boilers varied somewhat in detail, having been made by several different makers. The following description applies to Nos. 6 and 7 boilers, which failed by longitudinal fracture of the plates, the failures in the other boilers being confined to the circumferential rending of shell plate seams and flue tubes. Nos. 6 and 7 were practically similar, and were made of iron, the brand on the front end plates of No. 7 boiler being R. H. and Sons ♛ Best Best Iron. The shell and flue tubes were $^7/_{16}$ in. thick, and the end plates $\frac{1}{2}$ in. thick. The shell in each case was made up of nine rings of plates having three plates in each ring. The longitudinal seams were lap jointed and double riveted, the circumferential seams being lap and single riveted, with rivets 2⅛ in. pitch and holes ⅞ in. diameter in each case. The flue tubes were each made up of seven rings of plates, the front one in each case being 8 ft. long. Galloway tubes were fitted in the 2nd, 3rd, 4th, and 6th rings. The seams of the flue tubes were lap jointed and single riveted throughout with rivets pitched from 1⅞ in. to 2 in. apart, the holes being ⅞ in. diameter. The end plates were each fitted with four gusset stays in the steam space, two gussets being also fitted to the front and end plate below the flue tubes, one on each side of the manhole and one to the back plate at the bottom centre line of the boiler. Two longitudinal stays 1¼ in. diameter were also fitted in each case between the gussets in the upper part of the boiler and the flue tubes. The front end plate was attached to the shell by an external angle-iron ring 3 by 3 by ½, and the back end plate and flue tubes by internal angle-iron rings of the same section. The rivet holes were punched. No. 5 boiler was practically the same as Nos. 6 and 7, and was made of iron. No. 8 boiler was made of steel, the shell being made up of ten rings of plates and the flue tubes of seven rings of plates each. The latter were stiffened by three Bowling hoops, no Galloway tubes being fitted to this boiler. The frame surrounding the manhole in the shell was of cast iron, but round in form instead of oval. The other boilers were of the same type; Nos. 1 to 7 were made of iron, the others being of steel. Nos. 10 and 11 were made at a later date, and were fit for a higher pressure, and these two boilers had safety valves different from the others in that they were fitted directly on the boiler, independent of, and removed from, the stop-valve chest, two separate safety valves being fitted in each case. The boilers were placed side by side, Nos. 10 and 11 being set back, however, some feet behind the others. The main flue to the works chimney ran behind the back of the boilers transversely. The explosion was a most violent one, no less than four large Lancashire boilers in a range of eleven exploding, three others being ripped circumferentially at seams in the shell plating, through which steam and hot water escaped. All the boilers were dislodged from their seatings, the brick flues under Nos. 5, 6, and 7 being levelled to the soil. Nos. 5, 6, 7, and 8 boilers were hurled from their seatings, the shells of Nos. 6 and 7 being torn to pieces, those of Nos. 5 and 8 being ripped circumferentially into two parts, the flue tubes being also partly torn out, broken, and distorted. The shell of No. 7 boiler alone was torn into comparatively small pieces, upwards of 40 in number, some of which were hurled great distances. The end plates and flue tubes were also torn to pieces, the latter being also hurled considerable distances. The shell plate of No. 6 boiler also failed, but into fewer and larger pieces, the front end ring and most of the back end ring remaining attached to their respective end plates. The seven intermediate rings opened out flat, chiefly at a longitudinal line of fracture at the bottom of the shell where the boiler rested on the seating blocks at the right-hand sidoe of the central brick flue. This part of the shell, after opening out flat, was probably blown a great height, breaking up into three large and three small pieces, the largest piece falling through the roof of a smithy behind the boilers, the marks on the smithy wall showing that its flight as it neared the ground was nearly vertical, and it had evidently therefore dropped from a great height. The ends of the boiler with the adjacent rings of plate attached were shot in opposite directions; the flue tubes were torn completely out and broken each into two pieces. With regard to No. 8 boiler, the shell separated owing to the shearing of the rivets at the circumferential seam joining the 4th and 5th rings of shell plates. The front half was violently projected forward a distance of about 120 yards, and the back half was similarly projected in the opposite direction a distance of 234 yards. The front portion of the shell, together with half of the flue tubes, was battered flat at the open end after separating from the back portion, the latter part of the shell retaining its cylindrical shape with the exception of a small portion of the 5th ring, which was bent sharply in. The flues were each broken into two pieces and torn away from the back end plate. The explosion originated in No. 7 boiler, which burst from over-pressure, the explosions from the other boilers resulting from the bursting of No. 7. No. 6 boiler was crushed in on the right side and exploded, the flue tube on that side being also crushed in. The blow against the side of No. 8 boiler caused all the rivets in one of the circumferential seams to shear, and the boiler then burst. The sides of No. 5 boiler were crushed in, the shell plate failing in consequence through the rivet holes in one of the circumferential seams, and this boiler also burst. The minor explosions from Nos. 4, 3, and 2 boilers were similarly caused by the sides of the shells being crushed in, but to a lesser degree. The over-pressure in No. 7 boiler arose through the passage to the stop and safety valves being blocked from the inside of the boiler when it was empty, and, there being no outlet for the steam generated to escape, the pressure accumulated until the boiler burst.

Explosion from a Heating Tube in a Steam Oven.

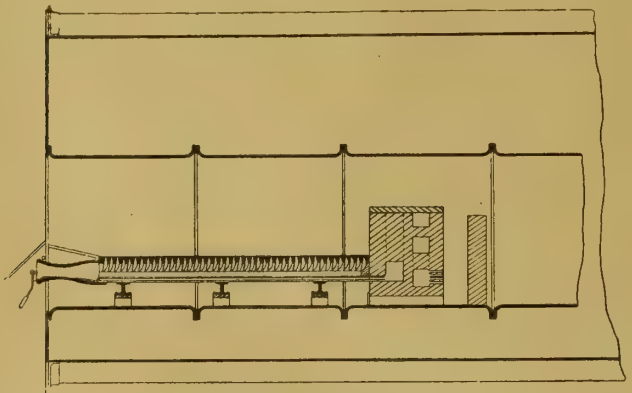
Report of Preliminary Inquiry, No. 1,963.—The explosion occurred on the 9th April last, at 56 and 58, Dock Street, Ellesmere Port, Cheshire. No person was injured by the explosion. The oven is described by the makers as a double-decked steam oven. It had two compartments, the internal dimensions of which were 8 ft. in length and 6 ft. in breadth, and it was built with double walls of steel plate, ⅛ in. in thickness, the space between the walls being filled with slag wool. The oven was heated by means of 78 tubes, arranged in three rows, as shown on the plate. The tubes were 9 ft. 6 in. in length, $1^{5}/_{16}$ in. in external diameter, and the bore of the original tubes was ¾ in., while 32 tubes, which were fitted in April, 1908, had an internal diameter of 1 in. They were all made of butt-welded wrought iron, the ends being plugged and welded. Each of the original tubes contained half-a-pint of water, and those subsequently fitted contained five-eighths of a pint. The tubes originally fitted in the oven were hydraulically tested by the manufacturers to 3,500 lbs. per square inch, and those supplied in April, 1908, were tested to 4,000 lbs. per square inch before leaving the makers' works. The tubes projected past the back wall of the oven into the furnace, and were butted against the opposite wall. The length exposed to the fire was equal to the width of the furnace, which was originally 7 inches. The top row of tubes was depressed from the horizontal about 11 inches, and the two lower rows about 8 inches, at the furnace end. The outer ends of the lower row formed the firegrate, and suitable doors were fitted to the furnace and ash-pit. A sliding damper was provided in the flue above, to control the draught. The tubes were independent of each other, and were not provided with fittings of any kind. The temperature of the ovens was indicated by a mercurial thermometer fitted to each oven compartment, and connected to an internal tube. On the top of the furnace flue there was a hot-water cistern, from which water could be drawn for ordinary purposes, or allowed to pass in small quantities through a heated pipe to inject steam into the prover under the oven. The twentieth tube from the fire-door in the bottom row burst at the furnace end, displacing a small portion of the brickwork forming the ash-pit side. The tube end split longitudinally for a length of two feet, the fracture being along the line of weld and through the solid metal opposite the weld. The severe working conditions to which the tube was subjected fatigued the metal until it was no longer able to withstand the pressure generated within the tube.

A NEW FORCED-DRAUGHT BOILER.

With the production and utilisation of the cheaper and smaller grades of coal, it has become increasingly necessary to devise means whereby such coal can be sufficiently utilised without producing wasteful and objectionable clouds of smoke, and in this connection many types of apparatus have from time to time been put upon the market, many of which have served their purposes extremely well. There yet remains, however, some room for improvement, and an interesting furnace produced under the Wilson and Furneaux patents by the Tyne Forced Draught Co., of Newcastle-upon-Tyne, is worth some attention, as its working results have given satisfaction. The general arrangement of the apparatus applied to a Lancashire boiler is shown in the illustrations. The furnace consists of a number of firebars of special design, lying across the furnace and resting on trough-like members, the upper edges of which fit into grooves formed in the lower edges of each firebar. These half tubes or troughs fulfil two functions, as they act not only as a support for the furnace but also as air reservoirs for the supply of air to the furnace and to the hollow bridge.

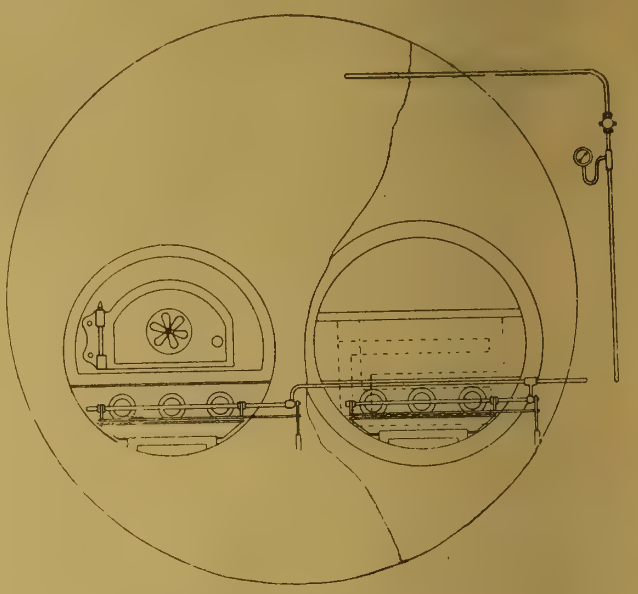
The lower portion of each half tube is fitted with a plate or diaphragm, which runs from front to back of the furnace and divides the troughs into two compartments or reservoirs, the upper of which supplies air to the furnace, the lower portion acting as an air duct to the hollow bridge. These half tubes rest in turn on stands placed on the furnace tube at intervals of 2 ft. The openings to the fire are three or more in number in each bar, and are formed on the front faces of the bars. Each bar is designed to form a separate air passage to the fire directly over each half tube, which therefore acts as an air reservoir or duct for one-third of each bar in the furnace.

A bell-shaped funnel is bolted to the front bar. The back bar is also shaped differently to the ordinary bars, the semi-circular openings being omitted. At the front end of the half tubes or troughs a flat valve is fitted, closing the space formed between the plate and diaphragm and the tube walls, and a steam pipe from the boiler steam space or other convenient supply admits steam, the supply of which may be regulated by the flat valves to nozzles placed centrally at the mouth of each funnel.


Forced-draught Boiler—Longitudinal Section.

Each half tube is led into a hollow fire bridge, which is common to all the tubes, and a baffle wall is built at the back of the hollow bridge directing the flow of the heated air from that bridge into a vertically upward direction, where it mixes thoroughly with the unconsumed smoke, which would otherwise pass away over the bridge, and thus a largely improved combustion is obtained at the back end of the boiler.

This process is in detail as follows: On opening the flat valves at the front end of the tubes, a proportion of air introduced by the steam jets is admitted through these tubes to the hollow fire bridge, and from there, after being heated, the air passes to the back of the bridge, where it mixes with the unconsumed products of combustion. The greater portion of the air introduced by the steam jets passes through the upper half of the passage formed by the half tubes and the lower portion of the firebars, and passes to the fire through the openings in each bar, these openings being so designed that an even distribution of air to the fires is obtained. The value of this arrangement in the prevention of smoke is that cheap, small coal, dust, and coke, the use of which is usually attended by the emission of smoke of considerable density and volume, can be effectively dealt with, inasmuch as the semi-automatic regulation of the air supplied to the back of the bridge and to the furnace is so adjusted as to secure maximum furnace efficiency with minimum smoke. Not only can wing firing be effectively done by an ordinarily experienced stoker, but the fires may be cleaned and every operation of stoking carried out without turning off the steam jets. All the passages formed in the front of each bar from the air reservoirs to the fire are specially designed to offer the least resistance to the passage of the air and to ensure that the air pressure is equal for the whole length of the fire space. Semi-automatic regulation ensures that the volume and pressure of air supply to the furnace bars is unaltered, or is capable of increase if desired, for in proportion as the valve to the fire or hollow bridge is opened, so is the steam valve to the jets, thus ensuring a sufficient supply of air to the bars to deal efficiently with each new supply of fuel as it is thrown on the fire.

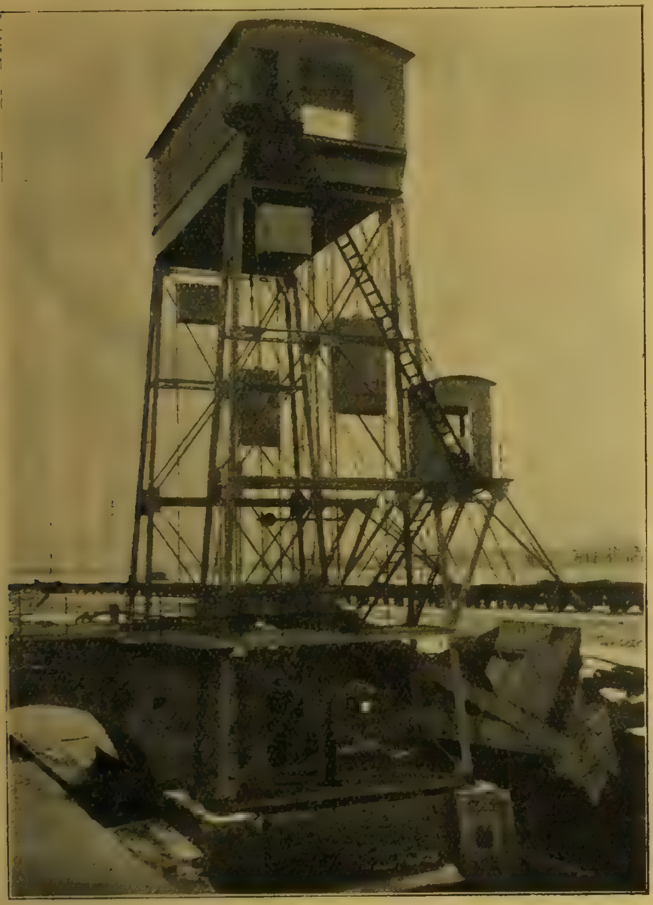

Forced-draught Boiler—Sectional Front Elevation.

Proposed Waterway from Lake Winnipeg to Edmonton. H.M. Trade Commissioner for Canada reports that Mr. Voligny, who has been directing the surveys (now nearly completed) for a proposed waterway from Lake Winnipeg to Edmonton, states that the scheme is quite feasible. The distance from the head of Lake Winnipeg to Edmonton is 398 miles, and there is no particular obstacle anywhere in the route. The cost of the work is estimated at some 15,000,000 dols. (about £3,080,000).—*Board of Trade Journal.*

NOVEL APPARATUS FOR TILTING RAILWAY TRUCKS

Some time ago an order was placed with a German firm to build a truck-tilter on the banks of the River Oder, by means of which coal could be unloaded into barges without being broken. This would have been easy enough if the water-level, and with it the ships or barges, remained at a constant distance from the chute; but, unfortunately, the former varies considerably, and as coal was the chief material to be unloaded, the fall from the height when the barges were at the lowest level, including the distance within the barges themselves, was found to break this brittle material.

The apparatus—shown in our illustration—devised by the firm to solve the problem is an interesting one. The tilting platform is made movable in a vertical direction. If a car is to be emptied at a high level an electric hoist raises that portion of the platform located on the land side, while at the minimum level the water-side portion is let down. At any intermediate position both electromotors are operated, elevating and lowering the respective parts. In addition, the platform can be tilted to an angle of 45 deg., a special device preventing a steeper inclination. The dead loads are counterbalanced by the heavy weights seen in the illustration.



Apparatus for Tilting Railway Trucks at Cosel, Germany.

When in an horizontal position the platform is locked by automatic catches, and an arrangement is also provided by which the ropes supporting it are relieved from tension when a loaded truck is moved upon it.

Another improved feature distinguishing this tower from other types is the employment of power machinery to draw the trucks to and from the platform. Here, again, electricity is used, and considerable time and labour is saved, against the slow and cumbersome way of moving the heavy trucks or wagons by hand. This arrangement increases the efficiency and reliability of the installation, and the apparatus is ready to work at any time, while a steam tilter requires considerable time for preparation.

The operation is as follows: When a truck loaded with coal arrives, it is drawn by an electromotor upon a turntable, turned there at 90 deg., and moved on to the platform. Here the front axle is secured by automatic clamps and the whole is tilted. The coal falls into a large tank, the lower end of which is closed by a trap door. This is electrically operated from the machinist's seat, and any larger or smaller quantity of coal can be let through. When all is empty the platform is tilted back, the hooks are removed, and the truck is moved on the turntable and then on to a side-track.

This tower has recently been erected at Cosel, a large German inland port, and its operation has given complete satisfaction. Certain of the novel features in the design have been patented.

FOUNDRY AND MACHINE SHOP AGREEMENT

By Walter J. May.

The cost of any article is really the actual sum which has been expended in getting it ready for sale, and, this being the case, each department should be in accord in endeavouring to reduce needless expenditure as a total, and not, as is so often the case, trying to reduce charges in one department irrespective of the effect it has on others. Of course, the work is originated in the drawing office, and it is here that the development of parts arises, but a good many working details are developed in the various departments. By careful forging, the smiths can reduce the work in the machining departments, and, where castings are concerned, the pattern shops can reduce the work in the foundry, and the foundry can very well reduce costs in the machine and other finishing shops if all departments work together to secure a final result, but if each one simply tries to secure the lowest cost in his own department only, then the total costs as a rule sum up to a much higher figure than would otherwise be the case. For instance, we will take a casting which can be produced in the foundry with the runner knocked off and the sand removed with the brush only for, say, one shilling, but dressed ready for placing in the machine for eighteenpence. Sent into the machine shop in its first state, the cost of machining will be, say, two and sixpence, but in the latter state two shillings, of course, taking labour charges only. In either case the cost is three and sixpence, plus the cost of the metal and proportions of various standing charges, but the results in the first case will show a low foundry cost and a high machine shop cost, while in the second case it will show the reverse, and yet the total remains the same. In the first case, however, you get a lot of dirt and dust, which should have no place in the machine room, as it is liable to damage the machinery, whereas it would do no damage in the fettling shop, the result in the end where a lot of this class of work is done being that repairs and depreciation of machinery becomes a heavy item.

To ensure economy in the total cost of any machine or article the whole of its production must be carefully worked out, and probably in regard to this point the drawing office will get most of the work. In regard to this, however, the draughtsmen very often have not the very necessary shop experience which will enable them to get out work in the way which would be most economical in production, and so long as nice-looking drawings are produced, this appears to many men to be sufficient, and in the result very awkward, and at the same time expensive, castings have to be produced which, with practical knowledge of foundry practice, would be avoidable. It is not supposed for one moment that the making of expensive work is done purposely, but if the pattern makers and foundry men were consulted, much trouble and expense would be avoided in producing castings, while the machinemen would be able to point out matters which tell against their department. For instance, in one case which came before the writer, a four-throw compound eccentric sheave had to be made, some dozens being wanted, and in the drawing office a solid pattern was evolved. The drawing went to the pattern shop, and a solid pattern was made and sent into the foundry, from whence it was promptly returned with the request that it should be split in a certain direction to enable the moulder to get the pattern out clean, as the sheave had to be cast half in the drag and half in the cope. As the pattern-makers could not alter patterns unless under orders from the drawing office, reference was made to this department, with the result that the pattern could not be split, the end of the matter being that each mould wasted an hour's work on the part of the moulder, which would be somewhere about ninepence; and owing to the form of the actual casting extra work was thrown on the turners, who soundly cursed the whole thing, while the cost of altering the pattern would probably not have exceeded a shilling. This is the sort of thing to be avoided, but the difficulty is how this is to be done unless each department is in friendly accord. In some cases each set of men employed are on piecework, or have a bonus on output, the machinists working on the quantity of work done or number of pieces turned out in a finished condition, while the foundry output is reckoned on tonnage. The foundry, therefore, has a direct incentive to turn out as heavy castings as can reasonably be made, and close fettling is not desirable from the foundry point of view. This clearly is not an advantage to other departments or to the ultimate cost of production of the finished goods, and it would appear to the writer that some form of bonus system based on the final costs should be arranged in preference to departmental bonuses, while all should share in such bonuses when earned. This would be more likely to tend towards economical production than the present system, because, all having an interest in the final result, all would try to reduce costs in a reasonable way, instead of each department trying to go one better than the others independently of the collective work.

So far as cast work is concerned, each department handling any part of its production, from its inception to its finished state, has some chance of reducing costs if all work in accord, but when working each for its own hand the ultimate result is apt to be rather disappointing, no matter what system of working is adopted.

Apart from the foundry, the smith's work will bear the same remarks, as where care is taken the work on metal after it has been forged into shape, can be very much reduced in a large number of cases, but necessarily this increases the smithy charges for labour, although in all probability reducing the cost of stock somewhat. The actual saving would come in elsewhere, and in many cases the saving would be considerable, but the greatest economy would be in providing good drawings and patterns to which the smiths could work with exactitude.

IN modern building construction the heating and ventilation is one of the most important considerations. The two must go hand in hand, for the heating arrangements, if not properly designed, may set up air circulations which spoil the scheme of ventilation. In this country living rooms are usually maintained at about 60 deg. Fah., and corridors, etc., at about 55 deg. Fah.; in America, on the other hand, a temperature as high as 70 deg. Fah., or even 75 deg. Fah., is deemed desirable. The great object to have in view is to keep the temperature even, as fluctuations cause draughts. The methods of heating fall naturally into two classes; in the first the heat is derived from a number of separate sources, scattered about the house, and in the second the heat is generated at one central point, and is distributed from there by radiation or by mechanical means.

THE UTILISATION OF ELECTRIC POWER IN THE IRON AND STEEL INDUSTRY.[*]

(Continued from page 716.)

KRAMER CONVERTER SYSTEM OF REGULATION.

A SECOND system, designed to bring about an economical speed regulation of induction motors, is shown diagrammatically in fig. 5, and is also due to Mr. Krämer. The slip rings of the main motor are connected to a rotary converter, which changes the slip energy into continuous current. The latter is used to feed a continuous-current shunt motor, which is coupled mechanically to the induction motor, and returns the slip energy to the main driving shaft. The speed is regulated by varying the resistance in the shunt field of the auxiliary motor. When resistance is cut out, the armature voltage and the continuous-current voltage of the rotary converter will increase. At the same time the alternate-current voltage at the slip rings must increase, as the continuous-current and the alternate-current voltage of a rotary converter stand in a fixed relation to each other. The speed of the main motor will thus decrease.

The speed of the rotary converter depends upon the rotor frequency of the main motor, and is proportional to the regulation. When the main motor runs at normal speed, the slip and rotor frequency are small, and the rotary converter turns very slowly. When the regulation is 50 per cent, the rotor frequency is 50 per cent of the line frequency, and the speed of the rotor converter increases proportionally. As the voltage at the slip rings should also increase in proportion to the regulation, and as in general voltage and speed are proportional values, it results that the design of the rotary converter is practically independent of the amount of speed reduction required. For this reason the Krämer system is very suitable for wide ranges of regulation.

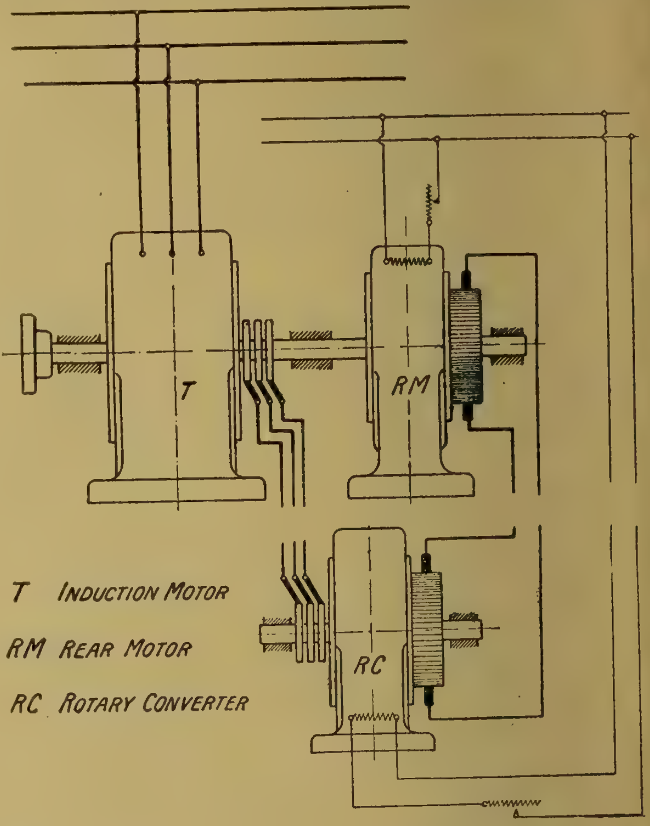


FIG. 5.—Principle of Kramer's System of Regulation with Rotary Converter.

The available output remains constant over the entire range of regulation, as the slip energy is returned to the main driving shaft.

The power factor of the main motor may be improved to unity by adjusting the excitation of the rotary converter accordingly.

A disadvantage of the Krämer converter system as compared with either of the before-described regulating motor systems is its greater complication. More machines are necessary, and a special source of continuous-current energy is required for their excitation. Also it cannot be so easily used in connection with existing motors.

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[*] Paper read by Mr. J. J. Elink Schuurman at the Iron and Steel Institute.

Deri Motors.

The single-phase commutator motor of the Déri type offers a third solution to the problem of economical speed regulation. It comes into question especially for smaller outputs, and has the advantages of extreme simplicity and ease of regulation. This motor belongs to the repulsion motor class, and its principle is shown in fig. 6. For each pair of poles the motor has four brush holders, two of which are fixed and two movable. Each set of fixed brushes is connected electrically to a set of movable brushes. At rest both are in line on the commutator in the pole middle. When the movable brushes are shifted to the right, the motor turns to the left, and *vice versa*. The result is that a reversal is possible without any switching over. The farther the movable brushes are shifted from zero position, the more the torque increases. Normally the motor can start with two to two and a half times the normal torque and possesses a large overload capacity. When required it may be designed for still higher starting torques.

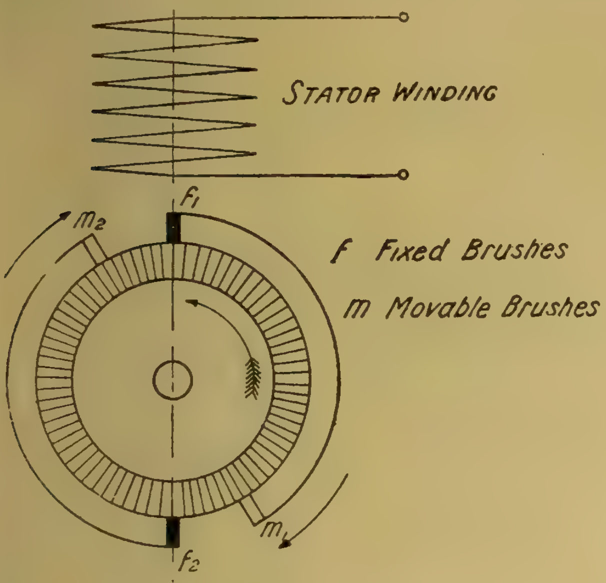

Fig. 6.—Principle of Deri Motor.

The stator and rotor are in no way connected, so that it is possible to keep the rotor voltage low. This seldom amounts to more than 100 volts at standstill, and decreases to 10 volts and less when the motor is running. The result is great safety of operation; the brushes can without danger be renewed during running. As there is no connection between stator and rotor, the stator can be directly connected to high-tension circuits. The insulation is easy to effect, as the winding is simple and no inter-crossing occurs. The rotor has a normal continuous-current winding without any complication.

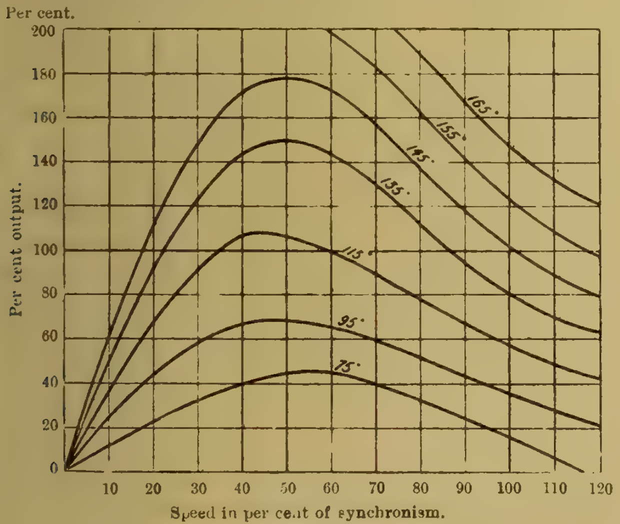

Fig. 7.—Characteristic Curves for the Deri Motor.

The motor has a series characteristic, or more exactly, an infinite number of such characteristics, each being for a certain position of the brushes (see fig. 7). It is consequently possible with any load, including running light, to adjust the brushes for any required speed. By moving back the brushes over the zero position during running regenerative control can be obtained. The farther the brushes are moved back the stronger will be the braking action. The efficiency of regenerative control is similar to the efficiency of normal operation.

As said before, the great advantage of the Déri motor lies in its extreme simplicity: the entire regulation—starting, reversing, and adjusting of all speeds between standstill and 10 per cent above synchronism—is effected merely by shifting the brushes. Beyond a two-pole stator switch no other switches, transformers, etc., are needed. In the case of smaller drives which require reversal, the Déri motor should be compared with an induction motor with starting resistance controller and reversing switch. The importance of the absence of such an apparatus is self-evident. Further, an absolutely continuous regulation is superior to regulation by means of controllers and resistances or regulating transformers, with which a great degree of sub-division is not possible.

When the output is small, the single-phase Déri motor will hardly affect the even distribution of the load on the three phases of the system, especially if there are several such motors which can be divided over the different phases. But when large motor outputs come into question, it is better to make use of a double commutator motor, which electrically consists of two Déri motors mechanically built into one (see fig. 8). By a simple method of winding such a double commutator motor can be directly connected to a three-phase line, and exact measurements have proved that with it the load is quite as equally distributed over the different phases as in the case of a normal induction motor, while such a double commutator motor retains all the good qualities of the Déri motor.

(*To be continued.*)

CORROSION OF COPPER AND BRASS.*

The following theories and notes are chiefly a brief resumé of a paper read before the Institute of Metals by E. L. Rhead, and the discussion thereon. Nothing of value has been added, the object being to condense the various theories.

In the above-mentioned paper the discussion and recorded experiments tend to establish the following facts; that corrosion of copper and brass is due—

(1) To methods of manufacture.
(2) To selective chemical action.
(3) Corrosion resulting from chemical action set up or promoted by the electrical conditions resulting from the presence, side by side, in the alloy, of different components containing the constituents of the alloy in varying proportions, or from the presence of included impurities.
(4) The effect of vagrant electric currents escaping from the electrical equipment.

It is conclusively shown that with copper of a fixed purity that part which is hardest, either from processes of manufacture or from operations in working it into shape, is more readily attacked and suffers more rapid deterioration. The evident remedy is uniform annealing, using copper or brass of the softest quality compatible with the service required of it. In this connection it was admitted in the discussion that copper corrosion troubles in serious form date from 1899, it being stated that this corresponds to the time when the first electrically produced copper, manufactured in 1898, was put on the market. It is difficult to see how this method of producing copper would make it more susceptible to attack, provided, of course, that it is re-melted afterward. It would not differ from ordinary smelted copper, except that it might be somewhat purer. This immediately raises the question whether electrically deposited copper has not had certain beneficial minute impurities removed. This question might be very readily answered in a general practical manner by having two similar pipes installed close together to do the same duty, making all conditions identical except having one of the pipes made of electrolytic copper and the other copper purified to the same degree by smelting processes.

In regard to causes (2) and (3), it is stated that it does not seem possible for cause (2) to operate unless affected by (3), but that the electromotive force resulting from the contact of copper with zinc alloys containing copper in large amounts is very feeble, never exceeding 0·08 volt when immersed in sea water. A long series of experiments was made, immersing hard and soft copper and various copper alloys in different saline solutions, from which it is shown that the harder the metal the more susceptible it is to corrosion or to solution, that the relative order of the solution tensions of metals varies with the liquid in which the metal is placed; but that in every case the corrosive action is increased by the presence of carbonic acid gas. In this connection the discussion brought forth descriptions of the rapid failure of condenser tubes due to lodgment of particles of cinder, ash and coal, or other forms of carbon in the tubes. The obvious manner of avoiding troubles due to lodgment of gas-producing solids is to locate suctions that they are well clear of ash discharges, have pipes, condenser tubes, etc., as straight and with as few pockets as possible, then increase the velocity of flow to the point where all silt or solid matter will be scoured out and swept through pipes or tubes.

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* Abstract of a paper published in the Journal of the American Society of Naval Engineers, from *Power and the Engineer*.

It is shown in the discussion by the members of the Institute of Metals that the tubes of a condenser were protected and their life materially lengthened by making electric contact from the main injection pipe to the overboard discharge pipe with a large capacity cable, thus electrically short-circuiting the condenser. This was the main condenser of an electric power plant in which there were known to be serious grounds.

From the above case, from our own experience and observation, and the experience of a large number of officers in the service, we offer the opinion that theory No. 4, vagrant electric currents escaping from the electric plant of the ship, furnish both the cause and the electromotive force that produces by far the greater part of the rapid destructive copper, copper alloy corrosion that occurs on board our ships. It is admitted at the outset that the fact that ship is purposely made the ground for the wireless has no direct bearing or effect; since its electromotive force, and consequently its current, is alternating, there can be no injurious effect other than the possibility of this alternating effect assisting a direct current to flow where otherwise the resistance was too great for it to be established or maintained by the small direct electromotive force due to leaks from the plant.

It is a matter of common experience and observation that copper pipes most frequently fail at or near bends; one side or other, sometimes both sides, of flanges. It occurs so frequently next to the flange at the outboard end of the line where the suction pipe connects to the stool pipe as to give rise among certain officers to the belief that the corrosion is, or may be, due to thermo-electric effects.

The location of the most destructive corrosion is where one would expect it, reasoning from the first three theories. The greatest differences in character of metal, due to working, are formed at bends and flanges. The greatest differences in composition are found near flanges due to brazing material, and the most active liberation of corrosive gases would naturally be at or near bends. Therefore postulate No. 4 is needed only to account for the rapidity of corrosion. The theory is that vagrant currents will take naturally the easiest path, that the copper pipe, where it is straight and continuous, offers this path, that at a flange the resistance is enormously increased, due to discontinuity of pipe and interposition of gasket, so that the current finds its easiest path through the salt water by the joint. It leaves the pipe just short of one flange and re-enters the metal of the pipe just beyond the joint, the point of leaving becoming the positive pole, the metal there going into solution and plating out further along the pipe or being swept out altogether. It is believed that some such action takes place at bends. So far as we know, nothing practical has ever been done to test this theory. With two similar or exact pipes doing as nearly as possible the same duty, one might have an uninsulated copper conductor of large capacity laid parallel, with one end in close mechanical contact with the pipe outboard of the outboard flange and the other end connected to a pump or whatever the pipe is attached to; or a copper sleeve might be slipped over each joint, making electric contact with the pipe each side of the flange; while no such precautions were taken with the similar pipe, long observation ought to give an indirect proof or determination.

With a Siemens-Halske thermo couple galvanometer and proper leads and contacts it ought to be possible to determine any potential differences from point to point in the body of a pipe, also the direction of current—at least such difference as would be produced by grounds—and from these determinations see whether corrosion does always, or usually, occur on the positive side of an interposed resistance.

To Prevent or Limit Corrosion.

(1) Uniformity, physical and chemical, in copper and copper alloys is necessary.

(2) Prevent entrance of sewage, carbonic acid gas, ashes, or coal; if latter cannot be prevented, make pipes and tubes as straight and free of pockets as possible, and increase velocity of water so that they will be scoured out.

(3) Eliminate or minimise grounds if the theory of vagrant currents be accepted.

If this be not accepted, make tests on board ship to prove or disprove its validity; those suggested previously, as well as others that will suggest themselves to the practical investigator.

INSTALLING GLOBE VALVES.

The globe valve that controls the steam to the boiler feed pump (says a correspondent in our American contemporary *Power*) is frequently adjusted by the attendant and is never wide open and seldom closed. For this reason it will always work better with the pressure under the disc, for with the lower pressure on the packing the valve can be closed and packed at will, and if the disc comes off the stem the pump is not thrown out of service.

A globe valve should never be put in the feed line with the pressure from the boiler under the disc, as the pressure from the pump will then be on the top, and if the disc should come off the stem, no water can be put into that boiler until the valve has been repaired. Nor can the valve be packed while the feed pump is running.

The blow-off valve on the water column should have the pressure from the boiler on the top of the disc for the reason that it is often used by inexperienced firemen and left loose enough to leak and so destroy the seat.

A globe valve should never be used on the steam line between the boiler and the main header. If the valve is put on with the pressure from the line on the top of the disc, it cannot be packed while steam is on the line. This would be bad, for steam may have to be kept on the line for months at a time. On the other hand, to instal the valve with the pressure from the line under the disc would be even worse, for no sane engineer or boiler inspector would enter the boiler with high-pressure steam on the line, because often the valve yoke breaks and the stem threads strip, in which event it would not be hard to guess what would happen to the man on the inside.

When he took charge at the works, says the writer, the angle blow-off valves were attached with the pressure under the discs, a Homestead valve being between each angle valve and boiler. When the angle valve leaked, which happened about every three days, the Homestead was closed, a new lining put in the iron disc of the angle valve, and the seat turned off. When he installed new blow-off piping he took out the Homesteads and changed the angle valves so that the pressure came on the top of the discs, with the result that the valves now give very little trouble.

CORROSION OF WATER-COOLED EXHAUST PIPING.

A correspondent of our American contemporary *Power*, of New York, gives the following particulars of the corrosion of water-cooled exhaust piping. He has, he says, two three-cylinder four-stroke cycle vertical gas engines running on natural gas; each engine runs 12 hours per day, and as the plant runs 24 hours a day, a small stream of water is piped to the exhaust manifold to cool the exhaust gases. As this seemed to attack the exhaust pipe, causing it to waste away in a short time, the pipe was tapped near the exhaust manifold, making a sort of trap for the water from which it was drained by a 1-in. pipe to the sewer.

This drain pipe and fittings were eaten through by the combination of water and exhaust gases in two months, so he changed to galvanised pipe and fittings, which seem to last much longer. Before changing to galvanised pipe and fittings he tried a few galvanised nipples in the line, using black pipe elsewhere, and when the iron pipe was eaten through the galvanised pipe was still in fairly good shape.

LAUNCHES AND TRIAL TRIPS.

Ceara.—Dimensions: 159 ft. by 32 ft. by 9 ft. Built by Messrs. Cammell, Laird, and Co., Birkenhead, to the order of Messrs. R. Singlehurst and Co., for service on the River Amazon. The vessel has been built to Lloyd's highest class for river purposes. The propelling machinery consists of triple-expansion engines with cylinders 13½ in., 23 in., and 35 in. in diameter, and a stroke of 24 in. Messrs. Wailes, Dove, and Co.'s "Bitumastic" cement was applied to bottom, and their "Bitumastic" enamel to floors fore and aft, also to bunkers, peaks, etc.

Strathardle.—The new steamer Strathardle, built by Messrs. Archd. M'Millan and Son, Dumbarton, has run trials on the Firth of Clyde. The vessel, which is the last of four built by this firm to the order of Messrs. Burrell and Son, Glasgow, was engined by Messrs. David Rowan and Co., Glasgow. During the trial everything worked very satisfactorily.

NAVAL NOTE.

Thunderer.—In all probability the new super-Dreadnought Thunderer will be launched from the Canning Town yard of the Thames Ironworks on January 17th next. Night work on the vessel has been in progress for some time.

TRADE NOTES.

Dredgers and Icebreakers.—The Russian Council for Affairs of the Mercantile Marine has decided that the acquisition of five new dredging outfits for use at Russian ports has become necessary, two being required for the Sea of Azov, one for the Black Sea, and one for the Caspian. The Council has also approved a proposal to apply to the Treasury for a sum of 3,630,000 roubles (about £383,000) with which to construct icebreakers for Archangel, Vladivostok, the Baltic, the Black Sea, the Sea of Azov, and the Caspian Sea.

Messrs. Buck and Hickman Ltd., London, E., have been appointed sole agents in the United Kingdom and all British possessions and colonies except Canada for the sale of grinding wheels, etc., made by the American Emery Wheel Works.

Concessions for Public Works in Turkey.—H.M. Embassy at Constantinople have forwarded a copy of a decree of the Ministry of Public Works defining the conditions under which that department will consider future applications for concessions for works of public utility. Persons desirous of obtaining such concessions must, in the first place, obtain from the department authorisation to undertake preliminary studies of the work, and draw up plans and estimates which have to be submitted to the department. Should the Government then decide to grant a concession for the work, this will be put up to public tender, in which the person who has undertaken the preliminary studies will have no preferential right. Should he not obtain the concession, however, he will be indemnified for his performance of the preliminary studies. The text of the decree (in French), together with a model application and contract for preliminary studies, and particulars of the plans and estimates to be prepared and submitted, may be seen by British firms at the Commercial Intelligence Branch of the Board of Trade.—*Board of Trade Journal.*

Buenos Ayres Exhibition.—We are informed that **Messrs. A. Reyrolle and Co. Ltd.,** Hebburn-on-Tyne, have been awarded a diploma of honour for their exhibit on the stand of their agents.

Railway Material.—The *Diario Official* (Brazil) contains decrees approving the plans and estimate of 2,459,373 milreis submitted by the "Companhia Lavoura e Colonizacao," of Sao Paulo, for an extension of the Marica railway from Nilo Pecanha to Iguaba Grande; the plans and estimate of 6,656,179 milreis submitted by the "Companhia de Estrada de Ferro de Goyaz" for the construction of a section of line 50 miles long from Catalao to Ipamery; the plans and estimate of 8,774,000 milreis gold (about £987,000) submitted by the South American Railway Construction Co. Ltd. for the construction of 173 miles of line belonging to the "Cearense system" of railways; the plans and estimate of 2,200,375 milreis submitted by the Great Western of Brazil Railway Co. Ltd. for the construction of 28 miles of line from Vicosa to Palmeira dos Indios; and for granting to the last-mentioned company powers to construct an extension from Garanhuns to Bom Conselho, forming part of the Pernambuco Southern Railway. The *Gazzette Ufficiali* (Italy) contains notices, issued by the Italian State Railways Administration, inviting tenders for the construction of sections of railway from Cattolica to Montallegro and from Partanna to Santa Ninfa, being part of the Sicilian railway system. The length of each section is about 3½ miles, and the cost of construction is estimated at 780,000 lire (£31,200) in the first case and at 520,000 lire (£20,800) in the second case. Tenders will be opened in each case on 29th December at the "Direzione Generale delle Ferrovie dello Stato, 16, Via Ludovisi," Rome. The same journal also contains notices inviting tenders for the construction of three portions of a total length of about 3¼ miles of the line from Varase to Airole, forming part of the Ventimiglia to Cuneo railway. The upset prices are put respectively at 1,822,000 lire (£72,880), 1,645,000 lire (£65,800), and 1,630,000 lire (£65,200). Tenders will be opened at the "Direzione Generale delle Ferrovie dello Stato, 16, Via Ludovisi," Rome, on the 5th January. The *Gaceta* (Spain) notifies that Don Pedro Alcober has applied to the "Direccion General de Obras Publicas," Madrid, for a concession for the construction and working of a secondary railway from Palma to the port of Soller. The cost of construction is estimated at 4,654,000 pesetas (about £172,000). The minimum amount of rolling stock required for the opening of the line will be three locomotives, 12 passenger coaches, and 20 goods wagons.—*Board of Trade Journal.*

British Motor Boat Club 21-footer.—**Messrs. J. W. Brooke and Co. Ltd.,** Lowestoft, have just completed a 21-footer motor boat. In form she represents a new departure, the bottom being peculiar, although the hull is, above water, like that of an ordinary boat. The engine is a three-cylinder Brooke of a special type. A speed of about 20 knots is expected.

The Reflector Syndicate, sole manufacturers of Cowper-Coles' gold mirrors, have now started a branch for the coating of glass and metallic mirrors with the metal palladium. This metal is almost as white as silver, is not nearly so tarnishable, is harder and does not scratch so readily.

Drainage and Harbour Works.—The *Gaceta de Madrid* announces that tenders will be opened on the 27th December at the "Ministerio de Agricultura, Industria, Comercio y Obras Publicas," Madrid, for the filling in and draining of reclaimed lands in the harbour of Pontevedra. The upset price is put at 90,000 pesetas (about £3,300). The same journal also publishes a notice, issued by the "Direccion General de Obras Publicas," Madrid, inviting tenders for the carrying out of improvement works in the harbour of Luanco, Province of Oviedo. The upset price is put at 602,130 pesetas (about £22,300). Tenders will be opened on the 31st December. Although the above contracts will in all probability be awarded to Spanish firms, nevertheless the carrying out of the works may involve the purchase of some materials out of Spain.—*Board of Trade Journal.*

Reported Shipbuilding Orders.—According to *The Shipping World* Messrs. Thomas Smailes and Son, Whitby, have contracted with Messrs. Robert Thompson and Sons Ltd., Sunderland, for the construction of a cargo steamer about 350 ft. long. The engines will be supplied by the North-Eastern Marine Engineering Co. Ltd.; Messrs. Furness, Withy, and Co. Ltd. have placed an order with the Northumberland Shipbuilding Co., Howdon, for two steamers of between 7,000 and 8,000 tons dead weight; and Messrs. Wm. Dobson and Co., Low Walker, are reported to have booked an order for a steam collier from one of the London gas companies.

Messrs. Mirrlees, Bickerton, and Day Ltd., Hazel Grove, near Stockport, are now making Diesel engines of the open slow-speed type for land purposes up to 200 B.H.P., the high-speed marine type up to 300 B.H.P., and the totally enclosed slow-speed type in sizes varying from 250 B.H.P. to 1,000 B.H.P. High-speed engines have been supplied by the firm for lighting purposes for various British war vessels of a total horse power exceeding 3,600. They have also supplied engines of 120 B.H.P. each for the propulsion of Admiralty boats.

TRADE CATALOGUES.

Messrs. W. P. Butterworth Ltd., Shipley, have just issued their December stock list of standard and odd size galvanised tanks, also copper cylinders and boilers. The former range in sizes from 20 gallons to 1,000 gallons.

We have received from **Messrs. Wallach Brothers Ltd.,** Royal London House, Finsbury Square, London, E.C., a copy of a leaflet describing their patent filling apparatus (Alison-Broadhurst patents) for which the firm claim the advantage of speed, economy, automatic action, accuracy, cleanliness, and no waste.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2293. **Cost of Engines and Boilers.**—I should be obliged if some of your readers would give me a few reliable figures on the cost of installing and maintaining various types of engines and boilers. Also the costs of fuel, wages, and supplies per annum (on a "per H.P." basis throughout).—Multo.

Answer.—Naturally these costs vary enormously with the exact type of plant concerned, with the nature and locality of the proposed site, with transit facilities, and with coal and labour costs in the vicinity. While it is impossible to allow for all these variables in the present case, the following figures are representative of fair average conditions, and at least form a useful basis for estimates.

For the present purpose it is convenient to subdivide various engines into high and low speed types, further subdividing each of these into simple and compound and condensing and non-condensing engines.

Thus classified, the usual capital costs per horse power are as in Table I., which also shows the corresponding costs of suitable boilers, and of smoke stack and buildings. The total capital costs per horse power vary from £10 to £13. The capital costs shown in the table should be multiplied by 1·05 to allow for the necessary supervision and inspection during erection.

TABLE I.

No.	Type.	Capital £ per horse power.			
		Boiler.	Stack and buildings.	Engine.	Total.
	Low speed :				
1	Simple non-condensing......	5·0	3·0	5·0	13·0
2	„ condensing..........	3·4	2·3	5·4	11·1
3	Compound condensing	3·0	2·2	6·0	11·2
	High speed :				
4	Simple non-condensing......	5·2	3·2	3·4	11·8
5	„ condensing	3·6	2·4	4·2	10·2
6	Compound non-condensing ..	4·2	2·8	4·4	11·4
7	„ condensing	3·2	2·2	5·0	10·4

TABLE II.

Type of engine (numbers as in Table I.).	Value of "constant."		
	K	A	B
1	3·6	1·50	12·75
2	2·9	1·60	7·00
3	2 7	1·70	7·75
4	3·8	2·35	13·75
5	3·0	1 60	9·50
6	3·2	1·50	11·25
7	2·8	2·50	8·25

These costs are merely average values applicable to engines of up to, say, 200 horse power. Actually the cost per horse power decreases as the total output of the unit rises, and in fig. 1 are shown usual limiting and average values of the capital cost per horse power (unset) of various engines, ranging up to 350 horse power. The lower limit is approached by simple engines, the upper by compound and triple expansion engines, Corliss engines, and so on.

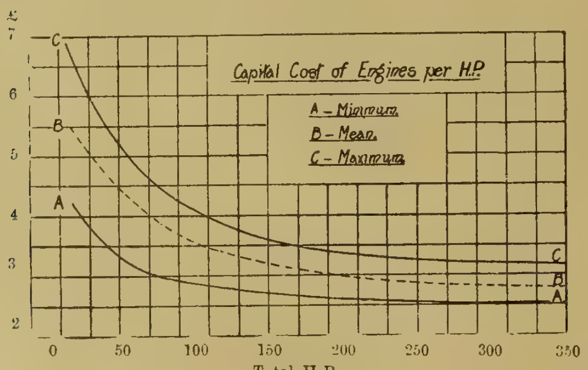

FIG. 1.

ATTENDANCE AND MAINTENANCE.—The *wages* of the engine driver and fireman per horse power annum may be expressed as a function of their wage rate thus—

$$\text{Cost per horse power year} = (K\,s)\text{ shillings} \quad . \quad . \quad . \quad (1)$$

where K has the values shown in Table II., and s = shillings per day wages of engine driver. Usually the firemen's wages = about $(\frac{2}{3}\,s)$. The cost of *fuel* and *supplies* per horse power year (= £ C) may be expressed as

$$£\,C = A + B\,P \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

where A = a "constant" having the several values shown in Table II.; B = another "constant" varying with the type of engine (see Table II.); P = price of coal, £ per ton.

In conclusion may be presented the curves of fig. 2, showing capital costs for water-tube boilers similar to those given for engines in fig. 1. The upper curve will include the cost of stack

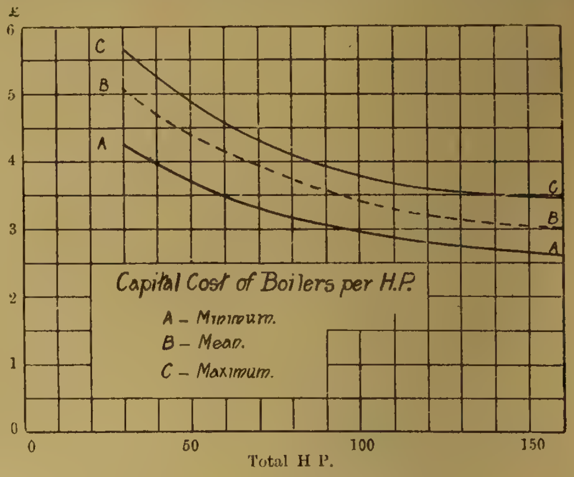

FIG. 2.

and setting in many cases, while the dotted central curve is usually a safe basis for estimating.—C. T.

2296. Strength of Flexible Steel Wire Rope.—Can any reader give me a more accurate formula than the usual $2\frac{1}{2}c^2$ for calculating breaking strength of flexible steel wire rope of 1 in. to 6 in.; also what factors should be taken for the working and proof loads?—W. G. G.

2297. Safe Load on Gear Wheels.—What is the safe load on gear wheels of the following particulars: A spur wheel in eight segments fastened to the arms of a balance wheel, 208 cogs, 2·777 in. pitch, 7 in. wide, webbed entirely on one side, 40 revolutions per minute; and a pinion wheel gearing into the spur wheel, 74 cogs, 2·777 in. pitch, 7 in. wide, 112½ revolutions per minute, the teeth neither shrouded nor webbed. Velocity of gearing at pitch line 1,925 ft. per minute. The flywheel has eight arms, and eight wrought-iron stays between the arms, and also an extra boss; approximate weight of flywheel 13 tons. These wheels are on a single McNaught beam engine, driving a cotton factory, and are made from cold blast cast iron?—MILL MANAGER.

MISCELLANEA.

AT a recent reunion of the past and present students of the Manchester School of Technology Textile Society, held at the Technical School last week, Principal Reynolds opened the meeting. There were about 300 students and friends present.

OWING to the sudden decease of Mr. James R. Barr, the meeting of the Glasgow section of the Institution of Electrical Engineers for the 13th inst. was postponed *sine die*. Mr. Barr was to have read a paper entitled "Some Considerations Relating to the Parallel Working of Alternators."

ANNUAL REPORTS.—The Glasgow and West of Scotland Technical College has just issued the report of the 114th session adopted at the annual meeting of governors in September last. Also the annual report of the Leeds Association of Engineers for the year ending October 31st last is to hand.

AEROPLANE ACCIDENTS.—Regarding the recent discussion about fatal accidents with aeroplanes, it may be of interest to some of our readers to learn that M. Soreau, one of the most scientific authorities in France, has given the following statistics on the matter. He states that there must be about 500 certified pilots and pupils in the world, that the total distance travelled by aeroplane must amount to some 200,000 kilometres, and that this would imply only one fatal accident in every 7,000 kilometres travelled.

The Witton-Kramer lifting magnets are now much used, in conjunction with the ordinary crane, for raising and transporting steel castings and plates, pig and scrap iron, etc. These magnets are capable of lifting a solid piece of steel, with machined surfaces, weighing 15 times their weight in the small sizes and five to six times in the case of the large ones, and up to six layers of metal plates can be raised at one lift. For sub-aqueous work special magnets are supplied. It is stated that 60 lifts, each of one minute's duration, may be made with a 24-in. magnet with a consumption of two units. The lifting capacity in the latter instance ranges from four tons of steel ingots or plates to 4 cwt. or 5 cwt of scrap stampings, filings, etc. The figures for the 60-in. magnet are respectively eight units. 10 tons, and 15 cwt. to 25 cwt.

PATENTEES' CHRONICLE

OF

Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

DECEMBER 3rd, 1910.

28090 Music stools. Davies.
28091 Motor cycles. Lechmere.
28092 Internal-combustion engines. Ellingham.
28093 Belt fastenings. Houston.
28094 Brushes. Livsey.
28095 Tipping vehicles. Constable.
28096 Expansion engines. Wilson.
28097 Pens. Brecknell.
28098 Pencil protector. Haycock.
28099 *Steam engines. Stumrf.
28100 Boots. Lees.
28101 Coal bag. Banks.
28102 Mechanical stokers. Robertson.
28103 Shoes. Sanford.
28104 Window fittings. Liley.
28105 Coat hook device. Folkes.
28106 Controlling valves. Blakeway.
28107 Drying machines. Charlesworth.
28108 Wheels.
28109 Brushes. Lomming.
28110 Rotary converters. Taylor.
28111 Lamps. Helps.
28112 Locomotive buffers. Crowe.
28113 Refrigeration chambers. Webb.
28114 Filing device. McLean.
28115 Shafting. Hookham.
28116 *Tea making device. Manners-Smith.
28117 Netting machines. Simpson.
28118 Tea rolling machines. Parry.
28119 Cases. Wals.
28120 Boxes. Aitchison.
28121 Outer covers. Denton.
28122 Stemming plug. Johnson.
28123 Fog signalling device. Pilkington.
28124 Wheels. Rollason.
28125 Pipes. Brown.
28126 Electric furnace. Ruthenburg.
28127 Hat device. Niven.
28128 *Pipe connection. Harrop.
28129 Electric oven. Ogden.
28130 *Coal jiggers. Lippel.
28131 *Umbrellas. Heck.
28132 *Swimming shoe. Larson.
28133 *Match box. Carter.
28134 *Dish pan. Mallquist.
28135 *Fire alarms. Bruhn, junr.
28136 *Turbine packing. Milne.
28137 *Steam engines. Neukovini.
28138 Lamps. Polack.
28139 Tyre. McPherson.
28140 Aeroplane. Constantini.
28141 *Breathing apparatus. Dräger.
28142 *Flat irons. Briandet.
28143 *Safety locks. Weddell.
28144 Coats. Cotman.
28145 Boiler. Parry.
28146 Seed separator. Dossor.
28147 *Locks. Laycock.
28148 *Taps. Blake.
28149 Indicator. Chitty.
28150 Change-speed gear. Green.
28151 Paints. Davies.
28152 *Bricks. Voss.
28153 Burners. Lucas.
28154 Burners. Coffin.
28155 *Plastic bodies. Johnson.
28156 *Garment measuring device. Richards.
28157 Boot device. Rawlings.
28158 Explosive. Dawson.
28159 Manufacture of quinoline. Jones.
28160 *Printing machines. Brockhoff.
28161 Electric current regulator.
28162 *Bottles.
28163 *Musical instruments. Henning.
25164 *Spinning machines. Schilgen.
28165 Collars. Mihm.
28166 Card cases. Posner.
28167 Inhaling device. Kingzett.
28168 Disinfecting device. Kingzett.
28169 Hoists. Armstrong.
28170 *Railway buffers. Gianpictro.
28171 *Reinforced ceilings. Dombald.
28172 Bolts. Gill.
28173 Tobacco pipe filler. Read.
28174 *Gas engine. Grant.
28175 Non-corrosion device. Noad.
28176 Burners. Morgan.
28177 *Generators. Juston.
28178 Manf. of emulsion. Wallbaum.
28179 Condensors. Giles.
28180 Indicating apparatus. Balton.
28181 Picture frames. Hobrajd.
28182 *Lamp bells. Mygatt.
28183 Aerial ropeways. White.
28184 *Moulding dough. Herschel.
28185 Printing machine. Cook.
28186 Stencil printing. Cook.
28187 Fountain pens. Perry.
28188 Flying machines. Hamschke.
28189 Pipe heating device. Ahrens.
28190 Pistons. Black.

DECEMBER 5th, 1910.

28191 Carburetters. Willey.
28192 Wool washing machine. Kay.
28193 Isolation of plant fibres. Silberrad.
28194 Sock. Daingier.
28195 Displaying goods in shop windows. Slack.
28196 Bicycle stand. Johnston.
28197 Earthenware supports. Arrowsmith.
28198 Brooches. Moodie.
28199 Flour sifting. Bamford.
28200 Vacuum flasks. Latham.
28201 Pots. Alexande.
28202 Lathework. Taylor.
28203 Speed gear. Eardley.
28204 Tyres. Whittle.
28205 Mops. Davies.
28206 Smoke consumer. Hausley.
28207 Velvet cutting machines. Gadd.
28208 Pipe charging. Maguire.
28209 Steadying ships. Alquist.
28210 Compressors. Alquist.
28211 *Boats. Doan.
28212 *Aerial machines. Glover.
28213 Braces. Morgan.
28214 Cooling apparatus. Rowland.
28215 Bone cutter. Cotton.
28216 Furnace doors. Pownie.
28217 Shaping hats. Atherton.
28218 Stoppers. Alexander.
28219 Brooders. Morgan.
28220 Games. Gray.
28221 Level indicator. Hutfield.
28122 Vehicles. Broünig.
28223 Valves. Brook.
28224 Teaching geography. Rand.
28225 Motor suspension. Culverwell.
28226 Production of iron. Cowper-Coles.
28227 Letter box. Lewis.
28228 Wheels. Ballantyne.
28229 *Filters. Gessler.
28230 *Routing machines. Schrade.
28231 *Boot manufacture. Marks.
28232 *Umbrellas. Freund.
28233 Engines. Kirby.
28234 Shock absorber. Morgan.
28235 Advertising. Hannay.
28236 Telephones. Watson.
28237 Gas burners. Wilkie.
28238 Camera. Friedl.
28239 Recording apparatus. Jung.
28240 Pleasure railway. Pollak.
28241 *Welding. Uesely.
28242 *Organs. John.
28243 *Tobacco pipes. Cragg.
28244 Door fastening. Pudney.
28245 Corsets. Adamson.
28246 Dynamos. Gray.
28247 Cinnamic esters. Newton.
28248 *Cooling towers. Mueller.
28249 *Package carriers. Lake.
28250 *Flow of liquids. Beddoes.
28251 Electric driving of gramophones. Pressland.
28252 Boiler cleaning. Marsh.
28253 *Gauges. Hirth.
28254 *Self-feeding pen. Gilbert.
28255 Invalid's chairs. Leslie.
28256 *Horse clipping machines. Tirlinc.
28257 *Eyeblass holder. Bishop.
28258 *Ferro prussiate printing. Salzmann.
28259 *Producing railway tickets. Wollheim.
28260 Non-skid wheels. Haward.
28261 *Alkali sulphides, Johnson.
28262 Metal bands. Tarbet.
28264 Articial stone. Barrett.
28265 *Embroidering. Keller.
28266 Doors. Sieurin.
28267 *Cutting machines. Pässler.
28268 Hat fastening. Baker.
28269 *Linen folder. Collon.
28270 *Felt strip cutting. Klipp.
28271 *Engine lathes. Chard.
28272 Electric fuse. Riddle.
28273 Condensers. Shuman.
28274 Extraction of metal from ores. Bradley.
28275 Varnishing of leather. Meygret.
28276 *Headrests. Dow.
28277 Production of bleaching solution. Niblett.
28278 *Roll shutter. Lorenz.
28279 *Disinfecting. Schwarzhaupt.
28280 Filter. Schwarzhanpt.
28281 Rotary engines. Slee.
28282 Street sweeping. Wirsing.
28283 *Hardness testing. Kirner.
28284 Cement producing. Hemingway.
28285 *Road scarifiers. Craven.

28286 Lock for carriage doors. Bray.
28287 Buffers. McClean.

DECEMBER 6th, 1910.

28288 Tyre levers. Morgan.
28289 Stamping machines. Williams.
28290 Grip bolt. Taylor.
28291 Fog signalling. Morgan.
28292 Prevention of puncture in tyres. Allen.
28293 Motor car seats. Brewer.
28294 Number plate. Arnell.
28295 Railway wagons. Williams.
28296 Gas burners. Greenfield.
28297 Roundabouts. Hackett.
28298 Bottles. Critchley.
28299 Sewage. Vickers.
28300 Doors. Dewhurst.
28301 Amusements. Shippobothany.
28302 Cigarette cases. Jackson.
28303 Hatpins. Crook.
28304 Wind screen. Seaden.
28305 Steam generators. Bailey.
28306 Street lighting. Burnett.
28307 Dynamos. Mould.
28308 Baskets. Pratt.
28309 Game. Graham.
28310 *Motors. Brooke.
28311 Screens. Gibbons.
28312 Route indicators. Greene.
28313 Horse shoes. Green.
28314 Internal-combustion engines. Davidson.
28315 File cutting. Howell.
28316 Panel work. Ellis.
28317 Variable gears. Browne.
28318 Grate. Sunlight.
28319 *Auto organs. England.
28320 *Ships' telegraphs. Ray.
28321 Prevention of skidding. Richardson.
28322 Grinding and kibbling mill. Jackson.
28323 Oatmeal dressing. McGill.
28324 Nail cutting. Dick.
28325 Gas mantles. McLean.
28326 Electric switches. Railing.
28327 Saucepan extender. Swan.
28328 *Rowing apparatus. Kaselowsky.
28329 *Mercerising cotton. Hahn.
28330 *Coil winding. Alexander.
28331 Combined pick and spake. Eyre.
28332 Thermo-electric motor. Rouse.
28333 Tying and releasing several animals. Kreuzer.
82334 Brakes. Clements.
28335 Watch bracelets. Betts.
28336 *Elastic webbing. Kops.
28337 Sea and river walls. Carey.
28338 Stocks and dies. Corby.
28339 Shades for lenses. Yeulett.
28340 *Hatchway fastener. Mulholland.
28341 *Cup and ball game. Neff.
28342 *Game. Neff.
28343 *Sash windows. Desiommunaux.
28344 Index. Willis.
28345 Joining. Abrams.
28346 Worm wrench. Dutlie.
28347 Sterilisation of milk. Walkey.
28348 Hospital furniture. Down.
28349 Hospital furniture. Down.
28350 Steam valves. Clark.
28351 Bracelet and purse. Young.
28352 *Dielectric films. Mershon.
28353 *Purifying water. Gans.
28354 Kettles. May.
28355 Limelight apparatus. Thomassin.
28356 *Searchlights. Werke.
28357 *Hand type moulds. Taylor.
28558 *Railway sleepers. Gebhardt.
28359 Fire extinguishing apparatus. Deval.
28360 Packing of bedsteads. Carr.
28361 Stoppers. Walker.
28362 *Typewriters. Howieson.
28363 *Spring motors. Howieson.
28364 *Film developing. Niell.
28365 Coin freed mechanism. Goodbun.
28366 Steam vessels. Duke.
28367 Pneumatic tyres. Wrentmore.
28368 *Telepone call recorders.
28369 *Aeroplanes. Gaara.
28370 *Documents for cheques. Todd.
28371 *Coin counting. Lundin.
28372 *Explosion engines. White.
28373 Artificial leather. Meygret.
28374 Expanding bracelets. Simon.
28375 Handling of invalids. Skeffington.
28376 Valves. Nutter.
28377 Navigation. Binyon.
28378 *Menthylated oil of wintergreen. Mathys.
28379 *Looms. Thiebeault.
28380 *Bullets. Mauser.
28381 *Fountain brushes. Fesler.
28382 *Electric arc lamps. Bisson.
28383 Purifying middlings. Turner.
28384 *Stairway climbing. Escuder.
28385 Electric lamp holders. Bein.
28386 Dish covers. Challis.
28387 Bridle bits. Swales.
28388 *Retorts. Duckham.
28389 *Pneumatic tyres. Harrison.
28390 *Window wiping. Petil.
28391 Lathe chucks. Owens.
28392 *Operation of shutters. Frombold.
28393 Pulling-over machines. Boult.
28394 Pulling-over machines. Boult.
28395 *Harness for children. Hartell.
28396 *Telephone instruments. Gottschalk.
28397 *Telephone transmitters. Gottschalk.
28398 *Firearms. Wesson.
28399 *Conservatories. Overpautte.
28400 Patterned pressed glassware. Mygate.
28401 Trouser holder. Blaess.
28402 Manufacture of bricks. Ormrod.
28403 *Economisers. Siegel.
28404 *Sinks. Sister.
28405 *Weighing apparatus. Maleusheck.
28406 *Bearings. Sihemidt.
28407 Pattern marking. Boult.
28408 *Vacuum brakes. Mitchell.
28409 *Carriage tops. Kruck.
28410 *Stability of aeroplanes. Bandry.
28411 *Safety razors. Levinsohn.
28412 *Float gauges. Landor.
28413 *Joining flat metal objects. Roots.
28414 Suspender attachments. Reynolds.
28415 Threshing machines. Mudsen.
28416 *Temperature of hay ricks. Foot.
28417 *Folding stage. Mary.
28418 *Stability of aeroplanes. Zoller.
28419 *Accumulators. Kamperdyk.
28420 *Gas burners. Wolf.

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28421 Pavement gutter. Jones.
28422 Rotary engines. Walker.
28423 Lathe. Brownlow.
28424 Spanner. Edwards.
28425 Gearing. Gibbons.
28426 Valve fittings. Blakeborough.
28427 Swings. Shippobottam.
28428 Roundabouts. Shippobottam.
28429 Penholder and knife. Williams.
28430 Mathematical instruments. Fullaway.
28431 Gramophones. Bassano.
28432 Baby carriage. Harris.
28433 *Gas burners. Volk.
28434 Treatment of sewage sludge. Grossmann.
28435 Wreath boxes. Saunders.
28436 Motor cyclès. Davis.
28437 Two-speed gear. Sturmey.
28438 Folding chairs Carter.
28439 Treating cotton fibres. Whitehead.
28440 Close annealing covers. Thompson.
28441 Washing machines. Parnaby.
28442 Resilient wheels. Little.
28443 Rubber heel. Leach.
28444 Solid tyres. Horstmann.
28445 Inking ribbon. Rowley.
28446 Taps. Michael.
28447 Flying devices. Fox.
28448 Hand bags. Martin.
28449 Belts. Alphonsus.
28450 Flushing arrangement. Adams.
28451 Filter for sewage. Adams.
28452 Resilient wheels. Forsyth.
28453 Fabrics for belts. Reddaway.
28454 Motor ploughs. William.
28455 Rotary air pump. Storey.
28456 Combination garment. Pownall.
28457 Electric motor lamps. Worsnop.
28458 Shirt fronts. Heeley.
28459 Puncture repair outfit. Wilks.
28460 *Adjustment of bicycle chains. Reul.
28461 Looms. Wilson.
28462 Toy aeroplane. Kersten.
28463 Cast-iron brazing.
28464 Fishing tackle. Roach.
28465 *Calculating machines. Odhner.
28466 Spinning tubes. Duesbery.
28467 Clasp buttons. Bell.
28468 *Mono railways. Mittag.
28469 *Bakeries. Lutze.
28470 Manf. of towels. Martin.
28471 *Gas igniters. Urban.
28472 *Aeroplanes. Gaara.
28473 Manufacture of boots. Boult.
28474 Manufacture of boots. Boult.
28475 Cycle brakes. Lamplugh.
28476 Diffused light. Roberts.
28477 *Scale in boiler tubes. Schrov.
28478 *Scale in boiler tubes. Schrov.
28479 Compound levers. Gilbert.
28480 Laminated springs. Bull.
28481 Soap racks. Vinten.
28482 Railway signalling. Raven.
28483 Cuffs. Walker.
28484 Submarines. Brameld.
28485 *Sliding catch lock. Nitzche.
28486 Wheels. Whitehead.
28487 Turbines. Formby.
28488 Pneumatic tyres. Brown.
28489 Waste rubber. Richards.
28490 Travelling targets. Butler.
28491 Substitute for amber. Kunisch.
28492 Liquid heater. Veltman.
28493 *Indian clubs. Vikers.
28494 Packing boxes. Ferguson.
28495 Tobacco cartridges. Homan.
28496 Toy blocks. Homan.
28497 *Crank mechanism. Albert.
28498 *Permutation padlocks. Bennett.
28499 *Transport of road tools. Allen.
28500 *Settling apparatus. Dorr.
28501 Electric switch. Price.
28502 *Milking machines. Westberg.
28503 *Textile machines. Clarence.
28504 Steam pumps. Sykes.
28505 *Dough mixing. Gordon.
28506 *Washing machines. Sofqüist.
28507 *Rolling shutters. Gibson.
28508 Bone cutters. Evans.
28509 Poultry houses. Evans.
28510 *Threshing mechanism. Schulze.
28511 Rotary explosion motor. Dewandre.
28512 Safety carrier. Edwards.

DECEMBER 8th, 1910.

28513 Picture hanger. Campbell.
28514 Hydro extractors. Broadbent.
28515 Manf. of bottles. Knowles.
28516 Hydro extractors. Broadbent.
28517 Entrenching tool. Todd.
28518 Tail lamp indicator. Appleyard.
28519 Gas engine. Heane.
28520 Cabriolet head.
28521 Lamp holder. Kay.
28522 Cinematographs. Bates.
28523 *Lighting gas lamps. Perry.
28524 Carburetted air. Williams.
28525 Aeroplanes. Saul.
28526 Internal-combustion engines. Relph.
28527 Heating apparatus. Relph.
28528 Gas mantles. Owen.
28529 Invalid's bed table.
28530 Electric conductors. Hitch.
28531 Basins. Mellor.
28532 Carriages for twist coil machines. Creassey.
28533 Punctures in tyres. Case.
28534 Hydrogen gas. Barton.
28535 Rubber tyring. Brook.
28536 Electric furnaces. Ruthenburg.
28537 Internal-combustion engines. Stevens.
28538 Physioligically active base. Wellcome.
28539 Rolling mills. Wallwork.
28540 Internal-combustion engines. Barnett.
28541 Golf balls. Wineberg.
28542 Retort mouthpieces. Mitton.
28543 Petrol cans. Sumner.
28544 Electric lamp fittings. Anderson.
28545 Ticket receptacles. Rumble.
28546 Internal-combustion engines. Brindley.
28547 Inflators. Gormby.
28548 Fishing tackle. Hoare.
28549 Radiators. Mather.
28550 Hair brushes. Kapham.
28551 Shipbuilding berths. Fairbrother.
28552 *Textiles. Paillet.
28553 *Oil colours. Meurant.
28554 Printing machines. Helliwell.
28555 Weighing machines. Round.
28556 Weighing machines. Round.
28557 Inhalation apparatus. Goss.
28558 *Gyroscope steering. Zottich.
28559 Speed gear. Wethered.
28560 Moving targets. Whitney.
28561 Rat rope guard. Rent.
28562 Treatment of sciatica. Borovszky.
28563 *Flying machines. Staveley.
28564 Soap. Bowling
28565 Talking machines. Fischer.
28566 *Aeroplanes. Cassel.
28567 Sparking plugs. Chapman.
28568 *Hooks. Malmberg.
28569 Pressure indicators. Smith.
28570 Galvanisers. Campbell.
28571 *Photographic pictures. Hans.
28572 Tie retainers. Knight.
28573 *Conduct pipes. Glossop.
28574 Funnel. Thomas.
28575 Garter and suspender. Diprose.
28576 Guards for machines. Horton.
28577 Stenographic apparatus.
28578 Variable speed transmission. Crown.
28579 Heel plate. Lumb.
28580 Mudguards. Birt.
28581 *Tent pegs. Green.
28582 *Internal-combustion engines. Schneebch.
28583 Mercury compounds. Bloxam.
28584 *Gas lamp extinguishing. Jintsch.
28585 Glass shades. Marks.
28586 Railway wagons. Atkinson.
28587 *Shirts. Weston.
28588 Electric relay. Taylor.
28589 *Extraction of metal from ores. Lake.
28590 *Explosion motors. Broc.
28591 *Hoods of carriages.
28592 Electro-deposition of iron. Coles.
28593 Carburetters. Bedford.
28594 Spinning. Birkenstock.
28595 *Account books. Seifarth.
28596 Musical instruments. Schone.
28597 *Nut locking means. Kirke.
28598 Metallic draught strip.
28599 Turbines. Curtis.
28600 Turbines. Curtis.

28601 Razor strop. Garde.
28602 Travelling trunks. Jackson.
28603 Manf. of paper. Skeppstedt
28604 Window sashes. Hartley.
28605 Manf. of mirrors. Thompson.
28606 Footwear. Horsfield.
28607 Rotary engines. Augustus.
28608 Advertising device. Ward.
28609 Producing vacuums. Viola.
28610 Pincers. Franke.
28611 Electric generators. Bottone.
28612 Electric generators. Bottone.
28613 Electric current regulators. Goodwin.
28614 Toilet paper supply. Howard.
28615 Artillery training. Hollich.
28616 Aerial machines. Dressler.
28617 Ovens. Dressler.
28618 Pneumatic tyred wheels. Wynne.
28619 Cargo carrying vessels. Sieurin.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

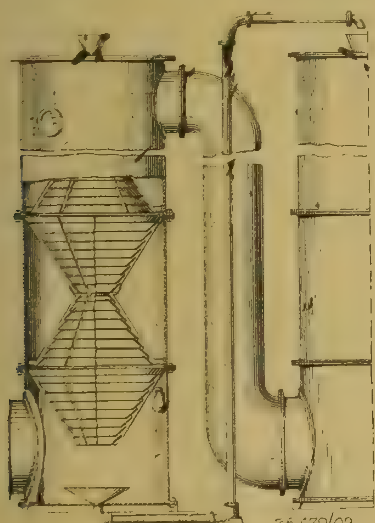
Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to January 16th, 1911, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

18334 Noad: Apparatus for distilling shale and other bituminous substances. 20272 Brown: Mariners' compasses. [Post-dated March 4th, 1910.] 21595 Liddle: Liquid controllers and starters for electric motors. [Post-dated March 21st, 1910.] 22585 Hewitt: Drying and burning or calcining of slip, slurry, chalk, clay, limestone, and the like and apparatus therefor. [Cognate Application. 25146, 1909.] 22846 Holloway and Williams: Method of sewing books, pamphlets, and the like. 23040 Boult (Electric Meat Curing Co.): Electro-magnetic apparatus for preserving and other purposes. 23108 Ramen and Beskow: Roasting of ores. 23224 Wilson: Make and break switches. [Post-dated April 11th, 1910.] 25146. *See* 22585, 1909. 25308 Rosling and Ross: Drop-down guns. 25365 Marks (Soc. Anon. Italiana Gio. Ansaldo Armstrong and Co.): Apparatus for operating ships' rudders by electricity. 25473 Kirke and Morris: Internal-combustion engines. 25485 Allesse and Banks: Sound boxes for talking machines. 25491 Willett: Dippers' drying mangles and means for supporting the ware during the drying process. 25496 Gardner and Emmons: Coin-freed gas meter lock. [Post-dated November 30th, 1909.] 25509 Henri, Helbronner, and Von Recklinghausen: Sterilising apparatus. 25521 Bonjean: Boring, surfacing, and grooving machine. [Rights under Section 91 of the Act not granted.] 25525 Landon: Apparatus for amplifying and improving the tone of musical and other sound-producing instruments, applicable also for other purposes. 25548 Werner: Projectile for use against air balloons. 25586 Elliston and Marryat: Electric driving. 25623 Wolseley Tool and Motor Car Co., James and Coombes: Extension hoods, more particularly for use with motor cars. 25638 Waterhouse and Bourne: Method of and apparatus for distilling. 25668 Fernie: Method of and means for operating electrical switches or other devices on three-wire systems.



25,679/09

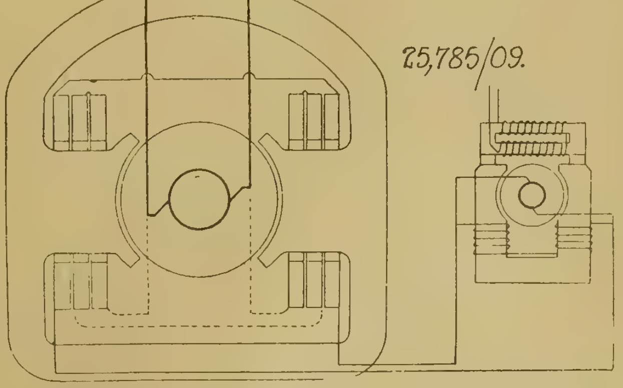
25679 Durant, and Metals Extraction Corporation Ltd.: Apparatus for bringing a gas into contact with a liquid.

This invention relates to apparatus for bringing liquid in contact with a gas in which the liquid runs over a series of overlapping conical or pyramidal rings spaced apart and so arranged that it runs over the rings in succession while the gas passes between them. A tower for bringing the gas into intimate contact with a liquid according to this invention comprises the combination with a vertical receptacle having an inlet near the bottom for the gas and an inlet at the top for the liquid of slightly truncated conical or pyramidal "contact elements," each comprising a series of overlapping conical or pyramidal rings spaced apart and so arranged that the liquid has to run over the rings in succession while the gas is forced to pass through the liquid between the rings. The "contact elements" are alternately upright and inverted pyramids, so that the liquid in falling is alternately moved from the centre of the tower to the periphery and *vice versa*. The apexes of the upright pyramidal "contact elements" are closed and the bases of the inverted elements extend to the periphery of the tower, so that the gas in ascending through the tower is alternately forced to pass into the inverted "contact elements" and out from the upright "contact elements."

25680 Grote: Valve devices for air or gas exhausting apparatus. 25697 Sayer: Variable-speed gear applicable to vehicles and other mechanisms. [Dated November 8th, 1909.] 25703 Pointon and Pointon: Bread-making machinery. 25753 Aqueous Works, and Diamond Rock Boring Co., and Freer: Diamond drills. 25755 Craven and Craven: Machines for pressing bricks and the like. 25757 Quinn: Memorandum appliances for use with telephones and the like. 25768 Fairweather (Huff Electrostatic Separator Co.): Process of separating ingredients of comminuted material.

25785 Parsons and Law: Alternating-current dynamo machines.

This invention relates to alternating-current dynamo machines, and has for its object to provide means for regulating the voltage of such machines. The invention consists in the use of a small auxiliary exciter provided with a leakage path or paths, and windings supplied by current proportional to the main current of the alternator, such exciter operating on or in conjunction with the main exciter to regulate the current in the windings of the alternator. The invention further consists in the improved means for regulating the voltage of alternators.

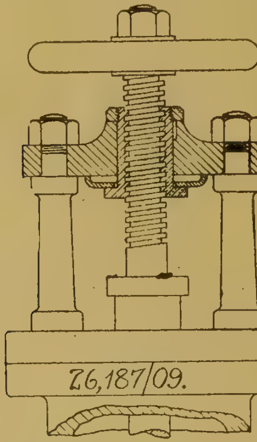


25786 Le Maitre: Use of liquid air or the like for motive or other purposes. 25798 Waterhouse: Steam generators. 25808 Bone, Wilson, and McCourt: Combustion of mixed gases. 25831 Whitaker: Drawing boards, blackboards, and the like. 25843 Leach: Machinery for forming yarns or threads into warps or like assemblages of yarns or threads and machinery for winding warps and like assemblages of yarns or threads.

25861 Wall: Bicycles or other vehicles propelled or assisted by motive power. 25863 Walker and Eustace: Railways for recreation. 25873 Plaisant: Construction of wings and planes and their application to aerial machines. 25893 Utley: Side lights for ships. 25899 McNab: Apparatus for counting revolutions and indicating direction of rotation thereof. [Date applied for under International Convention, July 22nd, 1909.] 25902 Cowburn: Means for indicating the quantity or depth of liquid in tanks or vessels. 25912 Smith and O'rien: Collapsible seats, tables, and the like. 25915 Jensen (Spitz): Process connected with separation of tin or other metals from waste metal, old metallic ware, alloys, and the like. [Application for Patent of Addition to 28551, 1908.] 25939 Kershaw: Stop motions for machinery for winding yarns or threads. 25960 Walker (Mergenthaler Setzmaschinen Fabrik Ges): Distributing mechanism of a typographical composing machine using matrices or type dies having different faces. 25974 Schumacher: Knapsacks and the like. 25994 Harrison: Joints for connecting tubes to plates, walls, or similar structures. 25996 Kent: Valves and valve mechanism for internal-combustion engines. 26035 Legrand and Gersant: Steam or like fluid-pressure turbines. 26051 Rohde: Feeding and reversing gear for electrically-operated rock drills. 26068 Cambridge: Grates for gas producers. 26099 Noble: Support of electrical conductors or cables. 26117 Beidler: Automatic apparatus for exposing, developing, and fixing photographic films. 26119 Walker (Mergenthaler Setzmaschinen Fabrik Ges.): Circulating matrices or type dies of typographical composing machines. 26148 Herzfelder: Manf. of elastic articles. 26177 Owen: Indicating or signalling apparatus for street vehicles and the like. 26181 Armitage and Haw: Self-acting mules. 26182 Ockenden and Fowler: Liquid metal polish in which the solids always remain suspended in the liquids.

26187 Turnbull: Stop and other valves.

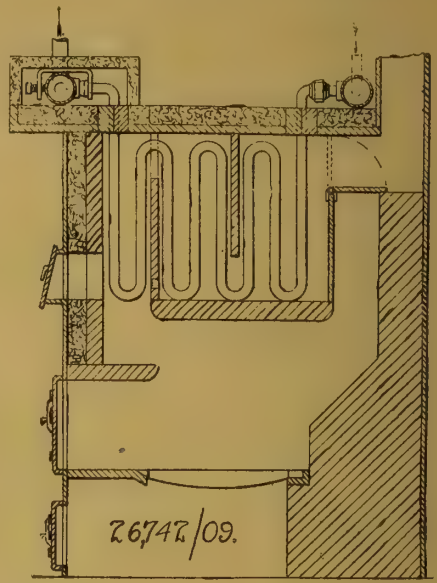
This invention relates to improvements in stop and other valves which are subjected to varying temperatures, and refers to that class of stop and other valves where a spring has been employed for taking up this unequal expansion or contraction and consequently obviating any great additional strain being put upon the crosshead or other parts of the valve and preventing complete fracture. The invention comprises the employment of a steel plate disc or washer which may be flat, dished, or corrugated, and/or with radial leaves and saw cuts and of tempered spring steel and introducing same to take the thrust between the collar on the screw and the underside of the cross head or nut, and being such as to withstand the force or load required to close the valve, and of sufficient elasticity to take up the difference in expansion or contraction of the parts of the valve, and all without the necessity of any special preparation in the valve to receive the plate or disc.


26,187/09.

26258 Swan and Kendall: Apparatus for the manf. of alkaline cyanides. 26268 Trewent and Proctor: Apparatus for ejecting ashes and other refuse and water from the holds of ships and from other places. 26273 Diplock: Means for supporting traction engines and other vehicles. 26289 Ferguson: Electric light systems for trains and other moving vehicles and apparatus therefor. 26297 Maccormack and McPhun: Bottle seals. 26357 De Sille: Resilient wheels. 26358 Welin: Boat-disengaging gear. 26359 Demetriade, Jonescu, and Coanda: Explosives. 26361 Collier: Feeding of animals. 26369 Coates, Hill, and Rang: Coin-freed locks. 26422 Cox: Electrical switches. 26426 Brown: Method of working steam or gas turbine installations for variable power and speed. 26431 Packham and Packham: Tobacco pipes. 26434 Warby and Senier: Means for checking and registering the receipts in theatres and other places 26441 Dunne: Aeroplanes. 26479 Kidder: Line-spacing mechanism for typewriting machines. 26483 Janney: Car couplings. 26514 Littlewood: Turnip hoe. 26515 Iremonger: Boot retailers' fitting-on stools. 26524 Hailwood: Miners' safety lamps. 26555 Printing Machinery Co., Pearce and Wood: Means for finishing and cooling curved stereotypes. [Application for Patent of Addition to 21896, 1909.] 26560 Pearson and Seward: Class of machines commonly known in the art as screw machines. 26582 Willis (Thomas): Door for cars adapted for transporting granulated substance in bulk. 26610 Morss and Blount: Wick burners for lamps and stoves. 26619 Gunstone: Detachable rims for wheels of road vehicles. 26627 Johnson, Riddle, and Co., and Mayrow: Apparatus for moving scenes adapted for advertising and other purposes. 26676 Davies: Apparatus for cleaning by vacuum.

26742 Hotso Steam Heating Syndicate, and Humphrey: Steam superheaters.

This invention relates to superheaters of the type in which the direction of the flow of steam is opposite to that of the furnace gases, baffle plates being arranged between the coils of the superheater for the purpose of obtaining an even distribution of the furnace gases. The invention consists essentially in connecting each coil to the outlet header by means of a cone joint held in place by means of a clamp and staggering the U-shaped legs of the coils whereby each coil is rendered self-supporting; also in adapting the lower baffle or baffles to be raised.


26742/09.

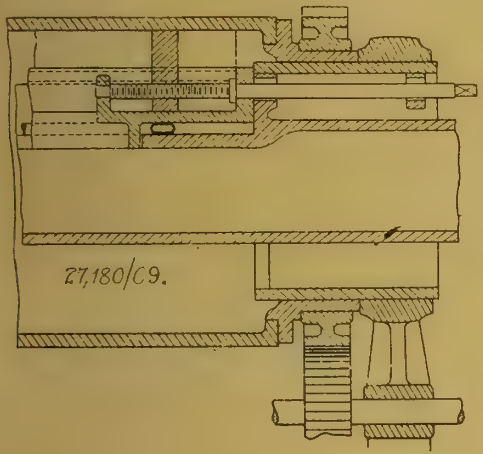
26743 Gazey: Toe clips for cyclists. [Request under Section 19 of the Act not granted.] 26748 Hosie: Domestic and like fireplaces. 26752 Jennings: Locking devices for the doors or covers of carding engine cylinders. 26753 Wilson: Diaphragm signalling horns such as are used on automobiles, launches, and the like. 26781 Paulet: Stands or supports for bicycles. [Application for Patent of Addition to 25699, 1905.] 26948 Heys: Commutator bars in connection with the armatures used in dynamos and motors. 26991 Luckwill: Gas tap.

27180 White and Gray: Paper-making machines. [Cognate Application. 1473, 1910.]

This invention relates to paper-making machines, and has for its primary object to provide improved means for adjusting the vacuum box so as to main uniform contact with the inner periphery of the usual hollow revolving roll around which the paper pulp passes, and thus ensure a positive tight joint without the use of springs, wedges, and the like. The invention consists of means comprising a stationary cradle having arranged within it a vertically movable box adapted to be operated through the intermediary of fluid pressure introduced between the cradle and the box.

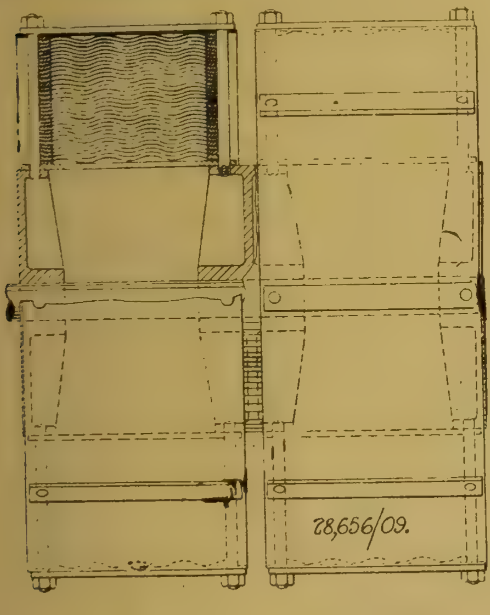
27235 Rhodes: Mattresses, bedding, and the like. [Post-dated April 22nd, 1910.] 27301 Howarth and Gaukroger: Devices for facilitating the separating of sheets of paper and the like. 27489 Kreutzberger: Means for tensioning driving belts and the like. 27607 Candy and Candy: Apparatus for use in or in connection with the purification of water. 27742 Finetti and Tischer: Light-projecting apparatus. 27763 Jepson: Baskets for holding potatoes and the like during washing. 27827

British Thomson-Houston Co., and Young: Automatic regulators for dynamo electric machines. 27875 Clayton: Manf. of nuts or headed bolts or the like. 28046 Craig and Gordon: Caskets for the reception and display of pictures. 28157 Ruthven: Combined brake buffer and automatic differential grip for safety clutches. [Application for Patent of Addition to 10325, 1909.] 28295 Burnet, Temple, and Burnet and Temple Ltd.: Serviette and the like suspender, more particularly for children's use. [Post-dated June 3rd, 1910.] 28385 Bardens: Covers for hatchways. 28480 Marzetti: Apparatus for boiling water for the preparation of coffee, tea, and other purposes. 28543 Pratt: Machines for making chip baskets. 28562 Reith and Flade: Coin selectors for use in connection with coin-freed apparatus and for other purposes. 28633 Grantham: Ball-bearing pencil.



28656 Heenan: Apparatus for cooling water or air, or for treating gases with liquids. [Application for Patent of Addition to 6452, 1909.]

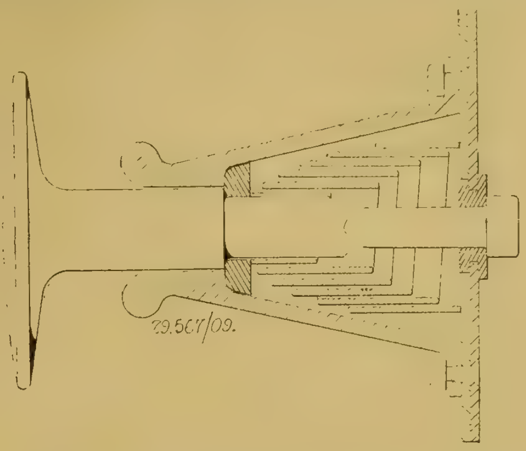
This invention relates to rotors for water-cooling machines or for treating gases with liquids of helical form made of corrugated sheets in which the corrugations run parallel to the axis. The invention consists essentially of a rotor constructed from sheets with one or more corrugations or undulations running longitudinally of the sheet and helically around the rotor.



28657 Furnival, Furnival, and Furnival: Rotary printing machines. 28660 Hargreaves, Hargreaves, and Hargreaves: Appliances for collecting and removing dust from carding engines during the stripping and brushing operations. [Application for Patent of Addition to 17986, 1908.] 28766 Findlay: Landing noose. 28871 Taylor: Gold printing or similar printing and apparatus therefor. 28993 Sommer: Coal-distributing apparatus. 29056 McLeod: Starting engines. 29083 Dahl and Bell: Resilient tyres for wheels. 29192 White and De Lamorton: Appliance for ruling straight lines. 29211 Cowper-Coles: Construction of domestic firegrates and the like. 29278 Reilly: Driving mechanism for motor cycles and the like. 29301 Hill: Mascots such as used on road vehicles. 29407 English and Davis: Reflecting device or signal to be carried at the rear of a road vehicle or on a stationary object. 29430 Bone, Wilson, and McCourt: Combustion of gaseous fuel. [Request under Section 19 of the Act not granted.] 29501 Elia: Method of and means employed for coaling ships. 29537 Lewis: Reversing valves for regenerative furnaces. 29556 Brown and Hipkins: Means of indication for weighing apparatus.

29567 Barson, and Cammell, Laird, and Co.: Buffers for railway vehicles and like purposes.

This invention relates to buffers for railway vehicles and like purposes, and consists essentially in the combination with a plunger having an enlarged rear end of a split bush to embrace the plunger having a flange and one or more projections and an opening in the base plate shaped to allow the projection or projections, but not the flange of the bush, to pass therethrough, and an inner plate or the like provided with an opening shaped to fit the projection or projections on the bush, and means for locking the plates against relative turning movement.

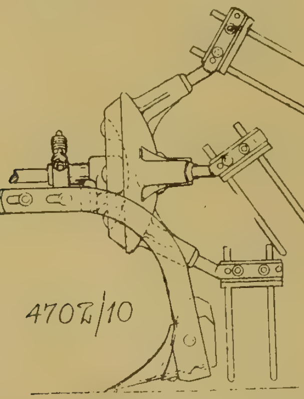


29602 Krumschmidt: Devices for compensating for wear of brake shoes and friction clutches. 29707 Stopford: Miners' safety lamps. 29791 Taylor: Skirt-drafting implement. 29846 Verne: Curling stones. 29851 Melville and Macalpine: Reduction gearing. 29952 Beer: Appliance for use in connection with the playing of pianofortes and the like. 30023 Steane, and Charlesworth Bodies Ltd.: Vehicle bodies. 30122 Smallman: Skittle boards. 30148 Von Unruh: Manf. of incandescing bodies for use in incandescent gas lighting. 30324 Peñiakoff: Manf. of alkali aluminates. 30327 Ham: Automatic or power-driven distributors for filter beds and the like. 30374 Smith and Smith: Valves for internal-combustion engines. 30401 Jenner and Jenner: Presses for joining belt sections and for similar purposes. 30425 Marks (Colorado Iron Works Co.): Furnaces for smelting ores. 30456 Hadwin: Scrimp rails for calico-printing machines and the like. [Application for Patent of Addition to 20235, 1907.] 30502 Johnson (Badische Anilin and Soda Fabrik): Manf. of nitrates. 30547 A. W. Penrose and Co., and Block: Transfer apparatus for printing purposes and the like.

1910.

15 Buxton: Construction of two-wheeled vehicles. 167 Evans: Wire fabrics or mattresses for bedsteads, cots, and like articles of furniture. 532 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of orthooxyazo dyestuffs. [Samples furnished under Section 2 of the Act.] 661 Elphinstone: Distance recorders or logs. 759 Rose, and Rose Bros. (Gainsborough) Ltd.: Apparatus for applying bands, wrappers, or labels to boxes, blocks, or packages. [Application for Patent of Addition to 16740, 1900.] 1008 Connor: Apparatus for the manf. of gas from oil and steam. 1017 Plaisant: Aerial machines with a view to diminish the atmospheric resistance to motion. [Date applied for under Rule 13, November 9th, 1909.] 1108 Allison: Automatic couplings for railway and like vehicles. 1241 Stidder: Tyres for road vehicles. 1260 Young: Grid bars and grids employed in prepreparing and opening cotton and other fibres. 1368 Lowe: Device for securing door mats or the like in position. 1411 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of dyestuffs of the triphenylmethane series. 1473. *See* 27180, 1909. 1641 Haddan (Firm Ferd. Luttgen Wwe):

Method of chemical cleansing by means of benzine, benzol, and the like, and apparatus therefor. 1767 Grimsdale: Piano players and like instruments. 1779 Bragas: Devices for heating water and the like. 1914 Denison: Internal-combustion engines. 1925 Geb. Siemens and Co.: Process for the manf. of fire and acid proof moulds, crucibles, and the like. [Date applied for under International Convention, March 5th, 1909.] 1930 Freeman: Glazing bars for roof lights, and windows and ridge cappings for skylights. 1967 Tatton, Tatton, and Walker: Washing and disinfecting machine for mackintosh sheets or the like. [Cognate Application. 17585, 1910.] 2048 Browne: Three-speed hub-contained gear for bicycles and light motor vehicles. [Cognate Application. 2589, 1910.] 2074 Mills, and Partridges Ltd.: Cycle head locks. 2145 Taylor: Pulley block. 2246 Bushill, and Thomas Bushill and Sons Ltd.: Cases principally for use as letter files, transfer binders, and the like. 2325 Morton: Suspender garters for socks and the like. 2329 Clegg: Rotary valve for internal-combustion engines. [Cognate Application. 13229, 1910.] 2392 Newton (R. Hoe and Co.): Cutting mechanisms. 2589. *See* 2048, 1910. 2613 Short, Short, and Short: Construction of aeroplanes. 2626 Bartelt: Flying machines. 2793 Ker: Fishing reels. 2795 Rowland, and Warne, Wright, and Rowland Ltd.: Pneumatic tyre valves. 2810 Henrard and Leveque: Method of and means for controlling the points of electric tramways and railways. 2872 Horrell: Spraying apparatus. 2999 Fassbender: Discharge devices for water of condensation. 3060 Olive Machinery Co., and Haigh: Sanding or wood and like smoothing or polishing machines. 3081 British High Power Gas Engine Co., and Neustadter: Pistons for explosion engines. 3127 Burgess: Glazed sash windows. 3256 Clark: Costume stands. 3269 Moore: Built-up bookcases and like furniture. 3287 Bogner: Travelling furnace grates revolving about a vertical axis. [Date applied for under International Convention, February 10th, 1909.] 3289 Nicholls and Fletcher: Incandescent gas lamps. 3473 Bartle and Tierney: Amusement device. 3486 Cuntz: Snow-melting machines. 3508 Muller: Method of reducing the proportion of salts and sugar contained in cow's milk without diminishing the content of fat and casein. 3516 Vincent and Benner: Adding and listing machines. [Date applied for under International Convention, February 23rd, 1909.] 3674 McLean: Means of preventing accidents to roller skaters upon elevated ways. 3675 Drummond: Stuff regulator for paper-making machines. 3677 Beevers and Beevers: Sheet delivery apparatus, particularly applicable to printing machines of the Wharfedale bottom feed stop cylinder type. 3689 Hall: Hooks and eyes. 3718 Spencer: Ball head clips for cycles and the like. 3756 Chisholm-Ellams: Contrivance for facilitating the recording of telephone calls. 3785 Wilson: Construction of adjustable bonding stirrup and tie bar for use in reinforced concrete structures. 3917 Winsor and Newton Ltd., and Massey: Sketching boxes for containing colours or paints. 3925 Sharp, and Air Springs Ltd.: Spring supports for cycle saddles. 4028 Herbert and Vernon: Radial drills. 4057 Brown: Folding boxes for carrying eggs and other fragile articles. 4114 Crabtree: Stand for the display of collars and the like in shop windows. 4269 Harper: Windmill. [Date applied for under International Convention, February 23rd, 1909.] 4304 Cook: Tobacco pipe stoppers. 4499 Challiner and Challiner: Tools or appliances for enabling tyre-protecting bands to be secured to the rims of wheels. [Cognate Application. 5982, 1910.] 4545 Ward: Yarn-cop carrying devices for use in lace curtain, warping, winding, and like machines. 4563 Rees: Holders for strip tickets. 4593 Chapman: Waterproof capes or coats and other garments. 4633 Ashcroft: Fastener for fixing a cape hood to the body of a motor car.


4702/10

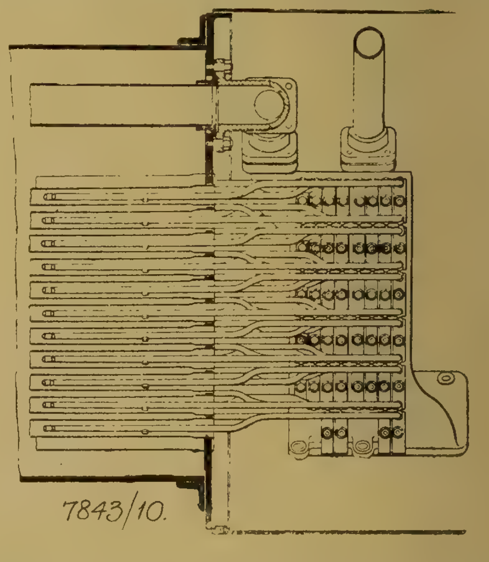
4702 Bamford and Bamford: Potato-digging machines.

This invention has reference to potato-digging machines of that type wherein the tines or forks are so controlled by mechanism as to be always in a hanging position as they are carried round. According to the present improvements in addition to the digging share or blade being removably bolted to its support or supports it is attached thereto by a stud and slot or tongue and slot arrangement, and, moreover, the digging share or blade is so constructed that it will better turn the soil towards the centre of the share to be acted upon by the tines, thereby enabling the share to lift a greater width of row than is possible when the share is constructed in the usual way.

4705 Thomas: Roller skate wheels. 4876 Ker: Fishing reels. 4877 Baile: Supports for cooking utensils. 4881 Schaffner: Harness or equipment for use by tramcar conductors and other persons in like employment. 4960 Goehler: Manually operated high-speed rotor. 5085 Railing and Garrard: Electric switches. 5116 Smith and Sharp: Corsets. 5252 Boult (Boye Needle Co.): Cabinets or the like adapted to contain needles or other small articles. 5267 Brougham (Firm Poldihutte Tiegelguszstahlfabrik): Melting and refining furnaces. 5455 Searle, and London General Omnibus Co.: Change-speed gearing for motor vehicles. 5478 Tourtel: Typewriting and like machines. 5778 Hopewell: Interlocking metal bar for ferro-concrete. 5810 Drummond: Steam generators. 5868 Walker: Targets for use in rifle shooting. 5875 Robinson: Apparatus for heating water for use in lavatories in railway carriages. [Cognate Application. 10512, 1910.] 5943 Borgenhagen: Clothes-washing apparatus. [Date applied for under International Convention, March 9th, 1909.] 5982. *See* 449, 10. 6094 Baxter: Plug for use in pipes for smoking tobacco. 6240 Fried. Krupp Akt.-Ges.: Safe or steel chamber walls. [Date applied for under International Convention, August 23rd, 1909.] 6537 Bauer: Trousers stretchers. 6591 Feather: Rotary sewage-distributing apparatus. 6630 Kilburn (Gebruder Sulzer): Apparatus for utilising the exhaust gases of internal-combustion engines. 6661 Rudolph: Mounting of unions on flexible tubing provided with metallic sheathing. 7051 Riesenfeld: Apparatus for the treatment of textile goods with liquids. 7093 Siemens Bros. and Co. (Siemens and Halske Akt.-Ges.): Automatic telephone exchanges. 7168 Rundlof: Internal-combustion engines. [Date applied for under International Convention, March 23rd, 1909.] 7327 Reed: Concrete or like mixers. 7410 Billette and Staehle: Feather coverings. 7454 Dietmann and Violon: Conveying chains for match-making machines. 7533 Levy: Apparatus for rectilinearly guiding longitudinal embroidery. [Date applied for under International Convention, March 27th, 1909.] 7617 Podszus: Electric igniter for explosion motors.

7843 Schmidt's Superheating Co. (Thomsen and Elnser): Combined superheater and boiler arrangements.

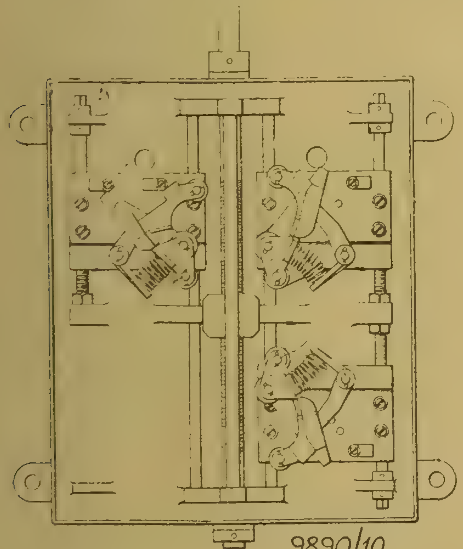
This invention relates to combined superheater and boiler arrangements, and is especially applicable to the types used in conjunction with locomotives. The invention consists of a superheater arrangement in which the superheater tubes open into collectors or headers located apart from one another and individually in communication with separate cylinders of a multi-cylinder engine, the collectors being interconnected by a duct in such a manner that all the collectors co-operate in supplying steam to the engine irrespective of the outlet from which it is withdrawn.


7843/10

7854 Bollman and Anstead: Bottles and stoppers therefor. [Date applied for under International Convention, March 31st, 1909.] 8123 Egersdorfer: Rotary engine or pump. [Date applied for under International Convention, April 2nd, 1909.] 8503 Champ: Automatically-operated valves. [Date applied for under International Convention, July 19th, 1909.] 8619 Bjelovucic: Devices for propelling boats and airships. 8727 Aktiebolaget Gebe and Petterson: Valve cocks and the like. 8858 Rawlings: Earthing device for electric switches. 8914 Hodkinson: Bond irons or wall ties. 8953 Dibble: Triple valves for air brake mechanisms. [Date applied for under International Convention, April 19th, 1909.] 9202 Morand: Lighting and extinguishing apparatus for gas burners. [Date applied for under International Convention, November 5th, 1909.] 9350 Fournier: Thermometers and the like. [Date applied for under International Convention, April 19th, 1909.] 9354 Bjorn-Henriksen: Apparatus for feeding or delivering measured quantities of pulverised or granular substances. [Date applied for under International Convention April 28th, 1909.] 9547 Beard and Townsend: Electric lamp shade attachments. 9634 Siemens Bros. and Co. (Siemens and Halske Akt.-Ges.): Circuits for registers in automatic telephone exchanges. 9646 Justice (Going Manufacturing Co.): Means for forming blanks for buttons and the like. 9647 Malcolm and Appleyard: Alternating-current conductors. 9824 Fried. Krupp Akt.-Ges.: Limber connections for artillery vehicles. [Date applied for under International Convention, November 12th, 1909.] 9888 Koller: Automatic safety catches for loads of all kinds, particularly for arc lamps.

9890 Adams Manufacturing Co. (Cutler Hammer Manufacturing Co.): Electric switches.

This invention relates to improvements in electric switches, and more particularly to limit switches. According to the present invention in an electric switch comprising a pivoted switch arm and a nut or like travelling member which is moved along a reciprocatory path for the purpose of actuating the switch at predetermined times the switch arm has in combination therewith a pivoted latch arm and a spring between the arms arranged to move the latch arm into position to lock the switch arm in its closed position and arranged to quickly move the switch arm to open the circuit when the switch arm is released. The said switch arm and latch arm are mounted so that a part of each arm can lie in the path of the travelling member, but so that when one arm projects into this path the other is entirely out of the path. Means are provided for adjusting the position of the arms along the path of the movable member in order that the latter may be caused to actuate the said arms at any predetermined points in its path of travel.

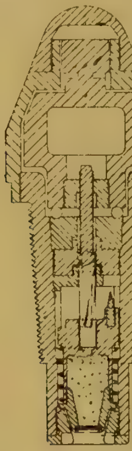


9890/10

9895 Harvey: Apparatus for damping paper and for other like purposes. 9958 Frazer and Chalmers Ltd., Whitmore, Chapman, and Kubler: Devices for controlling or regulating the capacity or the pressure of compressed air systems or air compressing apparatus. 10132 Collins and Hartmann: Hand-driving gearing for imparting rotary movement at high speed. 10143 Michener: Elevators. 10289 Phalp: Wheel-locking appliances for use in connection with perambulators, mailcarts, trolley carts, bassinettes, and other vehicles. 10512. *See* 5875, 1910. 10579 Tennen: Ladies' knickers. 10608 Lush: Apparatus for separating metallic ores from sand and other extraneous matters. 10675 Mooseberger and Graber: Turbine engines. 10707 Armstrong: Lay figure and like stands. 11096 Warburton: Covers for cloth and other patterns or samples. 11447 Hannington: Means for operating pivoted windows, fanlights, and the like. [Date applied for under International Convention, May 17th, 1909.] 11479 Bartlett: Devices for automatically igniting and controlling gas. [Date applied for under International Convention, May 11th, 1909.] 11488 Lovell and Bulman: Recreation apparatus. 11716 Thomson: Electric furnaces. [Date applied for under International Convention, May 13th, 1909.] 11922 Brihaye: Method and means for consolidating or strengthening sewn seams of leather or other material. [Date applied for under International Convention, May 28th, 1909.] 11926 Mendez: Compositions for use as a building material, paint, and the like. 12298 Carl Lindstrom Akt.-Ges.: Phonographs. [Date applied for under International Convention, April 9th, 1910.] 12339 Kemmner: Combined oil and air pump. [Date applied for under International Convention, May 19th, 1909.] 12431 Dorman: Bottleneck forming tools. 12533 Magney: Elastic tyres for wheels. 12605 McKean: Traverse mechanism of winding machines for yarns. [Date applied for under Rule 13, December 28th, 1909.] 12607 Burkhardt: Water-tube steam generators. [Date applied for under International Convention, July 15th, 1909.] 12734 Disdier y Crooke: Product applicable as a food for cattle. [Date applied for under International Convention, May 25th, 1909.] 12803 Ponting: Pawnbrokers' multiple writing machines. 13010 Hofmann: Pocket lighters for cigars, cigarettes, or other purposes. 13077 Marcotte: Spools for shuttles of automatically-charged looms. [Date applied for under International Convention, January 11th, 1910.] 13165 Ryan and Hengerer: Receptacle or socket for electric lamps. 13229. *See* 2329, 1910. 13294 Bonacina: Sludge-collecting and ventilating boxes applicable for the drainage of roadways and the like. [Date applied for under International Convention, June 1st, 1909.] 13330 Ketchum: Dynamo electrical machines. 13385 Cameron: Lubricators. 13652 Bajde: Bowed string musical instruments. 13779 Radcliffe: Internal-combustion engines. [Date applied for under International Convention, June 30th, 1909.] 13854 Hall and Kay Ltd., Hall and Kay: Apparatus employed for humidifying air in spinning rooms and like places. 13877 Koch: Apparatus for purifying sewage water. [Request under Section 19 of the Act not granted.] 13901 Firm Robert Bosch: Sparking plugs for internal-combustion engines. [Date applied for under International Convention, August 3rd, 1909.] 13978 Benninghoff and Firm of August Klonne: Process and apparatus for cooling coal gas and the like. 14005 Suy: Automatic protecting device for circular saws. 14244 Seymour: Rain shield for cyclists. 14277 Hanlon: Terrets. 14406 Kopmann: Cooking saucepans. 14515 Otto: Massage appliance. 14589 Champeix and Champeix: Apparatus for ascertaining the equivalents of various values, such as those of weights, measures, and money. [Date applied for under International Convention, June 17th, 1909.] 14685 Pither: Fastenings for the doors and drawers of cabinets, writing bureaux, and the like. 14850 Hofmann: Pocket lighters for cigars, cigarettes, or other purposes. [Application for Patent of Addition to 13010, 1910.] 14936 Hanlon: Hame line rings. 14947 Lake (Ingersoll-Rand Co.): Valve motions for rock drills and other direct-acting engines. 15030 Bohn: Hydraulic mechanism. 15119 Dickson: Polishing or rubbing appliances. 15140 Heimann: Apparatus for manufacturing wired glass. 15147 Whitmore: Chalk line reels. 15377 Aylott: Hats. [Request under Section 19 of the Act not granted.] 15406 Lake (Winchester Repeating Arms Co.): Small arms. 15458 John Marston Ltd., and Morgan: Bell crank levers for use in rod and similar operating mechanism. 15510 Thornton (L. B. Manufacturing Co.): Carrier for packages and other articles for attachment to bicycles and the like. 15776 Board: Resilient wheels. 15808 Poole: Apparatus for administering anæsthetics. 16171 Poppe: Method of and apparatus for re-grinding and polishing perforated diamonds. 16331 Goldstein: Central energy electrical signalling system. 16452 Rikli: Thread spools for the shuttles of embroidery machines. 16481 Healey: Window holders and rattling preventers for sliding sashes of vehicle windows and the like. 16643 Gleason: Re-railers for placing derailed cars upon the tracks. 16811 Van der Burg: Tyre for motor vehicles and the like. 16835 Allen: Reinforced concrete. 16893 Taylor: Motor spirit cans. 17047 Siemens Schuckertwerke Ges.: Electric fuses. [Date applied for under International Convention, July 23rd, 1909. Application for Patent of Addition to 14622, 1909.] 17144 Anderson: Resilient or spring wheels. 17417 Stahl: Process for the production of bread poor in carbohydrates. 17516 McLoughlin: Water heaters and the like. 17585. *See* 1967, 1910. 17615 Farbwerke vorm. Meister, Lucius, and Bruning: Manf. of bluish-green colour lakes. [Date applied for under International Convention, July 27th, 1909.] 17642 Bratke: Garment seam for loosely woven fabrics. 17965 Hemmingsen: Draft gear. 18008 Veale and Longstaff: Fastenings for wearing apparel.

18149 Bacon and Petrie: Projectile fuses.

This invention relates to fuses for projectiles, particularly those charged with lyddite or other high explosive material, and having a rotatable body articulated to the fuse casing and a reduced part which is fractured in its effort to communicate rotation to the body, thus permitting relative rotational movement between the rotatable body and the fuse casing. The present invention consists in the combination of the rotatable body with an axial screwed spindle which is caused by such relative rotational movement to move axially forward, so as to permit forward movement of the percussion pellet when the shell is retarded, but not until the projectile has left the gun.

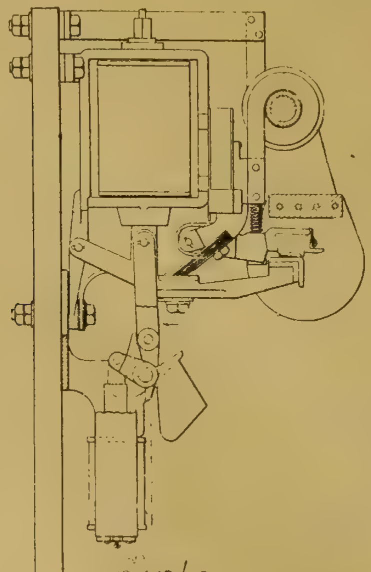


18,149/10.

18363 Mauser: Recoil-loading pistol with fixed barrel. [Date applied for under International Convention, March 17th, 1910.] 18429 Hodgkinson: Fluid-pressure motor plants. [Date applied for under International Convention, September 1st, 1909.]

18443 Adams Manufacturing Co. (Cutler Hammer Manufacturing Co.): Electro-mechanically-operated switch.

This invention relates to an improved electro-mechanically-operated switch of the kind adapted to be controlled from a distance, and provided with links forming a self-locking toggle for maintaining the switch closed after being operated, and a tripping device actuated by an electromagnet controlled from a distance to release the toggle and allow the switch to open. The invention consists in the combination with the toggle links of a weighted lever having a bifurcated portion providing limbs between which a part of one of the toggle links is disposed. In the closed position of the switch the weighted lever bears against this toggle to throw the latter past its centre to lock it and to hold the same in its locked position, supporting the switch. On energising the tripping electromagnet the weighted lever delivers a hammer blow to the toggle to release the same from its locked position. A comparatively small and weak tripping electromagnet may be used, as the momentum of the weighted lever is sufficient to overcome the resistance to motion of the levers and unlock the joint.

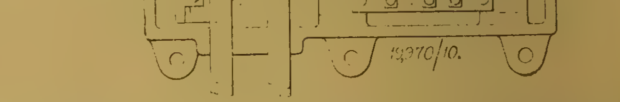


18.143/10

18610 Hallensleben: Power loom for cocoanut matting. [Date applied for under International Convention, December 23rd, 1909.] 18698 Soc. l'Air liquide (Soc. Anon. pour l'Etude et L'Exploitation des Procedes Georges Claude): Desiccation of air and other gases. [Date applied for under International Convention, August 9th, 1909.] 18771 Down: Operation tables for surgical use. [Date applied for under Rule 13, February 15th, 1910.] 18784 Junghans: Means for illuminating clock dials and other indicators. 18823 Leigh: Apparatus for automatically distributing liquids to filter beds and other areas. 19000 Bloxam (Chemische Fabrik Griesheim Electron): Manf. of a new mono-azo dyestuff specially suitable for the preparation of pigment colours. 19059 Du Cros: Rear lights or danger signals for cycles. [Date applied for under Rule 13, December 4th, 1909.] 19152 Delmage: Washing machines. [Date applied for under International Convention, August 18th, 1909.] 19339 Bellgrove: Scoring board for counting without figures. 19356 Villiers-Stuart: Wheels for vehicles. 19594 Gibbs: Apparatus and process for annealing wire. [Date applied for under International Convention, September 4th, 1909.] 19614 Hall and Illius: Lubrication of internal-combustion engines. 19792 Boult (Akt.-Ges. fur den Vertieb von Kuchengeschirr-Spulapparaten "Triumph"): Washing apparatus for plates or the like. [Application for Patent of Addition to 29905, 1909.] 19887 Von Markhof: Apparatus for determining the passage of a ship's gun on board ship through a given elevation. [Date applied for under International Convention, August 26th, 1909.]

19970 Siemens Bros. and Co., and Ferreira: Apparatus for electrically detecting railway points.

This invention relates to an apparatus for electrically detecting railway points which is adapted to give a fine detection of each tongue of the points, of the points conjointly, and of the locking bolt. When used in conjunction with electrically-operated points, the apparatus also comprises a quick break switch for the motor circuit in either of the complete final positions of the points and bolt. According to the invention the establishment of the detector circuit is made dependent on the one hand on the abutment against each other of two surfaces carried respectively by bars connected respectively with the tongues of the points, and, on the other hand, on a pressure exerted by a piece moved by the bar connected with the locking bolt upon a piece carried by one of the aforesaid bars connected with a tongue of the points. Furthermore, the fineness of detection is secured, without unduly limiting the rubbing surface, by providing that the contact is made under action of a spring only just before the locking bolt is home.

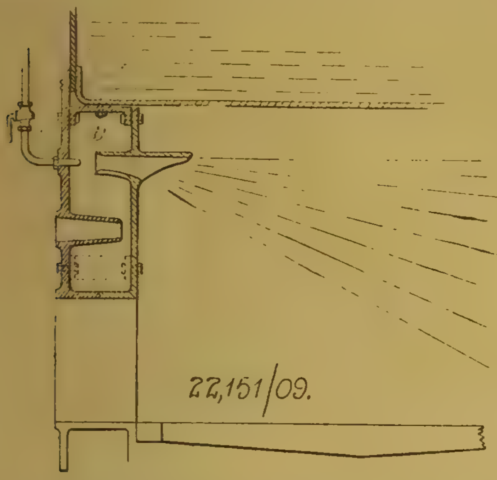


19970/10.

20422 Steuer: Process of and apparatus for sprinkling liquid. [Date applied for under International Convention, September 18th, 1909.] 20489 Kuhn: Manf. of beverages from grapes and raisins. [Application for Patent of Addition to 27831, 1909. Date applied for under Rule 13, November 29th, 1909.] 20838 Kendrick: Tyre-manipulating appliances. 20856 Soc. Francaise La Lingerie Universelle: Method of making buttonholes for wearing apparel, boots, and the like. [Date applied for under International Convention, September 8th, 1909.] 20872 Wright (Veifa-Werke Vereinigte Electrotechnische Institute Frankfurt Aschaffenburg): Interrupter particularly applicable for use with induction coils. 21066 Jones, and Patent Rapid Scaffold Tie Co.: Devices for binding or connecting together scaffold poles and the like. 21659 Veit: Sound box for talking machines. [Date applied for under International Convention, October 13th, 1909.] 21801 Teutschert: Lattice work for window frames and other purposes. [Date applied for under International Convention, September 21st, 1909.]

22151 Neil: Supply of air to the furnaces of steam generators. [Date applied for under Rule 13, November 20th, 1909.]

This invention relates to the provision of improved means for supplying heated air to the furnaces of steam generators in an improved manner above the surface of the fire, and comprises an air chamber formed between the face plate of the furnace and a heating plate located at a distance therefrom, the face plate being furnished with one or more supply pipes extending forward towards the heating plate, and the heating plate being furnished with one or more air delivery pipes arranged to project rearwardly into the air chamber, each delivery pipe being formed with a downwardly presented angularly inclined mouth directed and projecting from the furnace side of the heating plate.



22382 Ver-Mehr (Wemlinger): Shoring. 22523 Von Keissler: Ships' hulls. [Application for Patent of Addition to 19307, 1909.] 23157 Pietzsch and Adolph: Manf. of potassium persulphate. [Date applied for under International Convention, October 9th, 1909.] 23432 Bonjean: Tool feed mechanism for boring, surfacing, and grooving, and like machines having a boring. [Date applied for under Rule 13, November 5th, 1909.] 23923 Akt.-Ges. fur Anilin Fabrikation: Manf. of sulphuryl chloride. [Date applied for under International Convention, October 18th, 1909.]

COMPLETE SPECIFICATIONS OPEN TO PUBLIC INSPECTION BEFORE ACCEPTANCE, UNDER THE PATENTS ACT, 1907.

1909.

30521 Banki: Aeroplanes, airships, and the like.

1910.

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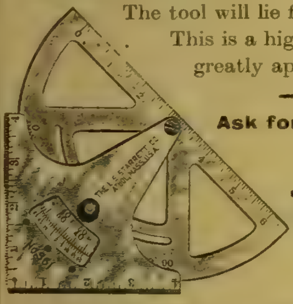

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VOL. 42. FRIDAY, DECEMBER 23, 1910. No. 1,243.

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ON GETTING BEFORE THE PUBLIC.

A YEAR or two ago there was strong opposition from organised electrical manufacturers to the increasing number of electrical exhibitions in which they were being invited to take part. The reasons for this attitude were easy to understand, for there was a dislike to paying profits to private exhibition promoters, and a disinclination to furnish apparatus free of charges to innumerable local exhibitions, organised for the benefit of electricity works, where there was as much chance of a rival getting the benefit of the display as there was that the actual exhibitor would benefit. It was plainly stated by some at the time that however much the organised manufacturers might dislike local exhibitions, they were among the best possible means of popularising electricity with the public. That was what the electric supply authorities were "out for," and if they experienced an increase in demand the makers and sellers of electrical manufactures would as a consequence benefit in the long run. There have been many local electrical exhibitions since then, and manufacturers of apparatus, sellers of electricity, wiring contractors, etc., have found them to be an admirable means of stirring up business—sometimes among the class of residents who can afford to fit their houses up with electric heating and cooking apparatus, as in the case of Hampstead and Marylebone; sometimes among the cabinet-making and other workshop trades, as in Shoreditch; and lastly, but equally if not more conspicuously in point of success, in the heavier engineering industrial district in and around Sheffield with the iron and steel works, in connection with which a show of this character led to the adoption of a number of new electric furnaces fed from the public mains.

In face of the foregoing, and other examples that we might quote, it is unlikely that the exhibition specially prepared to meet the demands and industries of a particular district will again be boycotted by any representative number of manufacturers, at any rate until electricity has made such progress that little scope remains. That there is enormous scope still remaining at present hardly needs pointing out. This is recognised by most electricity supply authorities, and many of them are so impressed with the good results attending exhibitions run for a few days that they are taking steps to establish their own permanent exhibitions in a main or central thoroughfare where the public pass by in their thousands every day, either in the shopping rounds or in the course of daily avocation. Marylebone has secured good results from a well-equipped department of this kind worked in connection with an aggressive commercial policy. The St. Pancras Electricity Department has a showroom next door to the Gas Company. Hackney Borough Council has followed suit by taking a shop and fitting it up in three departments for the people of that salubrious borough to see how they may make less smoke by adopting electric driving, and the manifold improved devices that ingenuity has conceived for their comfort and convenience in such matters as lighting, heating, cooking, and ventilating. At this moment several provincial boroughs are getting into conference with the contractors doing business in their towns to see whether mutually satisfactory arrangements can be made for opening showrooms without their competing with private interests.

Next year London is going to repeat the very successful electrical exhibition that was held at Olympia in 1905. There is every reason to believe that after the very satisfactory results of that event, and the excellent business that was brought to Manchester and district by the great electric show to which industrial people thronged in multitudes a couple of years ago, the electrical trade of this country is ready to enter with zest into the Olympia display of 1911. The space already booked is very promising. The local permanent exhibition is not a burden on the manufacturer, calling for the payment of large sums for exhibition stands, so the manufacturer only stands to gain from such arrangements. And in the case of the large electrical exhibitions of a month's duration these are now arranged on a more or less co-operative basis by the manufacturers themselves, though it is generally found that they require the assistance of parties who have made a specialised study of the management and organisation of such affairs in connection with other trades. In this electrical engineering and very scientific age it undoubtedly pays to give all the open publicity that we reasonably can to our inventions and manufactures in these classes. Some makers are finding their way direct to the public eye even through the advertisement pages of the daily paper; others are content with the technical and trade journal which they know gets into the hands of the particular class of men who either buy or have the specifying for their goods. But whether we adopt the exhibition, the daily press, the technical press, or the shop window, we must nowadays get for pushing the sale of most classes of smaller engineering manufactures into the glare of publicity. The man who neglects this important matter of bringing what he makes, or has for sale, efficiently before the sections of the community to whom it is designed to appeal must not be surprised if he is left behind in the race. He may have the best of all available devices for securing a particular result, but if the public do not know or cannot very easily ascertain where they can secure it, the second best, whose maker is better known to them, will be availed of. Every editor of technical publications knows from his business correspondence that names of makers of many specialities cannot be found by his readers. The remedy often enough lies with the firms themselves; they are waiting for the business that cannot find its way to them. Of course, occasionally it happens that the article asked for is not being manufactured, and orders are not wanted unless they are large enough to justify specially putting through.

THE NEW CUNARD LINER.—The contract for the gigantic new Cunarder is officially reported by the Cunard Steamship Company to have been given out to Messrs. John Brown and Co. Ltd., Clydebank. The firms who tendered for the work were Messrs. Vickers, Sons, and Maxim, Barrow; John Brown and Co., Clydebank; and Swan, Hunter, and Wigham-Richardson Ltd. Estimates have also to be called for from dozens of sub-contractors for the furnishing, electric lighting, different types of auxiliary machinery, and so on, and if possible options obtained for semi-manufactured building material, as a tender at one price for a vessel on a rising steel market might result in heavy loss when it became necessary to buy material. The dimensions of the new Cunarder compared with the White Star liner Olympic, recently launched at Belfast, are as follows:—Cunarder: Length, 885 ft.; breadth, 95½ ft.; speed (contract), 23 knots; displacement, 250,000 tons; passengers, 3,790. Olympic: Length, 882½ ft.; breadth, 92 ft.; speed (contract), 21 knots; displacement, 45,000 tons; passengers, 2,490. The cost of the new vessel will be about £2,000,000. A stipulation is said to have been made that provision shall be provided for running the vessel with oil fuel if deemed expedient.

A BULLETIN has just been published by the Canadian Department of Mines which has been prepared by Mr. E. Haanel, the Director of Mines. The publication deals with recent advances in the construction of electric furnaces for the production of pig iron, steel, and zinc. A long list of electric steel furnaces in existence is given, together with particulars of recent experiences at Domnarfvet, Sweden, and details of the Côte-Pierron and De Laval processes. A considerable amount of information is also given on the Frick electric reduction and electric steel furnaces.

HARBOUR IMPROVEMENTS.—The Bulletin of the South Australian Intelligence Department states that the Government propose to make extensive additions to the wharf in the Outer Harbour at the mouth of the Port Adelaide River, and to build a revetment mound a mile long on the northern shore of the harbour. These extensions, which will cost £190,000, are rendered necessary for the accommodation of the mail liners and large cargo steamers calling at Adelaide. H.M. Consul-General at Hamburg reports that the two dock basins under construction, the lengths of which are 1,640 ft. and 1,968 ft. respectively, have been completed. The floor of the projected dry dock has been constructed, but it will remain under water until February next; and preparations have been made for the construction of the west mole of the dock entrance. The dock will be 853 ft. long, and the entrance 113 ft. wide over the sill, which will be 38 ft. below ordinary high water level. After the completion of these works, the second section of the extension scheme will remain to be undertaken, namely, the construction of a new entrance lock, with chamber, from the Weser, and the so-called Wendehafen and Verbindungshafen. The British Vice-Consul at Marsala reports that dredging operations are being carried out at that port with the object of obtaining a depth of water at the entrance of the harbour of 29½ ft., and inside the harbour on the south-east side and adjoining the mole of 26¼ ft. This work is being undertaken in order to enable large steamers, which are to be put on the service from Naples to Palermo, Trapani and Tunis, to call also at Marsala. It is probable that new supplies of coal will be discharged at Marsala instead of Trapani, and also that vessels may load salt there. Preparations are also being made for lengthening the mole on the west side of the harbour. The British Acting Vice-Consul at Cadiz reports that the Cadiz Board of Harbour Works have purchased the dredging and other plant belonging to the Societa Veneta, and that work is to be begun at once on the first quay, which it is hoped to complete in eight or ten months.—*Board of Trade Journal.*

Launches on the Thames.—Complaint has been made to the Thames Conservancy Board that steam launches are navigated on the river, season after season, without their boilers being examined. This matter was dealt with by the conservators, when Mr. Tough asked Lord Desborough, the chairman, what steps had been taken in the matter. The chairman explained that a specific case had come before the notice of the Board, and the owner of the vessel, on examining the boiler, had found it defective, and had condemned it forthwith. Mr. Tough said there was no necessity for the Board to warn owners of steam launches to perform what they knew was a public duty. Boilers did not burst through being old and defective; more often it was the case that new boilers burst. This, he held, was a meddlesome policy, and one which might bring the conservators into trouble. Boilers were insured, and that insurance carried with it inspection, and there was no necessity to warn people of their public duties. The recommendation that a circular letter be addressed to owners, containing the warning, and urging upon them the desirability of having boilers examined and tested, was carried.

New Elements of Chemistry.—An address on this subject was given by Sir Wm. Crooks, the guest of the evening at a recent dinner at the Authors' Club, held at Whitehall Court. Radiant matter and radium had, he said, given them the new science of radio-activity. Derivative elements were increasing. Now there were about 20, and still they came. One of these, uranium, had a life duration of hundreds of millions of years, and one had so short an existence as that of four seconds. In his opinion the keynote of it all was that there was nothing permanent except change. Physicists were now considering that there was no such thing as matter, and it might be that residual matter might be nothing more than layers of positive and negative electricity. They might in future regard the universe as a rushing throng of electrons.

Pig Iron Production in Belgium.—The Belgian production of pig iron during last October was 160,250 tons, viz., 12,910 tons of forge pig, 5,920 tons of foundry pig, and 141,420 tons of basic and Bessemer pig. The production of pig iron in the corresponding month of 1909 was 142,250 tons, viz., 11,610 tons of forge pig, 7,600 tons of foundry pig, and 123,040 tons of basic and Bessemer pig. During the first ten months of this year the output amounted to 1,482,740 tons, as compared with 1,322,490 tons. At the end of October there were 38 blast furnaces in blast out of 41 in existence, while at the end of October, 1909, there were 41 furnaces, 37 of which were in blast.

STEAM ENGINE DESIGN.—XXXI.

(Continued from page 734.)

In this and the next, the two concluding articles of this seres, the subject of steam engine economy will be taken up. The matter is, of course, of great importance, since, for instance, in the steam consumption per horse power hour, the sizes of very many of the auxiliaries depend, besides the capacity of the boiler plant and its attendant apparatus.

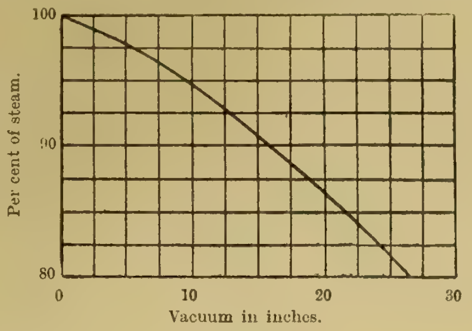


Fig. 172.

Apart from the type of engine—high or low speed, single or multi-cylinder—which has but comparatively little influence on the steam consumption, excepting always the improved conditions brought about by the use of Corliss or drop valves instead of those of the sliding type and other similar advantages in construction, the most important factors for economy are superheated steam and the large number of expansions obtainable by the use of a condenser. Regarding the former, in some cases a separate superheating apparatus is often employed. In this case the additional capital outlay and fuel used must be offset against the value of the steam saved. When condensing, the auxiliary pumps, etc., all detract from the saving at the main engine. It is, then, the overall economy of an installation which must be considered, each case on its own merits—some examples of actual practice

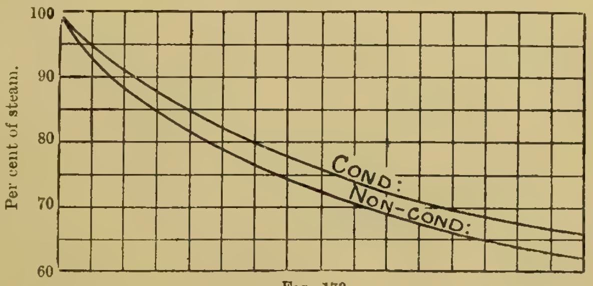


Fig. 173.

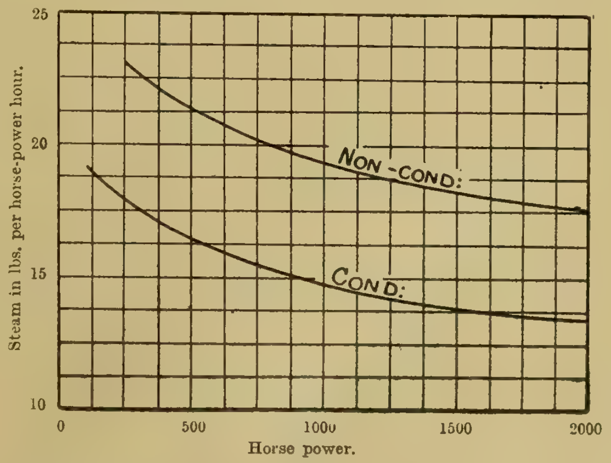


Fig. 174.

will be given a little later on. At this stage reference may appropriately be made to the latest marine practice, namely, the combination of reciprocating engines with low-pressure turbines. It is really only in virtue of its ability to avail itself of steam expanded almost to an absolute vacuum that the turbine is so great a rival of the ordinary engine. In Article I. the usual limits of expansion for various types of engines were mentioned. Beyond these limits the low-pressure cylinder becomes unduly large, and the condensation of steam neutralises all possible saving. The method of combination on a three screw steamer would be for the two reciprocating engines to work at their most economical vacuum and then to exhaust into the receiver of the same low-pressure turbine mounted on the third shaft. This turbine economically extracts the remaining energy from the steam and ultimately exhausts into a condenser of specially large capacity and usually fitted with both "dry and wet" air pumps in order to ensure the maintenance of the very high vacuum required.

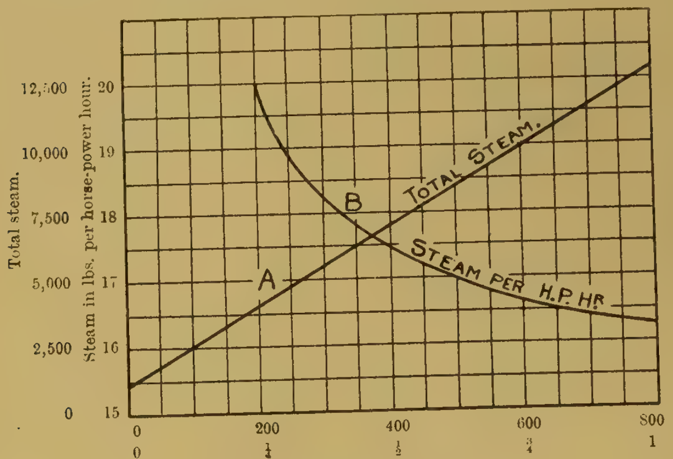


Fig. 175.

Vacuum and Steam Pressure.

The increase in power of an engine when the steam is expanded right down to the economical limit (for release pressures and number of expansions allowable, see Tables III. and IV.) ranges up to 30 per cent, although on some engines it may be as low as 10 per cent. The effect of vacuum in the steam consumption can be seen from the curve in fig. 172. Inches of vacuum are plotted horizontally, and, taking the steam used non-condensing as 100 per cent, the proportions of this used at different vacua are read vertically. It will be seen that the curve is very flat, in fact almost a straight line, but it should be remembered that in this case and for other curves in this article the results expressed *are averages*, and that tests in any particular engine may show considerable divergence. On a turbine the gain in steam per inch of vacuum is much greater, increasing very rapidly after 25 in.

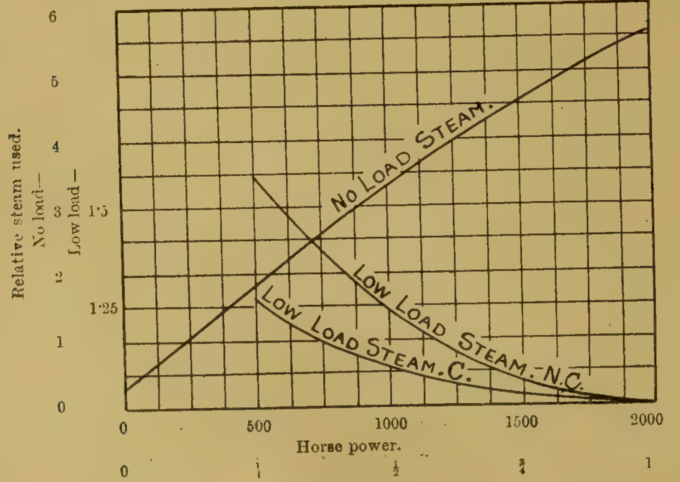


Fig. 176.

The effect of initial pressure shows economy in many ways—reduction of coal and steam used, and in increase in power for a given size of engine. With water-tube boilers there is no difficulty in generating steam at 300 lbs. per square inch, although latest naval practice favours rather lower pressures; in power stations the usual figure is 180 lbs. to 200 lbs. The curves in fig. 173 represent the savings in steam for high-class compound and triple-expansion engines of 500 H.P. to 2,000 H.P., condensing and non-condensing. Pressures 100 lbs. to 200 lbs. per square inch are plotted horizontally, while taking the steam used at 100 lbs. as 100 per cent, the savings can be read vertically.

Some idea of the gain in fuel obtainable by increase in steam pressure may be obtained from the following results of actual working:—

Triple expansion engine ..115 over 90 lbs. ..gain = 15 per cent.
,, ,, ,, ..150 ,, 80 lbs. .. ,, = 23 ,,
,, ,, ,, ..150 ,, 90 lbs. .. ,, = 22 ,,
,, ,, ,, ..150 ,, 110 lbs. . ,, = 10 to 15 ,,

On cargo boats or naval vessels the less the coal required for horse power the greater the cargo capacity in the one case, and the wider the steaming radius without having to re-coal in the other.

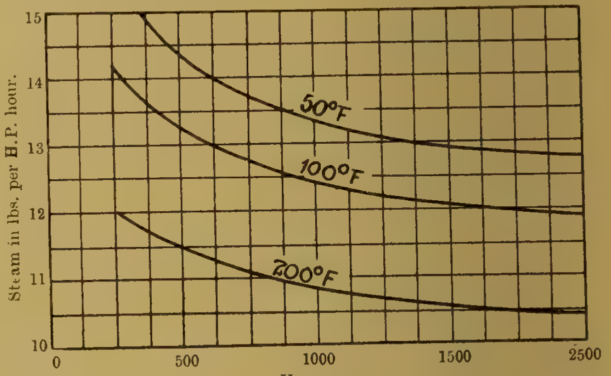


Fig. 177.

As the pressure increases the mean effective pressure is raised; the usual values are given in Article I., while the appropriate cut-offs for various classes of engines are given in Table III.

To show how great a service the higher steam pressures have been to naval engineers, the following table (XXXV.) has been prepared, showing the weight and space occupied by the main propelling machinery (for ships the size of engine room is given):—

Table XXXV.

Horse power	Pressure lbs. per sq. in.	Type of Engine.	Weights in cwts per horse power.	Square feet per horse power
12,000	140	3-cylinder triple expansion—Battleship	1·00	·20
15,000	250	,, ,, ,, ,, ...	·95	·15
10,500	145	,, ,, ,, 1st class cruiser	1·00	·18
15,000	250	,, ,, ,, ,, ,,	·84	·14
7,000	240	,, ,, ,, 3rd class cruiser	·57	..
6,000	250	4-cylinder triple-expansion engine—Destroyer	·19 to ·2	..
up to 400	150	Compound engine—High speed	·8 to ·7	·2 to ·18
,, 2000	180	Triple engine—High speed................	·8 to 1·0	·17 ·10
2,500	160	Compound 80 revolutions per minute	1·36	..
6,000	160	,, ,, ,, ,, ...	1·50	·09

SATURATED STEAM CONSUMPTION.

In order to give a good idea as to the steam and coal consumption of various kinds of engines working under different steam pressures, vacua, etc., the table (XXXVI.) has been compiled. It will be seen that all kinds of valve gear are included, as are also engines working with saturated and superheated steam, condensing and non-condensing. To make the table of greater value, the mean effective pressures have in many cases been filled in, while the remarks in the last column will explain this type of engine. It may be taken that the results given in most cases represent about the best that can be obtained on modern engines working under average conditions.

TABLE XXXVI.—STEAM ENGINE CONSUMPTIONS.

Indicated horse power	Cylinder diameter, inches.	Stroke, inches.	Revs. per min.	Steam pres. lbs.	Vacuum. ins.	Mean effective pressure.				Consumption in lbs. per I.H.P. per hour		Remarks.
						H.P.	I.P.	1st L.P.	2nd L.P	Coal.	Steam.	
11,800	43½ + 69 + two 77	42	137	193	27	72	32	18½	19	2·33	19·1	Battleship fitted with four-cylinder triple-expansion engines.
1,100	23 + 36 + 59	42	73	197	26¾	61	25	8	..	1·13	..	Mercantile steamer fitted with triple-expansion engines.
6,400	28 + 45 + two 52	32	177	242	..	..	..	..	..	1·78	17·5	Cruiser fitted with four-cylinder triple-expansion engines.
11,400	37 + 60 + two (69)	42	145	250	26½	105	41	19	19	2	15·5	Cruiser fitted with four-cylinder triple-expansion engines.
3,100	26 + 40 + two 45	30	177	177	27	57·5	30·3	15·4	15·3	..	..	Mercantile steamer fitted with four-cylinder triple-expansion engines.
800	34 + 58	36	62	125	26¼	41	..	..	12¾	..	13	Compound mill engine, piston and slide valves: cylinders jacketed.
380	21 + 34 + 52	48	26	160	28½	..	..	..	..	..	11·9	Triple-expansion pumping engine with Corliss valves and jacketed cylinders.
500	12 + 20 + 31	30	120	160	19½	65	24	..	11½	..	13·1	Triple-expansion dynamo engine, with Corliss valves and jacketed cylinders.
8,000	31 + 48 + two 71	44	100	165	26	..	..	..	..	..	11 75	Triple-expansion four-cylinder engine, as fig. 162 E. All cylinders jacketed, drop valves on high-pressure and indicated pressure, Corliss valves on low-pressure cylinders. Self-contained, with own air pump and jet condenser (as fig. 130).
360	14 + 21½	27½	..	170	26	..	..	..	..	..	12·3	Tandem compound engine, with saturated steam. Fitted with air pump and condenser, as fig. 133 Drop-valve engine, with jackets.
360	14 + 24½	27½	..	170	26	..	..	..	..	..	10·5	Tandem compound engine, with superheated steam to 150 deg. Fah. Fitted with air pump and condenser, as fig. 133. Drop-valve engine, with jackets.
1,600	25 + 40½ + 65	51	70	178	26	..	..	..	..	..	9·4	Triple expansion engine, with drop-valves and jacketed cylinders. Steam superheated to 200 deg. Fah.
124	....	..	114	140	27½	..	..	..	..	2·1	17·2	Saturated steam. Compound tandem, drop-valve, jacketed engine.
184	....	..	124	140	27	..	..	..	..	1·3	10·4	Superheated steam to 230 deg. Fah. Compound tandem, drop-valve, jacketed engine.
600	21 + 35	40	110	150	..	..	..	..	..	..	10	Compound tandem, drop-valve engine. Steam at 800 deg. Fah. reheats low-pressure receiver and enters high-pressure cylinder at 600 deg. Fah. No jackets fitted.
3,800	34½ + 60	60	84	137	27	..	..	..	..	..	9·62	Compound four-cylinder double tandem engine, with special drop valves. Cut-off in high-pressure cylinder 32 per cent. Steam superheated to 500 deg. Fah.
1,000	18 + 26 + 40	17	230	180	26	..	..	..	..	..	9·5	Triple-expansion, three-cylinder piston valve, high-speed engine. Steam superheated to 230 deg. Fah.
140	12 + 20	30	100	130	24	50	..	..	10	..	17·5	Compound horizontal drop-valve engine, with saturated steam.

The curves in fig. 174 give the consumptions of saturated steam for condensing and non-condensing triple-expansion engines for powers up to 2,000 H.P.; high-class compound engines would be a little greater. Steam is taken at 150 lbs. to 170 lbs. pressure, and for condensing engines the vacuum is assumed to be 26 in. Above 2,000 H.P. the saving in steam is comparatively small; it can be seen how flat the curves are getting for the higher powers.

WILLANS' LAW.

In the testing of engines, one of the greatest helps are the principles laid down in Willans' law; it is that the total fuel consumption, when plotted against power, can be expressed by a straight line law:—

$$F = Ax + y$$

where F = total fuel,
A = power,
x and y are constants depending on the engine.

The law is expressed graphically for a 800-H.P. engine in fig. 175, in which the line A is Willans' line connecting total steam and power. Referring to the above formula, if $A = o$, then $F = y$, therefore $y =$ steam used at no load, and is that required to overcome frictional and similar losses—it will be constant for any load on the engine.

Having from actual experiment determined the curve A, the steam consumption per horse power hour at different loads can be obtained, and is plotted at B; it is assumed that "total steam" is that used per hour. At 600 H.P. or three-quarter load, steam used per hour is 10,000 lbs., and the steam per horse power hour is

$$\frac{10{,}000}{600} = 16{\cdot}67 \text{ lbs.}$$

Other values can be similarly obtained and the curve B drawn in.

Steam Consumption at Variable Loads.

From the above remarks in connection with fig. 175, it will be seen that the no-load steam (the quantity y) decides the economy of the engine at low loads. This steam decreases in proportion as the engine power increases, the curve in fig. 176 showing the relative no-load quantities of saturated steam required for engines up to 2,000 H.P., and it will be seen that at 500 H.P. the relative quantity is 2, but at 1,000 horse power (double the other power) the value is only 3·3, or 1·65 times that at 500 H.P.

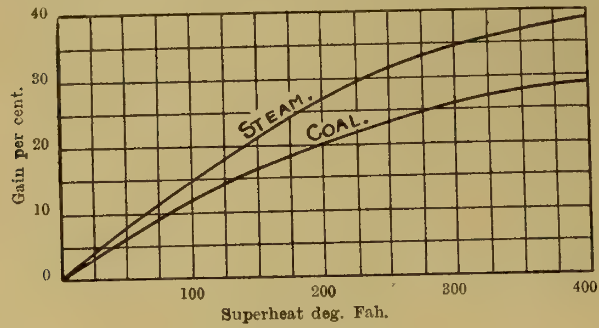


Fig. 178.

For high-class engines, the no-load steam at 1,000 H.P. would be approximately:—

Condensing, 1,200 lbs. to 1,300 lbs. per hour.
Condensing and superheat of 100 deg. Fah., 800 lbs. to 950 lbs. per hour.
Non-condensing, 3,000 lbs. to 4,000 lbs. per hour.
Non-condensing and superheat of 100 deg. Fah., 2,000 lbs. to 3,000 lbs. per hour.

The second curve in fig. 176 gives the relative steam used per horse power hour at various loads for condensing and non-condensing. Their ratios would not vary much for saturated steam in superheat engines, although, of course, the actual quantity of steam used would be as shown for full load in figs. 174, 177, and 178. Thus for a 1,000-H.P. engine, non-condensing at full load, saturated steam per horse power is $14\frac{3}{4}$ lbs. (fig. 174); at half load is 1·25 × 14·75 (fig. 176).

Superheated Steam.

In its competition with the turbine it may be said that superheated steam has been the salvation of the reciprocating engine. The gain obtained by even a small superheat, such that *dry* steam is delivered to the engine, is very considerable, amounting to as much as 5 per cent; and it has been found that for every 10 deg. Fah. the steam superheated above that just required to dry it gives an additional economy of 1 per cent to $1\frac{1}{2}$ per cent. The highest superheat which can be economically used on an engine is about 500 deg. Fah.; higher temperatures than this are often obtained, but in these cases it is usual to absorb the additional heat out of the steam by reheating the H.P. exhaust (in an expansive engine). It should, however, be borne in mind that as the temperature is increased, so the loss of heat in the pipe line, due to inefficient lagging, also increases.

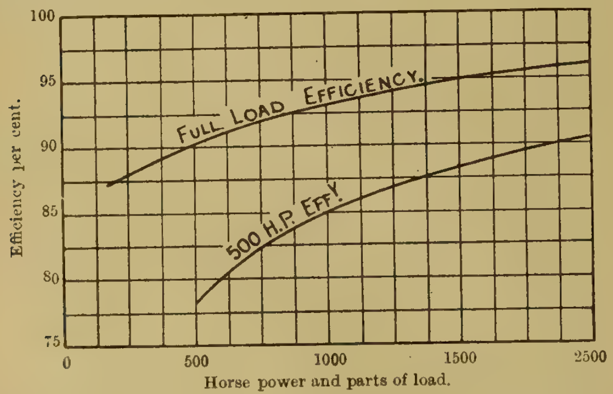


Fig. 179.

In fig. 177 are drawn curves for steam consumption for engines up to 2,500 H.P., working at about 180 lbs. pressure and a vacuum of 26 in., with superheats of 50 deg. Fah., 100 deg. Fah., and 200 deg. Fah. respectively. That there is great economy in raising the superheat is evident from these curves, and this is shown in fig. 178, which also shows the gain obtained in coal consumption.

Efficiency.

The efficiency of an engine is chiefly dependent on the care used in its correct design and construction. Between high and low-speed engines there is little difference the superior lubrication in the former being a great feature. Curves of efficiency are plotted in fig. 179, one set for engines up to 2,000 H.P. at full load, and a representative variable load curve for a 500-H.P. engine.

By efficiency is of course meant the ratio:

$$\text{Mechanical efficiency} = \frac{\text{brake horse power}}{\text{indicated horse power}}.$$

(*To be continued.*)

ELECTRICITY APPLIED TO MINING.

An address upon "Electricity Applied to Mining" was read before the Coventry Engineering Society by Mr. C. F. Jackson. During the past 25 years, he said, the use of electricity in mining had developed considerably, so that there were collieries now entirely dependent upon it for motive power. Many mining engineers preferred the D.C. system, of from 500 to 600 volts. In its application to lighting there was nothing different except the electric safety lamp. Telephone communication was provided, and arrangements for signalling. As to the installation generally, the cables were taken from the power station on the surface, down the sides of the pit shafts, ending at the bottom in a main transmission board, from which it was distributed to the different districts in the mine. He had a decided preference for vulcanised bitumen, double-wire armoured. The cables were better cased in iron pipes or in wooden troughs, well tarred. At Eshall Colliery they used two cables, so that if anything went wrong with one they could cross over to the other, and so keep the pit going. Cables were generally fixed very loosely in the mine workings, so that any stuff falling upon them would not cause damage. The method of suspension generally adopted was by hide suspenders. The jointing of a cable required to be very carefully done, or it would lead to loss of life; he recommended the star joint, wrapped with tape and run in with bitumen. He preferred double-armoured cable, properly earthed, because the moment the armour and the copper came together there was such a rush of current through that the contact breakers broke the current immediately, and would not set again until the leak was stopped. In gaseous mines it was important to have the electrical machinery fully enclosed and flame proof. In the use of electricity for shot firing he favoured low-tension fuses. For holing out the end of a seam, electrically-driven cutters had reduced the percentage of slack by 20 per cent, and there was also a tremendous amount of labour saved by a system of electrically-driven chain of conveyors for bringing the coal from the coal face to the main road.

The Tyne Brass and Copper Tube Manufacturing Co., Jarrow, are reported to have received a contract from the India Office for 7,000 brass boiler tubes, weighing approximately a little over 80 tons.

INTERNAL COOLING FOR INTERNAL-COMBUSTION ENGINES.

The arrangement of an internally-cooled engine is shown diagrammatically in figs. 1 and 2. In fig. 1 the main piston on its expansion stroke is on the point of uncovering an exhaust port located at *b*. As soon as this exhaust port is uncovered, the combustion products escape through it, and at the same moment the small auxiliary piston is driven into the cylinder up to about the position shown by fig. 2. Meanwhile the main piston completes its expansion stroke. The auxiliary piston helps to exhaust the combustion products and draws behind it a cooling fluid, air, or water, in fine sprays. Assuming the engine works on the four-stroke cycle, the main piston will next make its exhaust stroke, whilst at the same time the auxiliary piston makes its exhaust stroke and remains stationary until after the next combustion. The driving mechanism for the auxiliary piston shown by figs. 1 and 2 is, of course, only suitable for a four-stroke cycle engine if actuated from a half-speed shaft.

Owing to the excessively high temperatures produced in gas engines, piston and engine cylinder must be cooled artificially in order to ensure good working. Cooling of these parts is actually only required at the surfaces which come continually in rubbing contact. The temperature in any other place is practically of no consequence, providing the surfaces mentioned are comparatively cool. The interior area of the cylinder walls, which is exposed to the direct action of the burning gases and attains a high temperature, requires most cooling. The main object of a cooling system must therefore be to cool the interior surface of the cylinder walls where they come in rubbing contact with the moving piston.

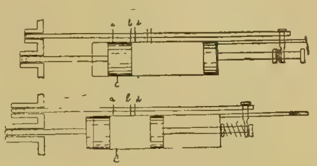
Let us see how this object can be attained by either of the two cooling systems, viz., external cooling and internal cooling.

The action of water circulating round the cylinder is retarded by the intervening strata of the walls, which increase in thickness with the heat developed by the engine. The efficiency of this system, therefore, decreases with the increased size of the engine. Owing to the retarded action of the water, the maximal heat imparted to the cylinder walls during combustion is only gradually reduced. On the exhaust stroke the piston comes therefore in contact with cylinder areas which have lost little of their heat, and it is probable that the thin film of lubricant deposited by the piston is evaporated, at least in the areas adjacent to the combustion chamber. Adequate cooling seems only to take place when the fresh charge drawn in during the suction stroke comes in contact with the heated cylinder area. At this moment no further cooling of the rubbing surfaces is required. But the water goes on cooling during the suction and compression strokes, the exterior and central strata of metal are thoroughly cooled, and when the next combustion takes place they are fit to take up about 30 per cent of the heat of combustion.

In an internal-cooling system the drawbacks adhering to external cooling are present to a small extent only, because internal cooling is at the same time efficient, rapid, and intermittent. The cooling stroke of the auxiliary piston takes place immediately after combustion, and the lower surface temperature of the cylinder walls is at once established, with the result that the main piston makes the following in-stroke into a cylinder whose surfaces are at the desired low temperature.

Unless preventive measures are used, an internally-cooled engine is, of course, also subjected to considerable external air cooling, and internal cooling would therefore only have to make up for the efficiency difference between external water and external air cooling. However, external cooling serves no useful purpose; on the contrary, it is a considerable waste of energy. It is therefore advisable to cover the cylinder with non-conducting materials, so as to reduce loss by radiation to a minimum. During operation the walls thus protected will become thoroughly warm, and it is evident that an internally applied cooling fluid would hardly fulfil its purpose satisfactorily if it only abstracted a small quantity of surface heat. Its action must now penetrate sufficiently deep, so that the effect will last sufficiently long. As soon as the cooling fluid is removed, a return flow of heat from the central layers of metal will immediately set in. This return flow of heat must not be so active that the interior surface of the cylinder walls are again overheated when the main piston makes its exhaust stroke. It will be noticed that the main piston follows closely the cooling piston, so that the cooling effect need not penetrate very deep. During the suction stroke any excess heat reappearing on the surface of the walls is readily taken up by the cool charge. This heat, of course, appears as energy at the next combustion.

It will now be seen that internal cooling abstracts a very small quantity of heat, and at the same time maintains the best working temperature of the cylinder walls. The main piston makes all its stroke into a cylinder the surfaces of which never exceed a sound working temperature. These conditions are present in all engines except those working on the Diesel system, where an intense heat is already produced during the compression stroke. This heat, however, is only excessive at the areas adjacent to the combustion chamber.



Figs. 1 and 2.—Diagrams showing Arrangement of Internally-cooled Engine.

After having thus shown that by means of internal cooling the desired effect is obtained by the abstraction of only a small quantity of heat, it need not be explained that the balance of heat from the quantity of heat absorbed by external cooling and the quantity absorbed by internal cooling represents the gain of thermal efficiency to the credit of internal cooling.

Therefore an internally-cooled engine, in order to yield the same power as an externally-cooled engine, requires a smaller volume of gas or combustible mixture. The necessary cylinder clearance thereby can also be made smaller, and this again increases the efficiency.

Except in small engines, the efficiency of the external-cooling system is taxed to the highest practical limit, and any further improvement in the cooling efficiency would require unproportionately large accessories for cooling and circulating the water. It is therefore found more convenient in practice to reduce the frequency of the cycle, and, as a last resource, to work with lower combustion temperatures by using a large excess of inert gases. As the quantity of heat imparted to the working parts is thereby reduced, the need for cooling decreases accordingly. It is well known that any reduction of the combustion temperature means a corresponding loss of thermal efficiency. It is needless to say that with an internal-cooling system it is not necessary to incur this loss, which cannot be avoided in large externally-cooled gas engines. Internal cooling, on the contrary, permits the use of higher temperatures generally, and it thereby affords a means for further increasing the thermal efficiency from this source. Internal cooling also removes the main obstacle which hitherto prevented the construction of gas engines equal in power to the largest steam engines.

The heat abstracted internally is contained in a gaseous body, air or steam, and as such its energy can easily be utilised, whilst the heat contained in water is of no practical value.

An internal-cooling system means a great reduction in the weight of an engine. This can readily be estimated if it is considered that in a petrol motor built for motor cars with a special view for lightness, the total weight of the cooling accessories including the water is from six to ten times the weight of the actual engine.

The means for actuating the auxiliary piston are so numerous that a description can be dispensed with, and it is only desired to show that the auxiliary piston does not introduce any noise, shock, or vibration.

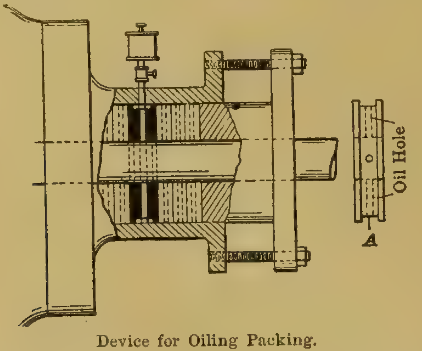
Except for the smallest sizes of engines, a solid seating is recommended on which the auxiliary piston rests, and with which it forms an explosion tight joint during compression and expansion. Several advantages are thereby secured, namely, the driving mechanism can be built light, as it has not to bear any pressure, and the piston can be made short and light, as its packing rings are not mainly depended on for an explosion tight joint.

In a recess of the above-mentioned solid annular seating a ring is fitted supported by springs and projecting into the cylinder. On its out-stroke the auxiliary piston falls first on this elastic ring and drawn close to the solid seat? ing. It retains this position until the gradually rising compression pressure overcomes the resistance of the springs supporting the ring. At the end of the compression stroke the piston is thus already pressed against the solid seating. The ring may be lined with indiarubber, or a heat-restricting composition of indiarubber.

The piston rod is, of course, not rigidly connected with the piston. A slide must be provided which allows the rod to extend about ½ in. or 1 in. against the tension of a spring. This slide can be dispensed with if a similar arrangement is already provided by the driving mechanism.

THE LUBRICATION OF PISTON PACKING.

THE device shown in our illustration for the lubrication of piston packing and the following description of same is given in our American contemporary, *Power and the Engineer*, New York. As will be seen from the illustration, a metal ring is made with a ¼-in. channel formed on the outside edge, as shown at A. Oil holes are drilled radially through the channel, so that oil and graphite may find their way from the oil cup to the piston rod.



Device for Oiling Packing.

The method of applying the ring is as follows: First, two rings of regular packing are inserted in the stuffing box. Then the brass ring, which is made in two sections, is put in place, followed by as much more ring packing as is necessary to fill the stuffing box.

The hole for the oil-cup connection must be drilled so as to come close to the inner edge of the groove in the metal ring when the packing is new. This will allow considerable compression of the packing rings before the groove of the ring has been forced past the oil-inlet hole in the stuffing box. The valve placed before the oil cup makes it possible to feed the oil and graphite at will.

PACKING FOR HYDRAULIC PRESSES.

(Concluded from page 676.)

Hat Packings.—Hat, or flange, packings are frequently used on swivels, operating valves, and rods not exceeding 3 in. diameter. They are also made in larger diameters for hydraulic elevator plungers. Fig. 18 shows a hat and cup packing used in the "draw-back" cylinder of an inverted press, the top of the cylinder being open, the liquid enters the cylinder and lifts the piston, which is connected to the platen of the press.

Spiral Packing.—Another form of self-acting packing is shown in fig. 19. It consists of a single strip of leather $^3/_{16}$in. to ¼ in. wide, and of sufficient length to wrap around the ram five or six times. This is a very satisfactory packing for small pump plungers and rams not exceeding 1 in. to 1½ in. diameter.

Hemp or Fibrous Packing.—The first fibrous packings were made from loosely-twisted strands of flax, saturated with hot tallow and wound around the ram until the stuffing box was full. This answered the purpose very well for low pressures, but soon became hard. The next step was to use braided flax, or hemp, with a rubber core to give resilience. The great demand for steam, water, and ammonia packings caused strong competition and the introduction of machines and processes for combining hemp, flax, cotton, rubber, graphite, and oils, which led to a great many varieties, and the development of packings suitable for very high pressures.

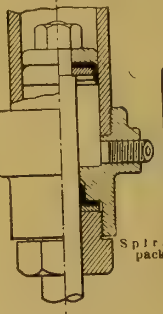


FIG. 18

Details of drawing cylinder.

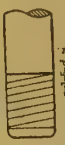


FIG. 19

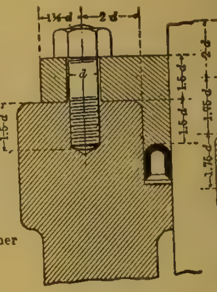


FIG. 20

Proportions of gland for U-packing.

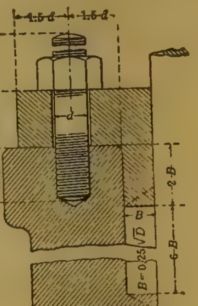


FIG. 21

Proportions of gland and stuffing box for fibrous packing.

A good packing must be pliable enough to readily adjust itself to the shape of the stuffing box, and firm enough to resist friction of the ram and pressures of the gland and liquid. In order to insure pliability, the packing must not dry out or harden, and this dictates the use of such materials as graphite, rubber and tallow; and to secure the necessary firmness and strength, flax, cotton, and sometimes copper wire are introduced.

Contrary to the general supposition, fibrous packings are satisfactory for pressures up to 2,500 lbs., and in some cases as high as 6,000 lbs. per square inch. They are less expensive, more accessible, and wear longer than leather packing, but produce greater friction and wear on the ram. They are much better than leather packings, if the working liquid contains any gritty matter.

Proportions for Leather Packings.—The proportions for leather packings are far from being standard. One of the leading manufacturers states that "nearly every customer on our books, when ordering, will specify packings which vary somewhat from any other customer."

The required thickness of leather depends upon the pressure, depth of cup, and somewhat on the diameter of the ram. There is but little need of making it greater than $^3/_{16}$in., although in practice it varies from ¼ in. to ¼ in. Mr. Welch (Proc. Inst. Mech. Eng., 1876) proposed the formula

$$T = 0{\cdot}156\ D^{0{\cdot}28}$$

which gives a greater value for the larger sizes than practice recommends.

The depth H in figs. 1, 2, and 3, depends upon the softness and thickness of the leather, and varies from ⅝ in. to 2 in. Welch suggested making the depth equal to 2·5 T, but this differs considerably from the valves used in practice. About 1 in. is sufficient to make a tight joint, and it is prejudicial to make the cup unduly deep, as the stress in the leather during manufacture is greatly increased by increasing the depth. This stress is also greatest on the portion subjected to greatest wear, and unless considerable care is exercised in the manufacture, the leather is liable to tear or suffer deterioration, which will afterward be revealed in the short life of the packing. The adjustable packings shown in figs. 9 and 10 must accommodate the expanding rings, and require a deeper cup than would otherwise be necessary.

The breadth B (fig. 2) of U-packings depends upon the thickness, and should be made as small as possible without injuring the leather. Any increase in breadth requires a stronger gland and more studs to hold it in place. The breadth of soft leather may be about $^5/_6$in., and for oak-tanned, hard-finished leather, ¾ in. is satisfactory.

The sum of the areas at the root of the thread of all the studs is

$$A = \frac{P \pi B (B + D)}{S},$$

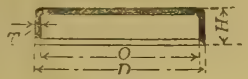
where S is the unit stress in the stud, and may be taken as 10,000 lbs. to 15,000 lbs. per square inch.

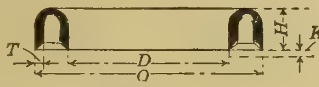
The next step is to determine the number of studs, by assuming a diameter and solving for N in the formula

$$N = \frac{A}{a},$$

when A is the area of the stud at the root of the thread; if the stud assumed be too small, a large stud circle will result, and it will be necessary to use a larger size.

The space between the studs should be sufficient to permit the use of a standard wrench, which requires the spacing to be about 3·25 *d*, but for high pressures it is frequently necessary to reduce the spacing to about 2 *d*, which will allow about ¼ in. clearance between the nuts. If the stud circle is too small, the liquid is liable to ooze through the material and leak around the studs, and if too large it will be necessary to flange the cylinders. In this connection the platen boss may become a consideration, as it is liable to strike the nuts or studs, and not go entirely down. The proportions for glands shown in fig. 20 have proved satisfactory.





PROPORTIONS FOR OAK-TANNED LEATHER HYDRAULIC PACKINGS.

	End U packing.				U-wall, or neck packing.				Cup packing.		Stock.	
Diameter of ram.	D	O	H	T	D	O	H	K	D	H	Diameter.	Thick.
In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
4	2½	4	¾	$\frac{3}{16}$	4	5½	1	$\frac{1}{16}$	4	1	6	$\frac{3}{16}$
6	4½	6	1	$\frac{3}{16}$	6	7½	$1\frac{1}{16}$	$\frac{1}{16}$	6	1¼	8½	$\frac{3}{16}$
[illegible]	6½	8	1¼	$\frac{3}{16}$	8	9½	1¼	$\frac{1}{16}$	8	1½	11	$\frac{3}{16}$
10	8½	10	1¼	¼	10	11½	1⅜	⅛	10	1½	13	¼
12	10½	12	1½	¼	12	13½	1½	⅛	12	1½	15	¼
13	11½	13	1½	¼	13	14½	1½	⅛	13	1¾	16½	¼
14	12½	14	1½	¼	14	15½	1¾	⅛	14	1¾	17½	¼
18	16½	18	1⅞	¼	18	19½	1⅞	$\frac{3}{16}$	18	2	22	¼
21	19½	21	1⅞	¼	21	22½	1⅞	$\frac{3}{16}$	21	2	25	¼
23	21½	23	1⅞	¼	23	24½	1⅞	$\frac{3}{16}$	23	2	27	¼
24	22½	24	1⅞	¼	24	25½	1⅞	$\frac{3}{16}$	24	2	28	¼

In the accompanying table proportions are given that have been extensively used, and are recommended for U and cup leather packings made of oak-tanned leather. If Vim leather is used, the thickness should be reduced to $^3/_{16}$in., and all hat, cup, and U packings not requiring an expanding ring should have the depths:—

Diameter of cylinder … 4, 6, 8, 10 inches and over.
Depth, H …………… ¾, 1, 1¼, 1¾ ,, ,,

The breadth of a cavity for a U-packing should be about $^1/_{32}$in. to $^1/_{16}$in. less than the packing to insure close fitting, and the height $^1/_{16}$in. to $^3/_{16}$in. greater, to allow liquid free access to the interior. The top of the cavity should be finished to fit the curvature of the packing, or filled with hemp. When a gland is used, as shown in fig. 15, the sharp edges on the end of the barrel should be slightly rounded to prevent cutting the packing.

Glands for U-Packings.—There is no initial tension necessary in the gland studs, and they only cary the load due to the pressure of the liquid in the cavity, which is equal to

$$P \pi B (B + D),$$

where P is the pressure of the liquid, D the diameter of the ram, and B the breadth of cavity.

Proportions for Stuffing Boxes.—The proportions for stuffing boxes in fig. 21 have proved satisfactory, where a good quality of packing is used. There exists a difference of opinion regarding the shape of the bottom of a stuffing box, some designers claiming that a taper as shown by the dotted lines in fig. 21 forces the packing against the ram sufficiently to make a tight joint without compressing it sufficiently to cause it to harden and score the ram; whereas others insist on the design as shown, claiming that taper increases friction, and is liable to permit leakage around the outside of the packing and under the gland. The breadth B in fig. 20 is made equal to the breadth of the packing, which varies from ¼ in. to 1¼ in., advancing by eighths, and may be determined by the formula

$$B = 0{\cdot}25 \sqrt{D}.$$

where D is the diameter of the ram.

The depth of the stuffing box may vary from 6 B to 8 B, depending upon the pressure and frequency of operation of the machine. Increasing the depth increases the amount of packing it will hold, decreases the necessary tension in the gland studs, and requires less attention.

The size and number of studs may be determined for leather packings by increasing the total bolt area about 12 per cent.

Efficiency of Packing.—By efficiency of packing is meant the ratio:—

$$\frac{\text{Total pressure on bottom of ram} - \text{friction of packing}}{\text{total pressure on bottom of ram}},$$

and may be expressed by the formula—

$$E = \left(1 - \frac{4\,F}{\pi\,D^2 = p}\right) 100 \text{ per cent},$$

where F is the frictional resistance offered by the packing.

From the experience of John Hick, the frictional resistance for leather packing is $F = C\,p\,D$, where C is a constant and equal to 0·0314 for leathers in good condition and 0·047 if new or badly lubricated. By substituting the value of F, the efficiency of leather packing in good condition is

$$E = \left(1 - \frac{0{\cdot}04}{D}\right) 100 \text{ per cent},$$

The resistance of fibrous packing varies with the depth of stuffing box and the degree of compression applied by the gland. Under the same degree of compression a long stuffing box would offer more frictional resistance than a short one, but a deep stuffing box will not require so much pressure to effect water tightness, hence the friction of a short stuffing box may be greater than a long one.

If the stuffing box is of the proportions given in fig. 21, and the studs not unduly tight, the frictional resistance may be expressed by the simple formula

$$F = 0{\cdot}2\,p\,D.$$

This value substituted in the formula for efficiency gives

$$E = \left(1 - \frac{0{\cdot}254}{D}\right) 100 \text{ per cent}.$$

To show the application of the above formula, suppose it is desired to determine the effective pressure of the platen against the material in a press having a 10 in. cylinder, packed with fibrous packing, working pressure of the liquid 2,000 lbs. per square inch, and weight of ram and platen 1,200 lbs.

The total pressure exerted on the bottom of the ram is 78·54 tons; the force required to overcome friction of the packing is $F = 0{\cdot}2 \times 2{,}000 \times 10 = 4{,}000$ lbs.

The net pressure on the platen then is

$$78{\cdot}58 - \frac{4000 + 1200}{2000} = 75{\cdot}94 \text{ tons}.$$

The efficiency of the machine is

$$(75{\cdot}94 \div 78{\cdot}54)\ 100 = 96{\cdot}7 \text{ per cent}.$$

TRADE CATALOGUES.

We have received from **Messrs. Smart and Brown,** Erith, Kent, a leaflet describing and illustrating a motor winch which they have recently brought out and which they claim to be eminently suitable for working spoon dredgers, and also for hauling trucks in chalk, sand, or gravel pits, etc. The winch, which is fully controlled by one lever, is entirely self-contained, and occupies very small space. It is made or the portable, semi-portable, or fixed type.

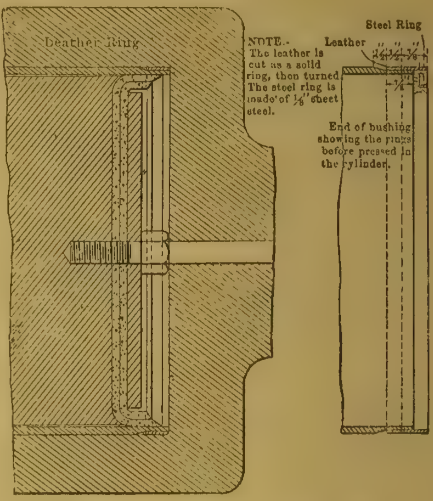
We have received from **Messrs. Merryweather and Sons Ltd.,** Greenwich Road, London, S.E., a leaflet illustrating and describing their improved electric motor fire engine, which the firm claim to be the first all-British machine of its kind.

MAKING A HYDRAULIC BUSHING TIGHT.

The following description and accompanying sketch of a method employed to make a brass bushing tight in the bottom end of cylinder of a hydraulic crank-pin press is given in our contemporary, the *American Machinist.*

The original construction of this cylinder was cast steel, and it was to be used by simply boring out to size, but when it was tried it leaked badly through blow holes in casting. To save the cylinder a brass bushing was cast and pressed into the cylinder with good, faced joint at bottom, but when pressure was applied it leaked between the end of bushing and cylinder, causing the bushing to be forced out.

Another brass bushing with bottom in it was then cast and pressed into the cylinder, but when pressure was applied, the oil worked through the bushing and leaked out between the bushing and cylinder. It was then suggested that the arrangement shown in the sketch should be used, which proved successful, and after two years' service it is absolutely tight at 200 tons pressure.


Leather Ring
NOTE.-
The leather is cut as a solid ring, then turned.
The steel ring is made of 1/8" sheet steel.
Steel Ring
Leather
1/2
1/2
7/8
1/8
End of bushing showing the rings before pressed in the cylinder.

Method of Bushing Crank-pin Press.

The method employed was as follows: Bushing was turned down at back end, $\frac{7}{8}$ in. long and then bevelled $\frac{1}{2}$ in. A ring of harness leather was then cut $\frac{1}{2}$ in. wide by $\frac{1}{8}$ in. thick. A $\frac{7}{8}$ in. by $\frac{1}{8}$ in. hoop-iron band was then made and the ring of leather was placed over turned down end of bushing, and next to it the iron band.

When the bushing was pressed into cylinder, it first bottomed against the iron band, which in turn forced the leather ring against the bevel in bushing. This forced the leather solid against the wall of cylinder and bushing, making a joint that will hold 200 tons hydraulic pressure.

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 15th December, 1910.

Dublin.—*Second Class:* A. S. Davies, W. H. Reay.

Dundee.—*Second Class:* W. P. Cook, R. H. Fairfoul, J. Fettes.

Glasgow.—*First Class:* R. C. Barr, A. McK. Macdonald, J. J. McKenzie, P. Morrison, T. H. Thomson. *Second Class:* C. D. Guild, H. N. Scott.

Greenock.—*First Class:* J. Fyfe. *Second Class:* G. A. Fitzpatrick, F. F. Key, R. R. McInnes.

Hull.—*Second Class:* P. Burnitt, T. N. Littlewood, A. H. Stanforth.

Liverpool.—*First Class:* J. Mathias, E. Williams, W. S. Ball, G. Webster. H. W. Hill. *Second Class:* G. B. Crossley, W. Duff, F. W. Marsden, J. A. Parry, A. H. Roberts, C. G. Williams, C. T. Wyatt.

London.—*First Class:* J. P. Avenell, T. C. Evans, H. J. Hollingum. *Second Class:* A. H. Cruickshank, J. Mather.

North Shields.—*First class:* G. McHugh, W. Hinchcliffe.

DEVICE FOR CONTROLLING THE CAPACITY OF COMPRESSED AIR SYSTEMS.

Our illustration shows an improved control device or regulator for compressed air systems or air compressing apparatus, and particularly for compressed air supply systems for power purposes, where the demand is liable to vary and where consequently the pressure within the system is liable at times to become excessive owing to the number of machines which are at the time being fed therefrom being less than the number provided for at the compressing station.

The improvement is designed to regulate the capacity of the air compressor without varying its speed, namely, by means of a capacity reducing or relief valve or other convenient part connected with the air compressor by a coupling or motion transmission device which would be under the control of, or responsive to, the air pressure in the pipe or system in such manner that normally the coupling or connection would be idle, but would, when the demand fell or the air pressure became excessive, become operative so as to transmit motion from the air compressor to the valve or other part, and thereby so operate the valve as to reduce the capacity or the pressure to the required amount. The improvement is the invention of Messrs. Fraser and Chalmers Ltd., of 3, London Wall Buildings, London, E.C., in conjunction with Messrs. F. L. Whitmore, J. Chapman, and G. Kübler.

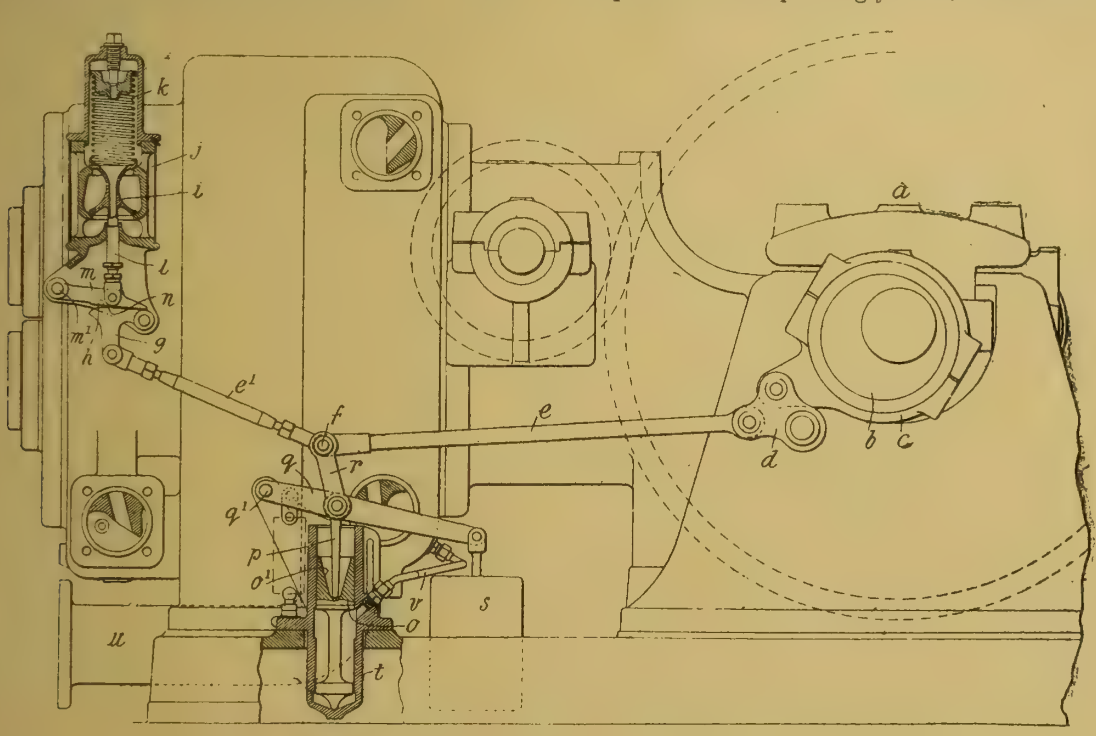
Referring to the illustration, *a* represents generally the air compressor, in this case a two-stage compressor with a differential piston; *e* e^1 are links forming the coupling or motion transmitting connection; *i* is the capacity controlling valve, and *o* the device for controlling the above coupling or connections, and *u* represents generally the system of supply pipes.

The shaft of the compressor *a* carries an eccentric *b* having a strap *c*, to which is secured the wrist plate *d* of the member *e* of the coupling. The other member e^1 of said coupling is jointed at *f* to the member *e*, and carries at its far end a wrist plate *g* having a wiper cam surface *h* for operating the valve *i*. This valve is mounted in a housing or case *j*, and is closed normally by a spring *k* of ascertained strength. The stem *l* of the valve is jointed to a lever *m*, which has one of its ends pivoted, as at m^1, to a fixed point, and its other end resting freely, under the weight of the valve, on the cam or wiper surface *h*, the under side of said lever being provided at this part with a co-acting or wiped surface *n*.

The device *o* comprises a piston cupped on its upper side, as shown at o^1, on which is loosely mounted an upright rod or stem *p* carrying a rocking beam or lever *q*. The lever *q* is pivoted at one end to a fixed bracket, as shown at q^1 and is jointed, preferably at a prolongation of the middle line of the rod or stem *p*, to a link *r*, which connects the beam or lever *q* with the joint *f* of the coupling *e* e^1. The free end of the beam or lever *q* is loaded by a weight *s*.

The housing or cylinder *t* of the piston is constantly in communication with the pipe system *u*, and the weight *s* is so adjusted as to be heavier than the air pressure that exists in the system *u* normally or when the full number of machines are being fed therefrom. At such times the jointed coupling *e* e^1 is in its bent position, but when the demand on a supply falls below a certain point and the air pressure correspondingly rises, or if from any other cause the air pressure becomes excessive, the piston *o* will be raised by the air pressure in opposition to the weight *s*, and will straighten and thereby lengthen the coupling *e* e^1. The thrust of the eccentric *c* will then be transmitted to the wrist plate *g*, and will cause the wrist plate to be turned about its pivot, thereby raising the cam surface *h* and actuating the lever *m* to open the valve *i*. The housing or cylinder *j* of this valve is in communication with the compressor cylinder, and therefore for a portion of the compression stroke of the latter air will be allowed to escape into the atmosphere. For the remaining portion of the stroke the valve *i* will be closed by the spring *k*.

It will thus be seen that the quantity thus allowed to escape through the valve *i* will depend upon the degree and duration of the straightening or lengthening of the coupling *e* e^1 or, in other words, of its condition for transmitting motion from the eccentric *c* to the valve mechanism; the reduction, therefore, of capacity will be proportional to or determined by the reduction in demand or by the degree and saturation of the excess of air pressure within the system.



DEVICE FOR CONTROLLING THE CAPACITY OF COMPRESSED AIR SYSTEMS.

In the case of large double-acting two-cylinder two-stage compressors, a valve similar to the one shown at *i* would be supplied for each end of the low-pressure cylinder and for each end of the high-pressure cylinder, making a total of four valves for the one compressor, as it is more efficient to maintain the receiver pressure approximately constant. In this latter case there would be provided two cylinders *t*, one of which would control the valves on the low-pressure cylinder and would be connected by means of a pipe to the intermediate receiver, while the other would be on the H.P. cylinder and connected by means of a pipe to the air delivery main,

In the compressor illustrated it will be seen that the cylinder *t* is supported on the bedplate, and is not directly inserted in the main or trunk *u*, the pipe connecting this cylinder *t* to the air delivery of the high-pressure cylinder being shown at *v*.

LITERATURE.

All books received or noticed in this column can be had through 'The Practical Engineer" Publishing Office, 55 and 56, Chancery Lane, London, W.C., at published price, postage extra.

"Mechanical Engineering for Beginners." By R. S. McLaren. Second Edition, revised. London: Charles Griffin and Co. Ltd. Price 5s. net.

The scope of this book will be remembered by many readers in the notice given of the first edition. It will be well, however, just to repeat the main features. The chapters include notes on the materials used in mechanical constructions, their strengths and physical properties, the purposes of various types of bolts and other fastenings, types and powers of boilers, piping, valves, and other accessories; also a comprehensive description of all the principal types of steam engines, their parts, and calculations of horse power, etc. Further chapters are devoted to condensing plants, the steam turbine, the different means adopted for the transmission of power, with a chapter on electrical matters which every engineer should understand, hydraulic machinery, gas and oil engines, and a closing one of general useful information.

Revisions have been made in articles on boilers and their accessories, which will be found useful to those engaged upon laying out plant. Further illustrations are given of water-tube boilers, condensers, pumps, heaters and softeners, with additional notes on the treatment of boiler waters.

The author has provided a text book of undoubted interest to engineers in whatever branch of engineering they may be engaged. He effectually treats of the whole subject without being too simple or too deep. The book is the best of its kind upon modern steam engineering.

Books Received.

"Who's Who, 1911." London: A. and C. Black. Price 10s. net.

"The Englishwoman's Year Book and Directory, 1911." Edited by G. E. Mitton. London: A. and C. Black. Price 2s. 6d. net.

"The Writers' and Artists' Year Book, 1911." London: A. and C. Black. Price 1s. net.

Messrs. C. A. Vandervell and Co., Warple Way, Acton Vale, London, W., inform us that they exhibited a full range of their manufactures at the International Transport Exhibition held during the past season at Buenos Ayres, and that they have just received an official intimation from the Argentine Government to the effect that their exhibit has been awarded the gold medal.

ALTERNATING STRESS TESTS AND MACHINES.

By C. A. M. Smith, M.Sc.

(Concluded from page 743.)

Professor Arnold's Tests.

As the time taken to perform a test in the methods of Wöhler is considerable, Prof. Arnold proposed to first stress the material just beyond its elastic limit, and in this way to reduce enormously the time taken to make a test.

The manner in which the stress varies in the "Wöhler" type of stress is shown in fig. 5, a diagram from one of Dr. Arnold's papers. It shows quite clearly how, during one revolution, the stress varies from a minimum (at Z^1) to maximum tension (MT^s) then falls to zero again at Z and becomes maximum compression at point marked.

Table of Results.

No. of bar.	Material.	Stress applied in tons per square inch.		Range of stress in tons per square inch.	No. of repetitions before fracture.
		Max.	Min.		
1	Iron for axles. Phœnix Co.	+ 15·3	– 15 3	30·6	56,430
2		14·3	14·3	28·6	99,000
3		13·4	13·4	26·8	183,145
4		12·4	12 4	24·8	479,490
5		11·5	11·5	23·0	909,840
6		10·5	10·5	21·0	3,632,588
7		9·6	9·6	19·2	4,917,992
8		8·6	8·6	17·2	19,186,791
9		7·6	7·6	15·2	132,250,000*
24	Homogeneous iron.	+ 23·9	– 23·9	47·8	2,375
25		22·9	22 9	45·8	4,986
26		21·9	21·9	43·8	11,636
27		18·2	18·2	36·4	31,586
28		16·3	16·3	32·6	94,311
29		14·3	14·3	28·6	161,262
30		13·4	13 4	26·8	464,786
31		12·4	12·4	24·8	636,500
32		11·5	11·5	23·0	3,930,150
33	Krupp's cast-steel axles.	+ 20·1	– 20·1	40·2	55,100
34		17·2	17·2	34·4	127,775
35		16·3	16·3	32·6	797,525
36		15·3	15·3	30·6	642,675
37		15·3	15·3	30·6	1,665,580
38		15·3	15·3	30·6	3,114,160
39		14 3	14·3	28 6	4,163,375
		14 3	14·3	28·6	45,050,640

* Not broken.

In fig. 6 the scheme of Arnold's tests is shown. The test-piece B, which is about 6 in. in length and $\frac{3}{8}$ in. diameter, is gripped in a die D. It is subjected to alternating bending by the movement of the slotted bar P P. The rate of alternation is about 650 per minute. In fig. 6 is shown the alternation of the stress-strain lines in this test.

Although theoretically the Arnold test is faulty when compared with Wöhler's, yet it gives results concerning the properties of materials which Wöhler's tests do not show.

Dr. Stanton's Alternating Stress Machine.

In this machine the specimen is subjected alternately to tension and compression. A rotating crank causes a heavy reciprocating mass to move with periodic motion. The crank gives motion to a crosshead, and the test bar forms the connection between this crosshead and another but heavier one sliding in the same guides.

On account of the obliquity of the connecting rod, the motion of the crossheads is not quite simple harmonic. The effect on the stresses, however, is so small that it can be neglected.

Let W be the reciprocating mass in pounds,
r the crank radius,
l the length of the connecting rod,
w the angular velocity of crank;

then the forces acting on the test bar are—

$$\text{Tension } \frac{W}{g} w^2 r \left(1 + \frac{r}{l}\right) \text{ pounds;}$$

$$\text{Compression } \frac{W}{g} w^2 r \left(1 - \frac{r}{l}\right) \text{ pounds.}$$

At the National Physical Laboratory, where there is a machine of this type, but with four cranks and four specimens, the ratio of crank radius to connecting rod length is as 1 is to 6.

With these proportions the maximum tension is 1·4 times the maximum thrust. In the preparation of specimens for tests under alternating stresses, great care must be taken to ensure a gradual change of section. The effect of a change of section on the resistance of a specimen is much more marked than in statical tests.

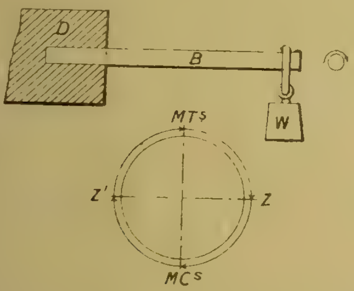


FIG. 5.—Diagram showing Alternation in Stress due to Rotating Specimen B. At points Z^1 Z there is no stress, at MT^s is point of maximum tension stress, and at MC^s is point of maximum compression test.

DR. J. H. SMITH'S ALTERNATING TENSION AND COMPRESSION STRESS MACHINE.

This machine, invented by Dr. J. H. Smith in 1904, is called by him a fatigue-testing machine. As in Stanton's machine, the load is produced by the centrifugal force of a rotating mass. Referring to fig. 7, which shows the principle of the machine, there are two arms pivoted at A and B, and each having a weight W attached to its outer end. The rod A B is rigidly connected to a vertical spindle C D, which passes through guides at C and D. Between the top of this spindle and the fixed mass E is the specimen F. At the bottom end of the spindle is a spring H, which tends to pull it in a downward direction.

Now, when the weights W are at the top of their path, they will pull the arm A B, and consequently the spindle C D, upwards with a force expressed by formula

$$\frac{2\,W\,V^2}{g\,r}.$$

If the spring H is tightened so as to exert force of S lbs. weight, then the load on the specimen F will vary between

$$\frac{2\,W\,V^2}{g\,r} - S \text{ and } \frac{2\,W\,V^2}{g\,r} + S.$$

By causing the tension S exerted by the spring to be greater than

$$\frac{2\,W\,V^2}{g\,r},$$

the load on the specimen can be made to be always tensile.

In fig. 8 the latest form of this apparatus is shown. Two specimens are used, and two other weights are employed for the purpose of balancing. The specimens used by Dr. Smith are comparatively small, being about ½ in. in length and ¼ in. in diameter. But by means of an attachment, specimens up to 4 in. in length can be tested. In the diagram shown, P is the pulley used for driving the machine, C is the revolution counter, and the position of the specimens will be seen by comparing the diagram with fig. 7.

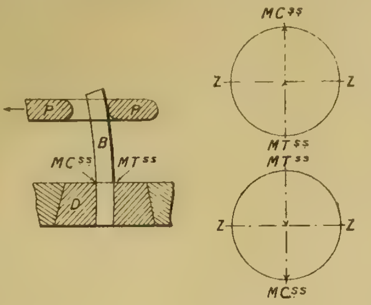


FIG. 6.—The Principle of Dr. Arnold's Alternating Stress Machine.

In practice, the whole machine runs in an oil bath. In fig. 9 is shown about one-half of the apparatus. It will be seen that at the point A no rigid connection is permissible, as, if there were, a part of the forces due to the revolving weights would be borne by the driving shaft.

The following are some results obtained by Dr. Smith on this type of alternating stress machine:—

OSCILLATORY WEIGHT, 12·42 LBS.; DIAMETER OF SPECIMEN, ·2469 IN.

Set A. Mild steel.	Revolutions per minute.	Maximum tensile strength per square inch.	Minimum compression stress per square inch.	Range of stress per square inch.	Number of reversals before rupture.
		Tons.	Tons.	Tons.	
Annealed	2 126	7·29	7·11	15·1	248,700
Unannealed	2,122	8·03	7·17	15·2	226,500

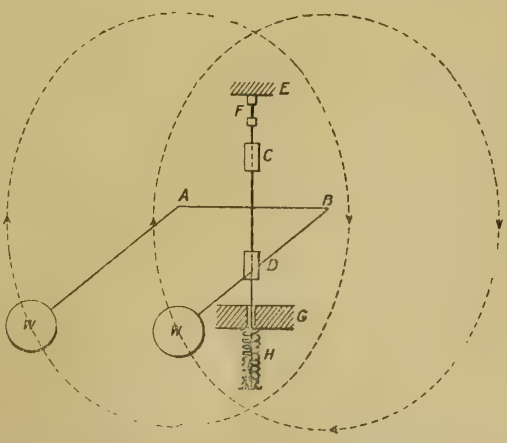


FIG. 7.—Dr. Smith's Machine for producing Alternating Tension and Compression depends upon the Centrifugal Force of the Weights W.

CAPTAIN SANKEY'S HAND BENDING MACHINE.

This apparatus is specially adapted for use in works for the comparatively rough testing of materials. In this testing machine the specimen is bent backwards and forwards until it is broken, the bending force being indicated by the deflection of a spring. There is an autographic attachment which records the bending effort for each bend, the number of times the test bar can be bent without rupture, and the total energy required to cause fracture. The quality of the material can be seen at once from this diagram. This machine shows in a remarkable way the power of the material to resist "fatigue." The machine is illustrated in fig. 10. It consists of a bedplate which can be bolted down to a bench. At one corner of the bedplate there is a grip A, in which one end of the flat steel spring B is secured. The other end of B is fitted in the special grip C, which also holds one end of the specimen D. The other end of the test piece is fitted in a handle E, which is about 3 ft. in length, by which it is bent backwards and forwards through the "standard" angle. One bend is defined as—"bend the specimen from the extreme position on one to the extreme position on the other."

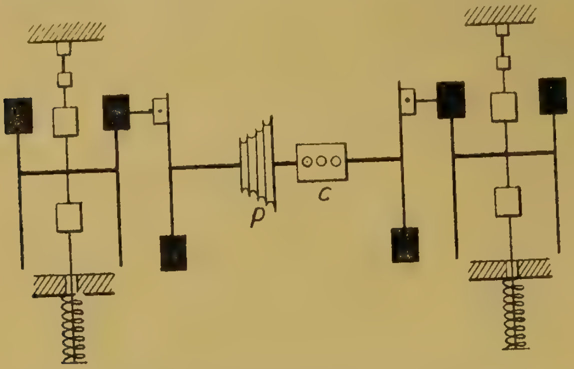


Fig. 8.—Dr. Smith's Machine adapted for Testing two Specimens.

Also fixed to the same bedplate is an autographic recording apparatus. It consists of a horizontal drum carrying the recording paper. A pencil moves on the paper, having a motion which is a multiplication of that of the grip C. The motion is transmitted by means of steel wires. The drum is revolved by the action of the recording apparatus. Consequently an autographic diagram is obtained with this machine. It will be seen that the motion of the pencil is proportional to the effort required to bend the test bar, since the stiffer the latter the more the flat spring B will be bent. The motion of the pencil depends on the deflection of this spring. The "standard" angle is so fixed that the distance travelled along the arc of the circle of 1 ft. radius from the point of bending is 1·6 ft. (this angle is 91½ deg.). Thus by multiplying the bending effort, in lbs., by 1·6, the energy, in foot-lbs., expended in making a bend is determined. Generally, the stronger the material the smaller the number of bends it will endure, and it may be noted that in the case of mild steel the bending effort of the first bend is approximately proportional to the tension yield stress.

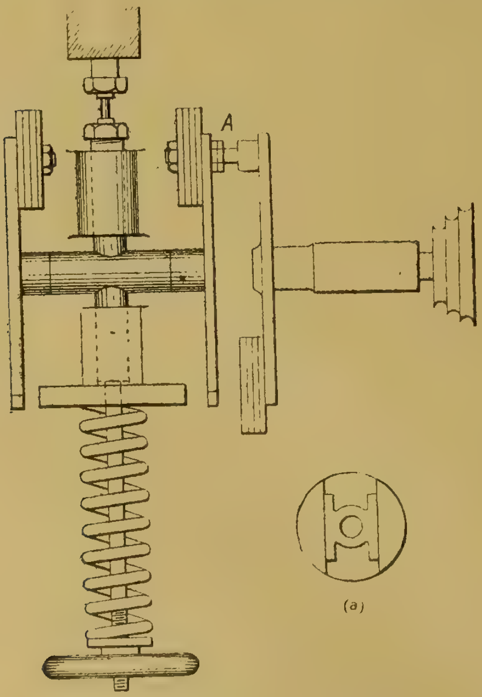


Fig. 9.—A Detail of Dr. Smith's Machine.

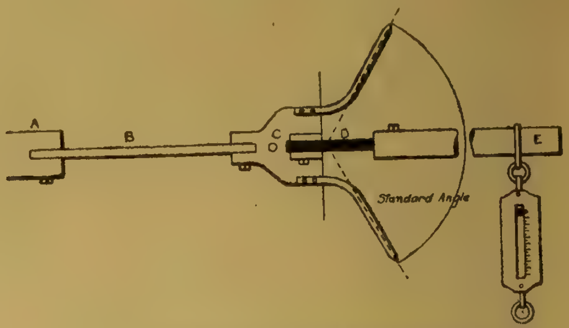


Fig. 10.—Captain Sankey's Hand Bending Machine.

The area of the diagram represents the energy required to break the test bar. The recording gear is so arranged than one square inch of the diagram represents 400 foot-lbs.

This value for the energy required to break the specimen should not be less than 2,500 ft.-lbs. for machinery steel, but for the steel used in petrol engines 3,500 to 4,000 is a more desirable figure.

As a result of many trials it has been observed that with steel in a normal state, the first bending effort is always less than the second. But if the steel has been artificially stiffened by drawing or hammering, the first effort is the greatest. The effect of the bending is to counteract the artificial stiffening. The indication of this phenomenon is a unique property of this testing machine.

C. A. M. Smith's Alternating Torsion Stress Machine.

In fig. 11 is shown the alternating torsion machine designed by the author. The alternations are produced by the reciprocating movements of the weight W. The connecting rod B, driven by the crank C, causes the long crank to vibrate and the weight W to oscillate through a small arc. There are three other sets of balanced weights, but these are merely for the purpose of preserving balance and obviating vibration as far as possible. The power for driving this machine is supplied by a small motor. The rate of alternation of the stress is easily varied. It will be remembered that, although crankshafts are made of mild steel (a ductile material), yet when they fail in practice they invariably show a fracture as of a brittle mate-

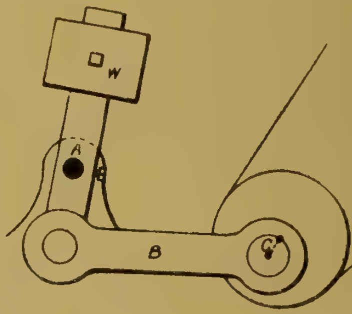


Fig. 11.—The Principle of C. A. M. Smith's Alternating (Torsion) Testing Machine

rial. The object of this new machine is to investigate this phenomenon, and other points connected with the elastic breakdown of materials.

Professor Goodman has devised a graphical method for determining the maximum stress allowable under a given variation of stress, the statical breaking stress of the material being known.

Fig. 12 shows the diagram. If H K is the minimum stress on the specimen, H L is the maximum stress which can be repeated without causing fracture.

If a member is subjected to a steady load W_{min}, and also to a fluctuating load $(W_{max} - W_{min})$, then the equivalent static load

$$W_0 = W_{min} \pm 2 (W_{max} - W_{min}).$$

The points on the diagram indicate the results of experiments performed by Wöhler, Spangenburg, and Bauschinger. It will be seen that there is little difference in the results obtained by theory and practice.

Prof. Lilley's Torsion-testing Machine.

This machine has been designed to give stress-strain diagrams under either direct or alternating torsional stresses.

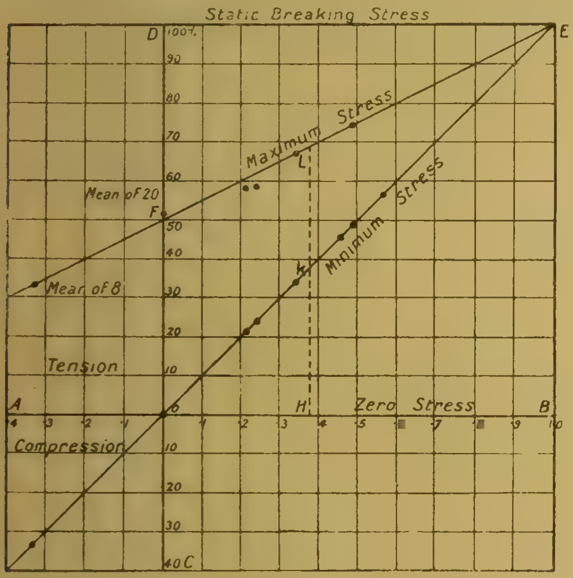


Fig. 12.—Professor Goodman's Diagram.

In fig. 13 is shown a plan of the machine. B is a circular table capable of rotation, and on which a sheet of paper can be fastened by means of clips. A is the specimen, which is fastened to the lever C by means of a key. The lower end of the test bar is fixed. To the end of the lever C a rectangular spring D is rigidly fixed. Attached to this spring at F is a light recording arm which carries a pointer P.

The method of performing a test on alternating stress is as follows: The table B is rotated by hand, so that the pencil P draws a circle on the paper. This circle is the base or zero circle. A spring is then placed on the handle at E, and a certain force is applied. The pencil is caused to draw another circle. Other known forces are applied at E, and a number of other circles drawn. The specimen is put under alternate torsional stresses by pulling the handle backwards and forwards through a given arc. The pencil then draws a number of stress-strain diagrams on the paper.

Eden's Machine.

Eden's alternating stress machine is similar in principle to one of Wöhler's, in that the change of stress is produced by the rotation of a loaded bar. In fig. 14 is shown the scheme of the apparatus. The rotating beam, of circular section, is supported on two swivelling bearings A and B. The bar is loaded at C and D by means of the weight W, which is carried on ball bearings resting on the journals. The stress is a maximum at the reduced portion of the test bar, and fracture takes place at this point. As the specimen revolves, the stress at any point in the reduced part alternates between a tensile stress and a compressive stress of equal intensity.

A number of tests were run with this machine on wrought iron, mild steel, and vanadium steel. The object of the experiments was to determine the relation, if any, between the frequency of stress and the endurance of the material. Tests were run at various speeds, the frequency varying between 250 and 1,300 alternations per minute. The conclusion arrived at by Mr. Eden was that the endurance of the materials taken was independent of the speed, at least within the range of his experiments.

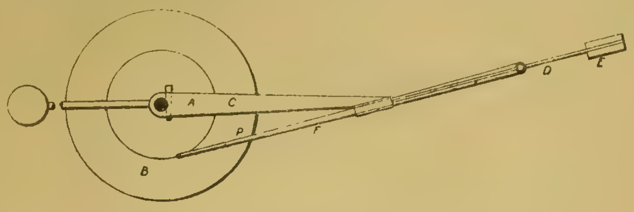


Fig. 13.—Professor Lilley's Torsion-testing Machine.

The results obtained by Mr. Eden are in accordance with those given by the special ring machine devised by Dr. Stanton, although the apparatus and the methods employed were different. In Stanton's experiments, however, the rates of variation were much higher, running up to 2,500 per minute.

On the other hand, Dr. J. H. Smith and Prof. Morley have obtained results which indicated a reverse state of affairs. In one metal they have found a very great lowering of limiting range with increase of speed.

It is probable that the methods adopted for calculating the stress due to bending in the specimen are responsible for many of these inconsistencies. The influence of ductility, elasticity, hardness, and the shape of the specimen has not yet been fully investigated. The very fact that there are such discrepancies in the results obtained by the different experiments shows that there is still a great deal of work to be done in this field of research.

In the meantime, engineers will safeguard their machines by using high factors of safety. Even with such precautions there is the danger of unexpected conditions. But one result of the various researches now in progress should be to make clear certain points which are very materials used in engineering work. This will enable us to proportion machines in a much more scientific and economical fashion.

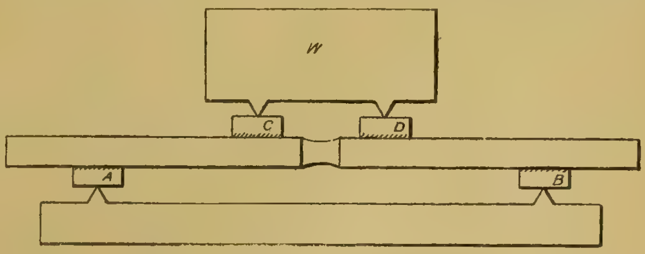


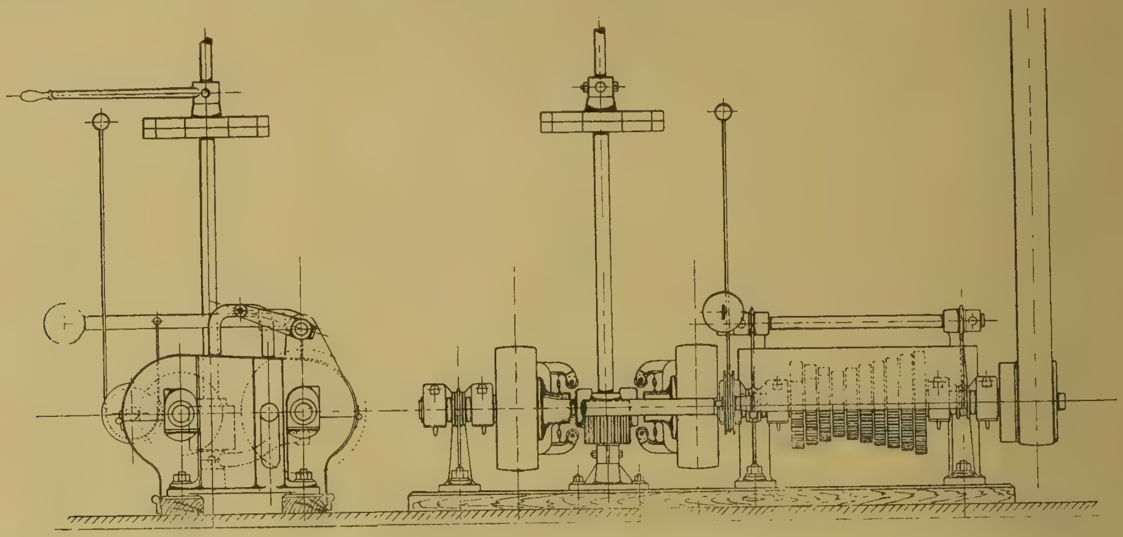
Fig. 14.—Eden's Improved Wohler Machine.

Ship Canal Between Yarmouth and Norwich.—The project of making a ship canal between Yarmouth and Norwich is being considered. The cost is put at £360,000. Thirty years ago a company was formed for a similar scheme, but the matter fell through.

A NEW VARIABLE SPEED GEAR.

The illustration shows the construction and indicates the method of operation of a gear for providing variable speed in operating milling machines, boring mills, lathes, or other tools. It will be noted that there are ten different gears of various diameters which mesh with a pinion which is movable so as to engage with any gear wheel desired. The device shown in the accompanying drawing transmits 5 H.P. at a speed of 78 revolutions per minute, the power and speed varying to 2 H.P. at 620 revolutions per minute. The driving pulley runs at 300 revolutions per minute, measures 11¾ in. in diameter, the face being 4 in., and the weight of the device being about 67 lbs.

A heavier variable-speed device of this type has been constructed weighing 1 cwt. 1 qr., and a still larger apparatus weighing 4 cwt., for transmitting a greater amount of power and providing 20 different speeds. The drawing indicates clearly the construction of the apparatus as built at Reutlingen and designed by Mr. Gustav Wagner.



VARIABLE SPEED GEAR.

THE PRINCIPAL DIMENSIONS OF STEAM TURBINES.

By Rankin Kennedy.

An instructive method for calculating the principal dimensions of steam turbines may be of interest to many engineers, as it throws a considerable amount of light upon the subject, and serves to impress upon the mind the relative importance of the elements of this simple type of prime mover.

The data generally given for a new design are usually the speed revolutions per second, the steam pressure and vacuum in condenser, if any, and the horse power.

For all practical purposes turbines divide into two classes—the impulse turbine in its simplest form typified by the De Laval turbine, and in its multiple wheels in series forms known as the Rateau and Zoelly and others, and the pressure or reaction turbine. The Hero reaction wheel is the simplest of this type, and the Parsons multiple wheels in series turbine the best known in practice.

Strictly considered, the Parsons turbine and all other pressure turbines partake of both systems, as in them is both impulse action at entry to the blades and reaction at exit. Much the same are in the well-known water turbines of Prof. James Thompson, the Vortex turbine.

In the impulse turbines the flow of steam is determined by the area of the orifices of the fixed nozzles or guide rings of blades, the fluid passing freely through the wheel blading and the turbine may be "partial flow." In the pressure turbine the rings of blades and the moving rings of blades both control the steam flow, and the steam fills the space completely.

In both cases, however, the first principal dimension is the cross sectional area of the nozzles or guide blading orifices, as upon this and the steam pressure depends the other dimensions. This area A multiplied by the steam velocity V_s, gives the quantity of steam passed in cubic feet, V_s being in feet per second and A in square feet. V_s depends upon the difference of pressure between the two sides of the guide blading or nozzles, within certain limits.

If the P is the initial pressure and P_1 the lower pressure outside the nozzle, or on the other side of the guide blade ring, the maximum weight flow of the steam is reached when P_1 is equal to 1·6 × P.

If the initial pressure is 100 lbs. and the pressure on the other side 100 × 0·6 = 60 lbs., then the flow of steam is at its maximum, and no greater difference of pressure will give any increased flow of steam.

For smaller differences of pressure than the above, that is when P_1 is greater than 0·6 × P, the velocity can be calculated by two methods—if $d\,p$ is the difference of pressure and p the absolute pressure behind any row of blades,

$\frac{d\,p}{p}$ is the amount of expansion taking place;

then $$V^2 = 2\,g\,H\,\frac{d\,p}{p},$$

wherein H is the homogeneous head of steam due to the pressure difference, ranging from 63,000 ft. to 45,000 ft. between high pressure and atmospheric pressure.

But a better system for the calculation of steam velocities consists in taking the British thermal units in the pressure difference; that is, the potential energy corresponding to the fall in pressure and temperature.

E the potential thermal energy in foot-pounds per pound of steam for any given pressure drop equals

$$E = \text{B.Th.U.} \times \text{Joule's equivalent};$$

and $$V_s = 8\,\sqrt{E};$$

hence $$V_s = 8\,\sqrt{\text{B.Th.U.} \times 778};$$

or $$V_s = 223\,\sqrt{\text{B.Th.U.}} \quad . \; . \; . \; . \; . \; . \; . \quad (1)$$

The British thermal units in the fall of pressure is found by taking the absolute temperatures of the steam at the two pressures P and P_1. If T is the initial temperature and T_1 the lower pressure, then

$$\text{B.Th.U.} = H\left(\frac{T - T_1}{T}\right) \quad . \; . \; . \; . \; . \; . \; . \quad (2)$$

wherein H is the total heat of the steam at initial pressure P.

But in the practical problems we have to deal with the speed V_s is fixed or given, and also the initial pressure, so that we have to find the lower pressure required to give this given V_s steam velocity.

This can be done by taking the absolute temperature of the steam at P pressure and by formula

$$T_1 = T - \left(\frac{V_s^2 \times T}{J.H.}\right) \quad . \; . \; . \; . \; . \; . \; . \; . \quad (3)$$

T_1 being the lower absolute pressure. If we deduct 460 from the result we at once obtain t_1 the lower temperature of the steam, and from that a table of steam properties will give the corresponding pressure.

J is Joule's equivalent, H total heat of steam at initial pressure, E the energy in foot-pounds per pound of steam is then for any given drop in pressure = B.Th.U. × Joule's equivalent.

$$E = \text{B.Th.U.} \times 778\,;$$

and $$V_s = 8\sqrt{E} = 223\sqrt{\text{B.Th.U.}}$$

Calculated out in this way we get a curve, as shown in fig. 1, giving the steam velocity for any given drop in Brithish thermal units.

This curve flattens into a straight line when the drop is proportional to $P_1 = P \times 0{\cdot}6$. It rises rapidly from 1 to 4 or 5 B.Th.U.'s.

V_t, the velocity of the turbine blades, must bear a certain relation to V_s, the velocity of the steam. In the impulse turbine the velocity V_t should be half V_s.

In Parsons turbines it has been made varying from V_t = 0·25 to 0·85 × V_s; and a common ratio is

$$\frac{V_t}{V_s} = 0{\cdot}6.$$

For any given blade velocity the speed ratio $\frac{V_t}{V_s}$ determines the number of stages in a turbine's expansion of the steam. The greater the ratio V_t to V_s, the greater the number of wheels required in series; for the lower the pressure drop in each wheel, the more wheels are required to accomplish the whole drop from the top valve to the condenser.

We have taken P × 0·6 as the limiting pressure difference for maximum weight flow at the throat of a nozzle; the correct fraction is 0·58 × P = P_1.

Fig. 2 shows a diagram of a convergent divergent nozzle, The maximum weight of steam passes the throat when P_1 = P × 0·58; for simpler calculation we take the fraction as 0·6.

Although neither more nor less steam can pass the throat, its velocity may by allowing it to expand in the divergent nozzle be enormously increased by the time it has fallen to P_1, and this expansion nozzle is the leading feature in the De Laval turbine to be now considered.

A LARGE CORE OVEN EQUIPMENT.

The half-tone illustration shows the design of a core oven equipment that is unique in having the ovens on the two upper floors fired from the first floor as recently placed in operation at Cleveland, Ohio. The equipment is believed to be the largest in the country for making small cores, and, so far as is known, no similar ones have been built where provision is made for firing ovens located more than one floor above the fire-boxes. In planning the plant, core making was heated as one of the most important parts of foundry work, and much time and thought were given to it, so that the quality of the castings might be as high as possible. The equipment is used in making cores for marine engines and automobile parts.

CORE DRYING OVEN.

It may be stated that the plant is in a three-storey brick and steel building, 77 ft. by 111 ft. The entire structure is devoted to the core department, and room is provided for 175 to 200 coremakers. The first floor or basement is used for mixing and preparing the sand for the second and third floor work. The ovens are all coke fired from the fire-boxes on the first floor, so that all the rough, dirty work in connection with the making of the cores is confined to this floor, which is very desirable. The building is equipped with an elevator, which is used for handling the sand and for taking the cores from the third to the second floor.

The ovens on the third floor consist of two batteries of eight ovens, each of the rolling drawer type. Each oven contains six drawers 2 ft. 10 in. wide and 5 ft. long, so that the 16 ovens on this floor have a total capacity of 96 drawers. The ovens on the floor below are arranged in two batteries of four ovens each. As each oven is five drawers high, the total number of drawers on this floor is 40. These ovens are used largely for pasting and blacking, although some of the heavier cores are baked on this floor.

It will be noted that the drawers are opened and closed by mechanical means. Above each oven is a small traveller, from which an arm carrying a number of short brackets hangs. The free end of the bracket fits between two small projections on the front of the oven drawer, and is fastened thereto by a bolt when it is desired to open or close the drawer. The traveller then moves forward or back along the channel iron track and carries the drawer with it.

The batteries of ovens on each floor are placed back to back, and, as the ovens are located practically at the centre of the building, the second and third floors are divided into two rooms. Confining the fire-boxes to the first floor makes a very desirable arrangement for the other two floors.

It is held that the coremakers work on an unusually good type of core bench, and these are separated so that the work of one coremaker cannot injure that of an adjoining workman. A series of benches is provided which may be changed around to suit the charging condition of the work in the core-rooms.

HUMPHREY PUMPS AND COMPRESSORS.*

(Continued from page 740.)

So far we have had one outward and one return stroke, but the expansion of the cushion in A starts a second outstroke, which results in drawing in a new combustible charge in A through valves *i* and *r*, which were released on the shutting of the exhaust valve *e*. As the second outstroke is nearly as long as the first it follows that too much combustible mixture is drawn in, but the surplus is got rid of on the second return stroke by allowing it to escape into the receiver X, and to slightly raise the pressure therein. Valve *i* was shut by its spring, but *r* waits to be shut by the action of the water, and when this occurs chamber A contains a definite volume of combustible mixture, the size of charge being fixed by the height of *r*. Finally we have only to observe that the second outstroke towards C merely compressed the air in C without causing delivery to take place, but storing in the air the energy given out by the expansion of the cushion in A. The air in C now expanding gives the compression stroke A, and the combustible charge is ready to be ignited to start the next cycle.

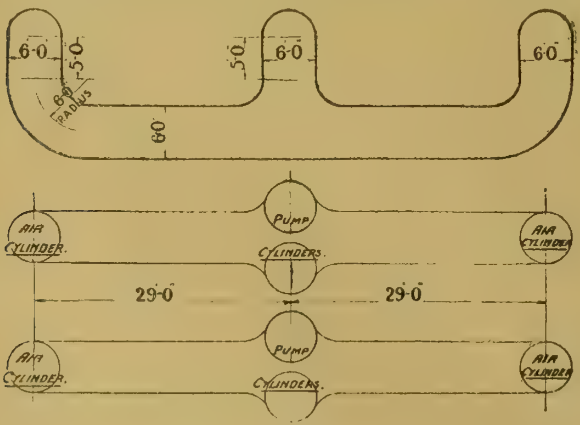


Fig. 19.

Perhaps the whole cycle, which may take two seconds to accomplish, sounds a little complicated, but if so it is merely due to the length of the description. It may be easier to grasp the action if it is set out to show the simultaneous steps in A and C, thus:—

	A.	C.
1st outstroke.	Expansion to atmosphere. Intake of scavenging air.	Expulsion of air till water shuts valve *s*. Compression and discharge of compressed air till water shuts valve *g*. Cushion till water comes to rest.
1st instroke.	Exhaust till water shuts valve *e*. Cushion till water comes to rest.	Expansion of cushion to atmosphere. Intake of fresh air.
2nd outstroke.	Expansion of cushion to atmosphere. Intake of combustible charge in excess.	Compression of air, but not sufficient for further delivery.
2nd instroke.	Rejection of surplus charge till water shuts valve *r*. Compression of charge till water comes to rest.	Expansion of compressed air.

It will be evident that in the next cycle when admission of combustible charge occurs, the surplus last rejected into reservoir X will want to enter first, because it is under slight pressure, whereas inlet valve *i* has to be sucked open against its spring. Consequently X will empty to atmospheric pressure each time, and only the additional mixture required will be taken in through valve *i*. A slight modification may be made by transferring valve *i* from the pump to the reservoir X.

The flexibility of the air compressor can now be studied. To begin with the pump side, the level of the inlet valve *e*, and the rejected charge valve *r*, are assumed to be variable, although fig. 18, being merely a diagram, does not show how the pipes carrying these valves are moved vertically. As the level of these two valves controls the amount of charge ignited at each cycle, and the amount of the cushion space, their regulation is all that is required to increase or diminish the energy developed per working stroke. On the compressor side the position of the valves *g* and *s* control the cycle of operations on this side of the apparatus, and render it possible to compress a large volume of air to a low pressure, or a smaller volume of air to a high pressure, or to make any intermediate changes which may be desired.

Thus all the conditions of output, up to the full limit of the compressor, may be governed at will, and for all ranges the compression pressure of the new charge may be kept up to the required degree, so that the apparatus works at its maximum efficiency throughout the whole range. The amount of water which oscillates between the chambers should theoretically be altered along with the total capacity per working cycle, but the reason for this is merely to prevent the last portion of each down stroke from being wasted by taking in surplus combustible mixture in one chamber, or surplus air in the other chamber to an undue extent. If the surplus of the combustible mixture is unnecessarily large, the extra amount rejected will increase the pressure in the reservoir X, and this increase of pressure may be made to automatically govern a water supply, and so bring up the total volume of reciprocating water, or to allow part of the water already in the apparatus to escape, so as just to keep a small amount of excess charge for each cycle, no matter what may be the output of the pump.

To illustrate the importance of the air compressor, and at the same time bring to your notice the use of the double-barrel pumps for this purpose, we may take a definite example, and fig. 19 shows a compressor capable of dealing with 25,000 cubic feet of free air per minute, and compressing it to 25 lbs. per square inch. It is composed of two units, as shown in elevation and plan, and the dimensions are given. The horse power in the air delivered is about 1,500. As the pressure of delivery increases the forces acting upon the water also increase, and the accelerations become greater. Consequently for a higher pressure of delivery the size of the apparatus becomes smaller for a given output.

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* Paper read by Mr. Herbert A. Humphrey, M.I.C.E., before the Manchester Association of Engineers.

Usually compressed air is required to be delivered at as low a temperature as possible, so as to free it from moisture, and it may be noted that where the maximum cooling is required vertical sheets of wire gauze may be fixed in the compressor, so that the gauze takes up water on each stroke and forms a very effective cooling medium in direct contact with the air, thus permitting the compression to be more nearly isothermal than in any other kind of compressor. The reciprocating water itself can be cooled either by cooling the play pipe externally, or by allowing water to be taken in and rejected at each cycle. The latter arrangement has been worked out, but for lack of space it cannot now be described.

One other type of compressor may, however, be briefly referred to, because it differs from the other air compressors in that the pump and the compressor alternate in their functions at each cycle. It has the advantage of giving a greater horse-power output for a given size of apparatus, but it has the disadvantage that the air and exhaust products are mixed together and delivered under pressure. For power purposes, however, this is not a drawback, and in such a case there is some advantage in delivering the compressed mixture rather hot, so that during its expansion, while performing work in some kind of air motor, there is no chance of it freezing the moisture contained, as frequently happens when the air enters the motor at normal temperatures. The thermal efficiency of such an arrangement is exceedingly high, provided that the air can be utilised close to the compressor so as to make use of its sensible heat.

(*To be continued.*)

AN IMPROVED SANDING MACHINE.

The sanding machine described and illustrated below belongs to that type in which a sanding disc and a sanding drum or bob rotate, one on a vertical and one on a horizontal axis, or both on vertical or horizontal axes, the bob also having reciprocatory or back and forth movement imparted to it. The present improvements are the invention of Messrs. The Oliver Machinery Company Limited, of 201-203, Deansgate, Manchester, in conjunction with Mr. W. B. Haigh.

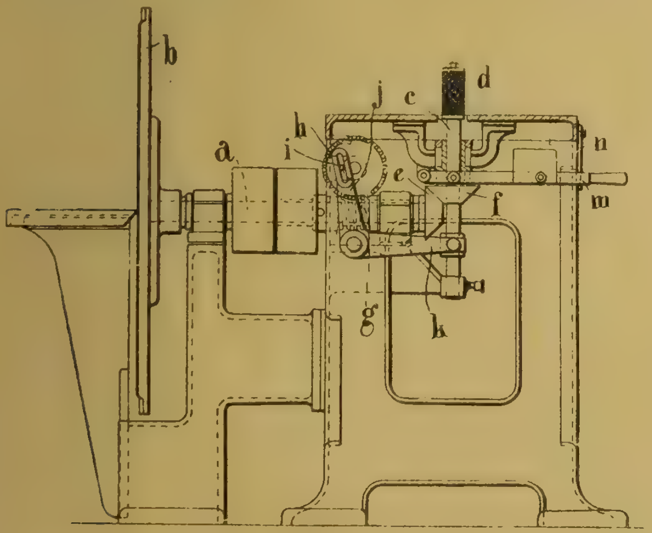

Fig. 1.

In the machine illustrated at fig. 1, fast and loose pulleys are provided upon a horizontal shaft or spindle *a* carrying the disc type sanding or smoothing device *b*, and the spindle *a* is arranged to drive the vertical spindle *c*, carrying the sanding drum or bob *d*, by means of bevelled friction wheels *e*, *f*.

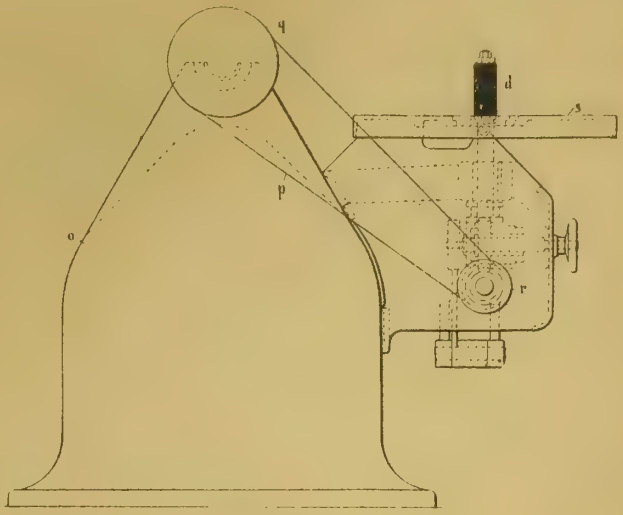

Fig. 2.

For imparting the up-and-down movement to the sanding drum or bob *d*, a worm *g* is employed, adapted to engage a worm wheel *h* carrying a pin or projection *i* which moves within a slot in one arm *j* of a bell crank lever, the other arm *k* of which acts upon the vertical spindle *c*. As the worm wheel *h* rotates, the bell crank lever is rocked or oscillated and the vertical spindle *c* reciprocated.

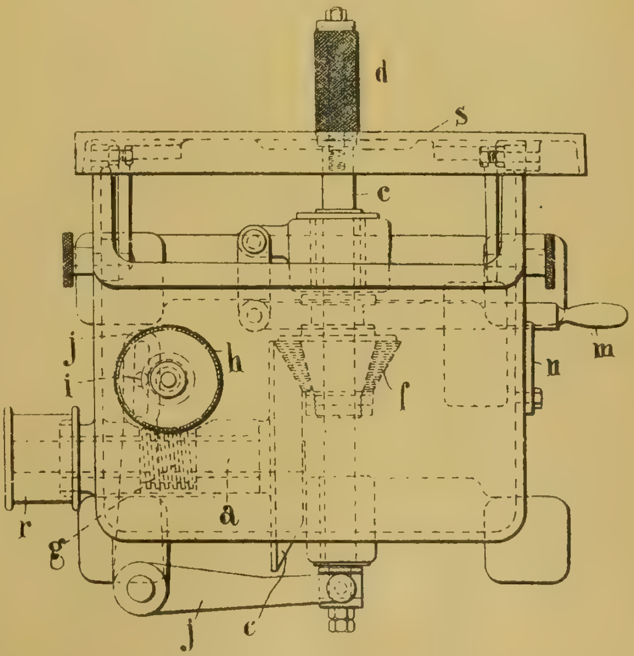

Fig. 3.

To enable the sanding drum or bob *d* to be put out of action, whilst the disc sander *b* continues rotating, the bevelled friction wheel *f* on the vertical spindle *c* is arranged to be capable of longitudinal movement on the latter, and an operating arm *m* is provided for moving the wheel out of contact with its fellow. A notched plate *n* may be employed for holding the arm *m* in a position in which the bevel wheels are out of contact with one another.

In the construction illustrated at figs. 2 and 3, a horizontal shaft supported in the upper end of the frame *o* carries the sander or sanders, the drum sander *d* being driven from this shaft through a belt or rope *p* running on the pulleys *q* and *r*. The latter pulley is mounted on the shaft *a* carrying the friction driving wheel *e*. The operation of the actuating mechanism for the drum sander *d* is similar to that of the mechanism shown in fig. 1. The table *s* around the drum sander *d* is capable of being tilted to any desired angle to suit the nature of the work being performed.

The sanding disc and drum or bob are of any convenient form, and such as are ordinarily employed in the sandpapering of wood or the like. It is, of course, obvious that the disc and bob may be disposed in any convenient position relatively to one another. For example, both disc and bob may be on vertical or horizontal axes, or the disc may be on a vertical axis and the bob on a horizontal axis.

Briefly the chief feature in the improvement consists in the means whereby the disc sander shaft also imparts reciprocatory or back and forth movements to the drum or bob sander, and in the means for putting the friction gearing out of action.

THE UTILISATION OF ELECTRIC POWER IN THE IRON AND STEEL INDUSTRY.*

(Concluded from page 779.)

Practical Applications of the Scherbius, Kramer, and Deri Systems of Speed Regulation.

Rolling Mills.—Rolling mill motors require large outputs, for which the induction motor is the most appropriate. For its regulation both the Scherbius and the Krämer systems are suitable.

At the Differdingen steel works (Luxemburg) a wire mill is in operation driven by an induction motor of 2,000 H.P. and 150 revolutions per minute, which is regulated by means of a Scherbius regulating set of 240 K.V.A. and 750 revolutions per minute. The latter produces a 10 per cent drop of speed between no load and full load. At the Deutsche Kaiser Steel works, Bruckhausen, Germany, a bar mill is driven by a 1,800 H.P. induction motor for 375 revolutions per minute, 50 per cent regulation, and 5 per cent drop of speed between no load and full load. The Scherbius set is built for 400 K.V.A. and 750 revolutions per minute (see fig. 9). Several other installations are in course of construction.

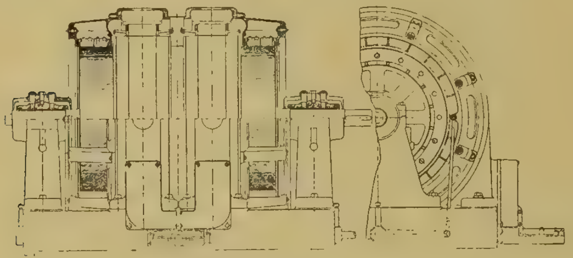

Fig. 8.—Déri Double Commutator Motor.

The Krämer system is also ready in use in a few rolling mills.

When a new rolling mill is installed, it often cannot be determined beforehand what will be the most favourable speed for the process. In such a case it is advisable to design the driving motor with a sufficiently wide margin. Should its speed prove to be too high one or other of the described systems of regulation permit of reducing it without affecting the efficiency of the installation or its power factor, while apart from this speed reduction the driving motor can deliver the full output for which it was designed.

For small rolling mills of special type, such as plate-bending machines, corrugated tube mills, etc., the Déri double commutator motor does good service, on account of the technical advantages above referred to. For the Borsig Works in Upper Silesia two double commutator motors, each for 250 H.P. normal and 400 H.P. maximum output, are at present in course of construction for the operation of a corrugated tube mill.

Blowers.—For the operation of blowers at variable speed, the Scherbius system with regulating set is often very useful. The Krämer arrangement with direct-coupled regulating motor is in this case less favourable because of the high speed of blowers. High speeds always entail certain technical difficulties for commutator machines. Moreover, the main advantage of the direct-coupled regulating motor, viz., to keep the output constant, is of no value with blowers, fans, and similar machines, for which the required output greatly decreases with decreasing speed.

Fig. 10 shows a fan motor of 850 H.P., 365 revolutions per minute, at the Gelsenkirchener mines, the speed of which can be regulated to the extent of 26 per cent. Fig. 11 shows an electrically-driven blast-furnace blower at Skinningrove Iron and Steel Works, Yorkshire, for an output of 24,000 cubic feet of air per minute, and a pressure of 7 lbs. per square inch, the speed being 2,360 revolutions per minute, this being a case in which the special working conditions did not call for speed regulation of the driving motor.

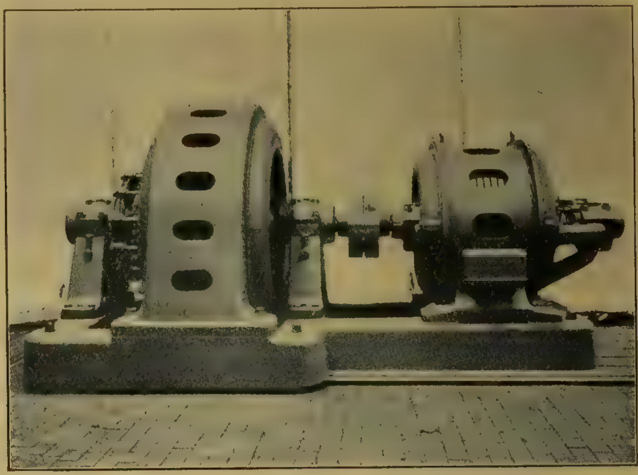

Fig. 9.—Scherbius Regulating Set (400 K.V.A., 750 R.P.M.) for the Speed Regulation of a 1,800 H.P. Induction Motor, for driving a Bar Mill at the Deutscher Kaiser Steel Works.

Minor Drives.—The Déri motor, either as single or as double commutator motor, is very suitable for most of the auxiliary drives in steel mills which require regulation.

In the first place, the drive of those live rollers which require constant reversing must be mentioned. Their starting conditions are severe because of the acceleration of all the moving parts. To this class of service the Déri motor, with its high-starting torque, is well adapted.

For the operation of blast-furnace hoists the Déri motor is to be preferred to the induction motor on account of its smooth acceleration and the smaller current peaks which it produces, while again it permits of an entirely automatic operation. The furnace labourer, who puts the barrows in the cage at the ground level, closes a small switch to start the lift. The mechanism then takes care of itself, and the hoist stops exactly at the right level, so that the barrows may be conveniently wheeled off.

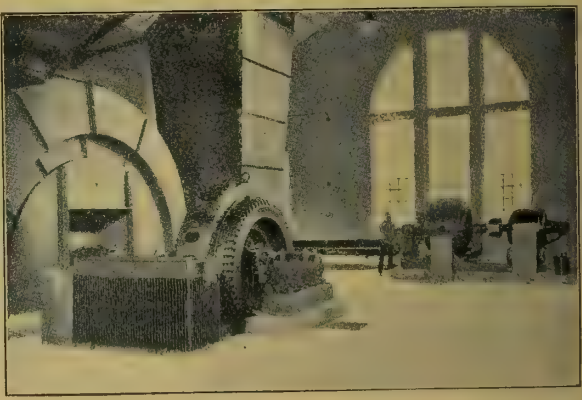

Fig. 10.—Fan with Electric Drive at the Gelsenkirchener Mines, with regulating set in the background.

The Déri motor adapts itself in particular to the operation of travelling cranes. Its use reduces the controlling apparatus in the driver's cage to three levers, or hand wheels, one for the lifting motor, one for the traversing motor, and one for the cross traverse motor. Each lever, or hand wheel, serves to shift the brushes of one of these motors. As the distance between the driver's cage and the crab is variable, a special mechanical transmission is required for shifting the brushes of the motors which are mounted on the crab. As a rule, a square shaft and a moving socket with a gear wheel are used for this purpose. The driver is able to displace the brushes always according to the starting torque required, and thus the current demand can be kept at a minimum. The driver is also able to adjust the brushes to any speed he needs.

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* Paper read by Mr. J. J. Elink Schuurman at the Iron and Steel Institute.

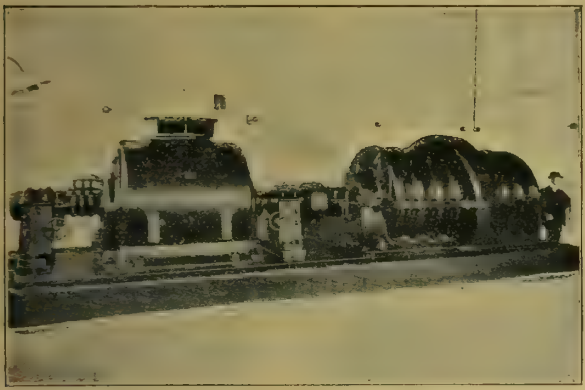

Fig. 11.—Electrically-driven Blast-furnace Blower (2,360 R.P.M.) at the Skinningrove Iron and Steel Works, for an output of 24,000 cubic feet of air per minute and a pressure of 7 lbs. per square inch.

The greater part of the brake equipment usually supplied can be omitted, as electrical braking and regenerative control can be used. As a rule, only the lifting motor is fitted with a mechanical brake. This brake is often not used during normal operations, but is of advantage when during long intervals the load has to be held at a certain height. The mechanical brake can then be applied and the lifting motor disconnected in order to save electrical energy.

Conclusion.

On the foregoing pages it has been shown that economical speed regulation for alternating-current motors, both of large and small output, may nowadays be obtained. It has also been explained that the inherently low power factor if iron and steel works installations can be greatly improved, when one or more induction motors of the plant are arranged for speed regulation according to the Scherbius or Krämer systems before described.

Owing to these improvements, the three-phase system of current distribution will more than ever meet the requirements of an economical utilisation of the blast-furnace gases.

The energy available in these gases furnishes a large source of power. It must be borne in mind that from the gases arising from the production of 1 ton of pig iron a gas engine power station will develop 400 k.w. hours, when it is assumed that 60 per cent of the total gas production is consumed by the blast furnaces themselves. The utilisation of this source of power is of the greatest importance for an economical production.

Also from the standpoint of national economy this question is of vital interest, as it is closely connected with the conservation of the country's coal supply. With the annual production of pig iron amounting to 10,000,000 tons, the use of the waste gases permits of a saving of 2,500,000 tons of good coal. This saving becomes possible only through the centralisation of the power production and the distribution of energy by means of electrical transmission, and nowadays it can be utilised to the utmost by such means, with the help of the efficient motor drives referred to in this paper.

Messrs. Scott's Shipbuilding and Engineering Co. Ltd., Greenock, are reported to have received an intimation from the Admiralty that they had been successful in their tender for one of the big battleships which the Government intend to build. The new warship will be the largest and most powerful vessel in the British Navy, being larger and heavier than that now under completion at Messrs. Scott's yard. According to the Press Association's Glasgow correspondent it is reported that an English firm has secured the contract for the sister warship. It is stated that the contract for the improved Dreadnought is to provide a warship of about 21,000 tons displacement, and not less than 27,000 H.P. The cost will exceed two millions sterling.

LAUNCHES AND TRIAL TRIPS.

Francisco.—The steamship Francisco, built by the Northumberland Shipbuilding Co. Ltd., Howdon-on-Tyne, to the order of Messrs. Thos. Wilson, Sons, and Co. Ltd., Hull, for their Atlantic trade, left the Humber for her official trial trip, which was in every way satisfactory, a speed of 12 knots being easily obtained. The vessel has been specially designed for this trade, and built to the highest class in British Corporation and constructed on the deep frame and girder system, rigged as a two-masted schooner, and is fitted with all the latest improvements and up-to-date appliances to make her in every way a first-class liner. She is about 425 ft. in length, with three complete steel decks. Loading and discharging facilities are considerably in excess of usual. The steamer has 12 derricks and 10 powerful steam winches with extended shafts by Messrs. John Lynn and Co., Sunderland, to ensure the most expeditious handling of cargoes. Powerful combined steam and hand gear on the Wilson-Pirrie principle by Messrs. Donkin and Co. Ltd., Newcastle, is fitted in steel house on shelter deck aft and actuated from amidships by telemotor gear, and a powerful windlass of the latest type by Messrs. Emerson, Walker, and Thompson Bros., Dunston-on-Tyne. The vessel has been built to a fine model and to the most modern improvements, including Board of Trade regulations. Triple-expansion machinery, 28 in., $45\frac{1}{2}$ in., 76 in., 54 in., of special design and construction has been supplied by Messrs. Earle's Shipbuilding and Engineering Co. Ltd., Hull, with three extra large boilers working at a pressure of 180 lbs., and fitted with Howden's system of forced draught.

Berwindvale.—Sir Raylton Dixon and Co. Ltd. launched from their Cleveland Dockyard, Middlesbrough, a fine steel screw steamer, which is believed to be one of the largest merchant colliers yet built. The vessel is being constructed for American owners on builder's latest improved patent cantilever framed system, with top-side water ballast tanks, shelter deck type. The principal dimensions of the vessel are: 425 ft. long by 54 ft. beam by 29 ft. moulded, and she will have a dead-weight carrying capacity of over 8,500 tons on a light draught of water. Triple-expansion engines are placed aft, having cylinders 28 in., 46 in., and 77 in., by 48 in. stroke, supplied with steam by three large single-ended boilers fitted with Howden's system of forced draught, which are estimated to drive the vessel a speed of $11\frac{1}{2}$ knots, loaded, will be fitted by Messrs. Richardson, Westgarth, and Co. Ltd., of Hartlepool.

Ragworth.—On the 16th December Messrs. Ropner and Sons Ltd., Stockton-on-Tees, launched from their yard a steel screw steamer, having length, 389 ft. 3 in.; breadth, 57 ft. 6 in., and depth, 28 ft. 6 in. The vessel will be classed 100 A1 at Lloyd's. The vessel has double bottom for water ballast on the cellular principle. The appliances include 10 steam winches, double derricks to each hatch, steam being supplied by a large donkey boiler working at 100 lbs. per square inch. The engines will be of the triple-expansion type, by Messrs. Blair and Co. Ltd., Stockton-on-Tees, of about 2,450 I.H.P., having three steel boilers 15 ft. 6 in. by 11 ft., 180 lbs. steam pressure.

On the 16th December Messrs. Craig, Taylor, and Co. Ltd. launched from their Thornaby Shipbuilding Yard a single-deck screw steamer of the following dimensions, viz.: 392 ft. by 52 ft. by 29 ft. 6 in. moulded. She is built of steel to the highest class in Lloyd's Registry under special survey. She has a complete equipment of loading and unloading winches, etc., telescopic masts to Manchester Ship Canal requirements, also double derricks. Her engines have been constructed by Messrs. MacColl and Pollock Ltd., Wreath Quay Engineering Works, Sunderland, the cylinders being $25\frac{1}{2}$ in., 43 in., and 70 in., by 45 in., with three boilers working at 180 lbs. pressure. Messrs. Craig, Taylor, and Co., Ltd. are about to put down the keel of a still larger vessel, which they have to build on the "Isherwood" patent system.

Aquiry.—Messrs. Murdoch and Murray, shipbuilders, Port Glasgow, have launched the steel screw steamer named Aquiry, which is destined for passenger and cargo service in South America. Triple-expansion engines of large power will be supplied by Messrs. Muir and Houston Ltd., Glasgow. This is the tenth vessel Messrs. Murdoch and Murray have put in the water this year, and an eleventh is ready for launching.

NAVAL NOTE.

Indefatigable.—On the completion of her 30 hours' trial the new battleship cruiser Indefatigable returned to Plymouth, and preparations were commenced for the full-power trial of eight hours' duration. During the whole of the 30 hours the vessel was at sea the water was rough, and at times the wind, which was from the westward, reached almost the force of a gale. From time to time enormous waves broke over the vessel, and that she should ship some water was inevitable, but throughout the test she is stated to have proved a splendid sea boat. The trial was at varying speeds, and the cruiser made six runs on the measured mile course. Her average speed was 24 knots, and when doing her best at three-quarter power, while running up Channel, she reached 27 knots.

CORRESPONDENCE.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only; and if accompanied by sketches, these should be neatly drawn, and forwarded on a roll, to prevent creasing. We cannot undertake to return rejected communications, or to reply to inquiries by letter. In all cases letters must be accompanied with the name and address of the writer.

We do not hold ourselves responsible for the opinions of our Correspondents.

ACETYLENE.

To the Editor of "The Practical Engineer."

Sir,—In your issue of the 9th inst. appears a note on acetylene gas as an illuminant. Several of the statements made in the latter half of the paragraph may possibly do some harm to an expanding industry if not rectified.

You state the gas is very poisonous. As a matter of fact, no case of poisoning by acetylene has ever arisen; in fact, the risk of poisoning by acetylene after it has been purified by one of the ordinary means is nil, and even unpurified acetylene will have little or no effect on account of the pure raw materials which are used in its manufacture to-day. Pure acetylene has no appreciable odour; it is the impurities that cause the smell, and these are generally almost wholly removed by the use of a purifier attached to the plant, and it would not be advantageous to eliminate all the impurities, as the presence of a fraction of percentage of impurities in the gas leads to the instant detection of any leakage long before any possible chance of an explosion could take place by the introduction of a naked light into the mixture of air and acetylene. As a matter of fact, there is no more danger with the use of acetylene than there is with the use of coal gas.

The price of carbide stated is not to-day's price. The general cost per ton delivered is £13 to £14; thus the cost per 1,000 ft. being £1 3s. 6d. or a little above, and not £1 16s. 4d., as stated by you.—Yours, etc.,

Charles Bingham and Co.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2294. **Steel Chimney.**—State the advantages and disadvantages of steel chimneys; give notes on their proportions (including limiting height); give a rule for their weight, and express opinion as to their safety against wind and lightning.—Steel.

Answer.—There are many points in favour of the iron or steel chimney. They are cheaper to construct, more quickly erected, and being considerably lighter than brick chimneys do not need such extensive foundations. Another point in their favour is their freedom from cracks, which not only weaken brick chimneys but tend to minimise the full draught effect of their height. The base usually consists of a strong taper section with a good footing, or the first section is fitted into a flanged cast-iron base. Guy ropes are generally provided to counteract wind pressure, but in modern constructions are often dispensed with, even for tall chimneys, and in cases where the extent of the property will not allow of a proper disposal of the ropes. Whether the sections have butt joints with riveted cover plates or have ring angle irons is a matter of design.

With steel chimneys one has to guard against corrosion, the rate of which depends upon the class of coal used. It is therefore good practice to thoroughly paint them with two coats once a year.

To give stability in unguyed chimneys the lower sections should be gradually increased in diameter, making the lowest ring at least twice the diameter of the top one. The thickness of the metal should not be less than $\frac{3}{8}$ inch, the lower sections being about $\frac{5}{8}$ inch thick, according to the height.

The total wind pressure can be determined by the area exposed, which is simply the height multiplied by the diameter. Two hundred feet high is about a maximum that has been adopted; but when the maximum wind pressure is allowed for, a good contractor will go beyond this. The force of the wind can be ascertained from a table in "*The Practical Engineer* Pocket Book." As regards protection from lightning, this is not nearly so important as in the case of brick chimneys, but it is advisable to carry a metal connection in the form of a copper strip from the base of the chimney to an adequate earth plate.

No difficulty will be experienced in calculating the weight of a steel chimney. It is best to take each section separately and sum the lot, allowing for the cap, cover plates, angle irons, and base castings.

Let l = length of section in feet
d = mean diameter in feet
then $\pi d l$ = square feet per section.

From "*The Practical Engineer* Pocket Book" table of weights of square foot of metals we obtain the weight from $\frac{1}{16}$ in. thick steel upwards.

As it is best practice to build a firebrick lining for at least one-third the height, this should also be included in the weight—

If σ = specific gravity of firebricks,
w = weight in pounds,
$W = 62{\cdot}5\,\sigma \times$ No. of cubic feet.—Guy.

Replies received from L. C. and V. S. are to the same effect. V. S. states that for small chimneys those in steel cost about 20 per cent less than brick chimneys, while at 100 ft. high 30 to 35 per cent cheaper.

2295. **Inertia Governors.**—Would some reader kindly tell me where I can find descriptions of inertia type governors, *i.e.*, governors which are operated by the inertia forces called into play by imparting a reciprocating motion to a heavy mass. What are the advantages and limitations of this type of governor?—F. B.

Answer.—It is hardly necessary here to enter into a description of inertia governors and their action. A full account will be found in the book on "Governors and Governor Mechanism," by H. R. Hall, published by The Technical Publishing Co. Limited.—Ajax.

TO CORRESPONDENTS.

Resilient.—The following firms are likely ones to supply you with the machines you require: David Bridge and Co., Ltd., Castleton, Manchester; and Johnson and Phillips, Victoria Works, Old Charlton, Kent, S.E.

MISCELLANEA.

The Commercial Motor Users' Association purpose holding their next annual parade on Whit-Monday, 5th June, 1911. Forty-eight vehicles have already been entered.

Calendar for 1911.—The wall calendar for next year issued by the United States Metallic Packing Co. Ltd., Soho Works, Thornton Road, Bradford, is a specimen of high-class art, the subject of the illustration being "Paul and Virginia," the impression being in relief.

The Steam Engine Indicator.—At the Institute of Marine Engineers on December 12th a lecture to the junior section was given by Mr. J. G. Hawthorn on "The Steam Engine Indicator." The lecturer described the indicator diagram as a graphical representation of the work done during one stroke of the engine. By taking the difference between the forward and back pressure of the piston at any particular moment the effective pressure at that moment could be ascertained, and the mean effective pressure by taking the average of a number of such measurements from which the horse power could be worked out. He then described how the position of the valve, the cut-off, the point of exhaust, and linking up affected the diagram. On the sugestion of one of the members present the author described a typical air pump diagram, and the effects likely to be produced by various faults. A hearty vote of thanks was accorded to the lecturer on the proposal of Mr. A. Robertson, seconded by Mr. T. A. Crompton.

OSRAM·LAMPS

PATENTEES' CHRONICLE
OF
Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

DECEMBER 9th, 1910.

28620 Games. Duke.
28621 Brakes. Jautzen.
28622 Sliding doors. Brousfield.
28623 Exhaust silencers. Jones.
28624 Malt milling. Gregory.
28625 Needle straightening. Tivendale.
28626 *Telescopes. Zeiss.
28627 Turning leaves of books. Searls.
28628 Gravitation engine. Grimes.
28629 Columns. Thomson.
28630 Stand pipes. Mills.
28631 Sewage tanks. Adams.
28632 Mine cages. Golding.
28633 Mine props. Kirkley.
28634 Flour mill stock. Turner.
28635 Carpet dusting. Siddall.
28636 Reinforced concrete beams. Rylands.
28637 Boxes. Rigby.
28638 Wheels and tyres. Halder.
28639 *Holding open doors. Mullan.
28640 Tyred wheels. Brü.
28641 Washing textile fabrics. Roberts.
28642 Vehicle lamps. Storey.
28643 Boiler furnaces. Holehouse.
28644 *Safety devices. Eichelkrant.
28645 *Shrinking cloth. Houston.
28646 Washing culinary utensils. Pinoli.
28647 Gas heaters. Little.
28648 Submerged vessels. Giusti.
28649 Steam generators. Parr.
28650 Builders' scaffolds. Fuller.
28651 Embroidering. Sawtell.
28652 Screw propellers. Price.
28653 Pipe rust intercepter. Harris.
28654 Cooking apparatus. Sanders.
28655 *Ball bearings. Werke.
28656 Punt guns. Joly.
28657 *Electric switches. Kuhnel.
28658 Tubular frames.
28659 *Meteorolgical instruments. Culley.
28660 Road covering. Bolashauser.
28661 *Electric motors Werke.
28662 Coke ovens. Jones.
28663 Fastening cables. Kackett.
28664 Trouser stretcher. Dennett.
28665 Aerating liquids. Hill.
28666 Valves. Shelley.
28667 New compound. Ferra.
28668 Electric generators. Ferra.
28669 Electric generators. Ferra.
28670 *Aeroplanes. Gaara.
28671 Dyeing and bleaching. Pegg.
28672 Keyboard instruments. Clutsam.
28673 *Propellers. Pinkert.
28674 Skiving leather. Boult.
28675 *Bobins. Wormsed.
28676 Gas lamps. Matlock.
28677 *Dyestuffs. Bloxam.
28678 *Dyestuffs. Bloxam.
28679 *Dyestuffs. Bloxam.
28680 *Dyestuffs. Bloxam.
28681 *Azo-colouring matter. Bloxam.
28682 Fog signalling. Morgan.
28683 *Sawing machines. Wimmer.
28684 Reservoir brushes. Corney.
28685 *Miners' lamps. Goulet.
28686 *Elevation of guns. Schneider.
28687 *Electric transmission. Paul.
28688 *Billiard cues. West.
28689 Valve. Jenkins.
28690 *Aeroplanes. Bablin.
28691 Water heaters. Green.
28692 *Type setting. Pierpont.
28693 Watches and clocks. Moser.
28694 Asphalt blocks. Johnson.
28695 *Electric lighting. Ferguson..
28696 *Turning malt appiiance. Weisenfeld
28697 *Alarm apparatus. Gansinger.
28698 Road suspension arrangements. Walton.
28699 Bombs. McKechnie.
28700 *Electric transmission. Schneider.
28701 Boilers. Scott-King.
28702 Motor car lighting. Simms.
28703 *Water heaters. Ewart.
28704 *Food storage. Montague.
28705 Fish plates. Smeltze.
28706 Knives. Wotherstom.
28707 *Extracting device. Schism.
28708 *Piston rings. Gessellschaft.
28709 Vehicle suspension arrangements. Walton.
28710 Combustion engines. Durtnall.
28711 Gas generating plant. White.
28712 Motor car lighting. Digwood.

DECEMBER 10th, 1910.

28713 Motor cycles. Robson.
28714 Pressure beer displayer. Gravesend.
28715 Point levers. Vellère.
28716 Fire place curbs. Whittle.
28717 Stop valves. Pearson.
28718 Gradometer. Manisty.
28719 Speed gears. Hatton.
28720 Hose pipes. White.
28721 Ejectors. White.
28722 Sash fasteners. Taylor.
28723 Toaster. Lansdown.
28725 Electric lighting. Fleming.
28725 Damping machine. Larsson.
28726 Steam hammers. Massey.
28727 Fans. Richards.
28728 Cot. Neukirch.
28729 Slicing tool. Wall.
28730 Coupling device. Wilson.
28731 Cutting machine. Davies.
28732 Seats. Orme.
28733 Side cars. Gorton.
28734 Indicators. MacAlpine.
28735 Toy. Hough.
28736 Doors. Crossley.
28737 Planimeters. Johnstone.
28738 Grids. Jepson.
28739 Silversmiths' shaping machine. Hall.
28740 Firelighters. Helliwell.
28741 *Hat fasteners. Thompson.
28742 *Printing machines. Albert.
28743 Rules. Homan.
28744 Match box. MacDougal.
28745 Power transmission mechanism. Boyd.
28746 *Iron and steel. Boucher.
28747 Internal-combustion engines. Bowman.
28748 *Concrete laying apparatus. Gascoign.
28749 *Belt fastener and purse. Kammann.
28750 *Staple making machine. Nasmith.
28751 *Horticultural frames. Schmidt.
28752 Electric lamps. Sale.
28753 *Internal-combustion engines. Laurin.
28754 Dynamos. Jurig.
28755 Secondary batteries. Jurig.
28756 Travelling belts. Marshall.
28757 Colouring device. Hewitt.
28758 Drinking troughs. Mansfield.
28759 *Vehicles. Pieper.
28760 Duster. Bell.
28761 *Planing machine. Little.
28762 *Chimney pots. Clegg.
28763 *Gas. Corroll.
28764 *Glass ventilation. Hudson.
28765 Cleansing fluid. Borrill.
28766 Tyres. Shelley.
28767 Handlebars. Bohle.
28768 Liquid polish. Udall.
28769 *Gas purifier. Vanlaer.
28770 Collars. Levy.
28771 Hay fork. David.
28772 Alkaline cyanide solutions. McCall.
28773 *Anhydrous hydrosulphites. Von Heyden.
28774 Roundabouts. Dodds.
28775 Electric fuses. Peace.
28776 Mercerising yarn. Friedrich.
28777 Internal-combustion engines. Richards.
28778 *Aeroplanes. Ramel.
28779 *Cellulose. De la Cellulose.
28780 Ring spinning machines. Sommerhalder.
28781 Anthroquinone dyestuffs. Newton.
28782 Airships. Roenne.
28783 Propellers. Barber.
28784 *Lubricating device. Donaldson.
28785 *Doors. Klock.
28786 *Tyres. Knipp.
28787 *Brooms. Reusch.
28788 Planing machines. Miller.
28789 Corrugated sheets. Thompson.
28790 Boilers. Fraser.
28791 Switches. Venner.
28792 Tyres. Wilk.
28793 Electric horns. Davy.
28794 Vessels. Blaubach.
28795 Vessels. Blaubach.

DECEMBER 12th, 1910.

29796 Soap cooling machine. Widdowson.
28797 Match boxes. Williams.
28798 Signs. Alabaster.
28799 Beehives. Bailey.
28800 Tyres. Strong.
28801 Frame clamp. Irwood.
28802 Coupling and buffer. Foster.
28803 Compressers. Alquist.
28804 Gears. Alquist.
28805 Tyres. Price.
28806 Small arms. Baker.
28807 Ferrules. Sticht.
28808 Lamps. Railing.
28809 Reflecting mirrors. Eltringham.

28810 Hammers. Lord.
28811 *Poultry house device. Perret.
28812 Brackets. Morgan.
28813 Pictures. Lulticke.
28814 Ore discharger. Donaldson.
28815 Silent exhaust system. Cole.
28816 Screw drivers. Soxon.
28817 Calculating machines. Debenbaug.
28818 Gas apparatus. Cox.
28819 Carburetters. De Beer.
28820 Arc lamp device. Mason.
28821 Game. Westcott.
28822 *Lacing device. Hennessey.
28823 Sharpening tool. Tilden.
28824 *Indicator. Tschirpig.
28825 *Paper machines. Nind.
28826 Bottle machines. Whitehouse.
28827 *Plate device. Reichwald.
28828 *Planing machines. Smith.
28829 *Wagon. Heidenheimer.
28830 *Bottle making machines. Brown.
28831 Organic substances. Wellcome.
28832 Tyre inflators. Rowland.
28833 *Filtration practice. Chesebrough.
28834 *Electric insulators. Rasonussen.
28835 *Wheels. Harvey.
28836 *Street coverings. Wiedemann.
28837 Coal plate. Burley.
28838 Ranges. Burley.
28839 *Concentrated acetic acid. Behrens.
28840 *Multifuse cut-outs. Romen.
28841 *Bed pans. Howdard.
28842 *Tobacco pipes. Grundel.
28843 Electric transmitters. Osborne.
28844 Wood-morking machine. Dunbar.
28845 Speed indicators. Tomlinson.
28846 Engine. Moon.,
28847 Extracting device. Walpole.
28848 Cellulose. Snowden.
28849 *Bookbinding device. Hoyt.
28850 *Windows. Henderson.
28851 *Composite packing. Barton.
28852 Latrines. Kent.
28853 Lavatory seats. Kent.
28854 Airships. Wulffing.
28855 Gas. Glasgow.
28856 *Opening envelopes. Reis.
28857 *Box covering machines. Nasmith.
28858 Curtain suspenders. Quelch.
28859 Folding furniture. Peters.
28860 Lamps. Lowden.
28861 *Box seat. Schuh.
28862 *Colouring device. Redlich.
28863 Tyres. Crossley.
28864 Valves. Wharton.
28865 Recreation devices. Lynch.
28866 *Utilising heat device. Carriere.
28867 *Tube manufacture. Derain.
28868 *Hook and eye machine. Smith.
28869 *Wheels. Ellis.
28870 *Scaffolding. Withers.
28871 *Manufacture of acids.
28872 *Manufacture of acids.
28873 Cleaning boots. Pilliner.
28874 Outlet valves. Finney.
28875 Receptacles for fluids. . Saunders.
28876 Crackers. Crockford.
28877 *Filing appliances. Jensen.
28878 *Filing appliances. Jensen.
28879 *Clutches.
28880 *Door fastening.
28881 Clocks. Creese.
28882 Speed gears. Beresford.
28883 *Vehicle device.
28884 *Meter. Besancon.
28885 *Meter mechanism. Besancon.
28886 *Disc ploughs. Fowler.
28887 Holding type device. Long.
28888 Arc lamps. Michott.
28889 *Air-tight closures. De Hipt.
28890 *Valve. Stewart.
28891 Tube manufacture. Astfalck.
28892 *Condenser. Moore.
28893 *Mats and rugs. Nichols.
28894 *Screw propellers. White.
28895 *Stand device. Kunst.
28896 *Clothing. Harmasch.

DECEMBER 13th, 1910.

28897 Football protector. Ward.
28898 Cycling device. O'Callaghan.
28899 Physical process. Phillips.
28900 Tyres.
28901 Household device. Herbert.
28902 Yarn winding device. Metcalfe.
28903 Hackling machines. Kennedy.
28904 Lathes. Moon.
28905 Cranes. James-Carrington.
28906 Fork and grille. Meager.
28907 *Aerial motor car. Walker.
28908 Speed gears. Marfell.
28909 Tool sharpener. Collings.
28910 Bedsteads. Moore.
28911 Screw dies. Perry.
28912 Pulleys. Crowther.
28913 Carding engines. Holland.
28914 Ball bearing device. Adams.
28915 Chemical apparatus. Chambers.
28916 Tyres. Smye.
28917 Punching ball. Campball.
28918 Artificial teeth. Attenborough.
28919 Stone-sawing machines. Pritchard.
28920 Horse shoe. Beall.
28921 Ranges. Parker.
28922 *Gas apparatus. Senior.
28923 *Textile machinery. Atkinson.
28924 Weaving looms. Klein.
28925 Evaporating apparatus. Studer.
28926 Photo-copying machine. Dixon.
28927 Separating settling tanks. Reid.
28928 *Stencilling machines. Underwood.
28929 Fuel. Wainwright.
28930 Turbine. Sayers.
28931 *Controlling systems.
28932 Concentrator belt. Wilson.
28933 *Gases.
28934 Locks. Marchant.
28935 Carburetters. Longford.
28936 Rotary internal-combustion engines. Currin.
28937 Camera lenses. Davis.
28938 Inlet traps. Hazard.
28939 *Insulators.
28940 *Couplings.
28941 *Distilling retorts. Bolz.
28942 *Distilling retorts. Bolz.
28943 *Incandescent gas mantles. Cohn.
28944 *Presses. Milne.
28945 *Paper. Klaber.
28946 Bottles. Thorne.
28947 Even driving device. Jackson.
28948 *Acetylene burner.
28949 *Lamp holder. Ingham.
28950 Alarm device. Sadowski.
28951 Window blinds. Kring.
28952 *Gases.
28953 Metals. Wintle.
28954 Excavating apparatus. Gibbs.
28955 Bricks. Brooke.
28956 Taps. Woodhall.
28957 Ranges. Evers.
28958 Sugar. Browne.
28959 Gas burners. Koerner.
28960 *Display packages. Glidden.
28961 Davits. Welin.
28962 *Collision mats. Beart.
28963 Couplings. Zijl.
28964 *Tools. Lake.
28965 Oil fuel burners. Fletcher.
28966 Internal-combustion engines. Kellaway.
28967 Tyres. Daniel.
28968 *Lighting device. Boult.
28969 Liquid coating device. Adnitt.
28970 *Basins. Mellowes.
28971 Pianos. Atkinson.
28972 Ovens. Callow.
28973 *Controlling system. Wirth.
28974 Lamp. Thompson.
28975 *Tyres. Loebinger.
28976 Non-smoke escape device. Thomas.
28977 *Perforating machine.
28978 Fire alarms. McNeil.
28979 *Wheels. Moser.
28980 Condensers. Parsons.
28981 *Water heaters. Stroganoff.
28982 *Furnaces. Bernhardt.
28983 *Spark arrester.
28984 Treatment of smoke. Lennox,
28985 Sewing machines. Boult.
28986 Electric batteries. Russell.
28987 Carburetters. Jones.
28988 Valves. Abbott.
28989 Hatpins. Dove.
28990 Jewellery attachment. Shaw.

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28991 Mercury vapour lamps. Salisbury.
28992 *Sewing machines. Fairweather.
28993 Cheese warping machine. Ashton.
28994 Electric current gauges. Trisby.
28995 Tar macadam. Thompson.
28996 Walls. Thomson.
28997 Wheels. Sykes.
28998 Printing machines. Cossar.
28999 Device for securing covers. Smith.
29000 Hose pipes. Hall.
29001 Bending machines. Watts.
29002 Paper machines. Martin.
29003 Wardrobe hangers. James.
29004 Cigarette packing machine. Rogers.
29005 Electric bells. Dixon.
29006 Curtain rod holders. Russell.
29007 Type line casting machines. Castle.
29008 Business books. French.
29009 Gas meters. Wibberley.
29010 Oxygen gas generator. Smith.
29011 Carding machines. Sime.
29012 *Door indicators. Strittles.
29013 Drying cylinders. Parker.
29014 Spinning mules. Whitehead.
29015 Gas and liquor treating apparatus. Walker.
29016 Superheaters. Leask.
29017 *Dust prevention device. Leask.
29018 *Dust prevention device. Leask.
29019 Treatment of carbonaceous substances. Moore.
29020 Cycle device. Bond.
29021 Ratchet spanners. Thomas.
29022 Lubricating device. Ruckstuhl.
29023 Garment. Miller.
29024 Lace machine jacquards. Jardine.
29025 Lace machines. Jardine.
29026 Knitting machines. Spiers.
29027 Cycle lighting device. Madaler.
29028 Advertising devices. Pryor.
29029 Dust removing apparatus. Whitfield.
29030 Photographic device. Friedl.
29031 Coffee pots. Ayres.
28032 Pins. Wicking.
29033 *Tools. Gibson.
29034 *Music device. Streich.
29035 Wheels. Boult.
29036 Glove measuring device. White.
29037 Gas holders. Pickering.
29038 *Candle extinguisher. Jacob.
29039 *Pen. Jacob.
29040 Umbrella. Schleser.
29041 *Spanner. Albrecht.
29042 Nut crackers. Cohn.
29043 Separating device. Cohn.
29044 *Grinding machine. Schmidt.
29045 Wheels. Wall.
29046 *Cellulose thread manufacture.
29047 Gas generators. Salsbury.
29048 Egg cup. Williams.
29049 *Paper machine. Graves.
29050 Fire escape. Marshall.
29051 *Bottle sealing device. Wetmore.
29052 Magnetic separators. Thompson.
29053 *Cycles. Bohle.
29054 Insect destruction device. Grégr.
29055 Rock drills. Treckmann.
29056 Winch device. Sieurin.
29057 *Loom shuttles. Steier.
29058 *Typographic casting machines. Harrison.
29059 Candles. Robbins.
29060 Tool. Bray.
29061 *Concentrating liquid device. Kestner.
29062 *Dustless removal device. Schultz.
29063 *Feeding vessels. Nathan.
29064 Curtain carriers. Troman.
29065 Cycle device. Price.
29066 Pulleys. Titley.
29067 Hooks and eyes. Newey.
29068 *Moulding presses. Boult.
29069 Millstones. Pohjanpals.
29070 Circular saws. Pohjanpals.
29071 *Malt. Winde.
29072 Game. Bouracier.
29073 *Acetylene. Johnson.
29074 Cycle device. Stewart.
29075 Horn manufacture. Cox.
29076 *Stud.
29077 *Trains. Reik.
29078 Governors. Jackson.
29079 *Massage device. Hartle.
29080 *Incinerators. Haddan.
29081 *Pipe union. Kühn.
29082 Flying machines. Lennox.
29083 *Instep support. Connell.
29084 Aluminium. Selijman.
29085 *Boxes. Nasmith.
29086 Internal-combustion engines. Lewthwaite.
29087 *Wood pulp. Stanley.
29088 Photographic device. Whitehead.
29089 *Burnishing machines. Richardson.
29090 Envelopes. Evans.
29091 Ladder. Tipping.
29092 Actinic ray apparatus. Perkin.
29093 *Speed gear. Cheneaux.
29094 Zinc. Pollitt.
29095 Couplings. Sunney.
29096 Tyres. Carlile.

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29097 Pyrometers. Foster.
29098 Tailors' dummies. Keyte.
29099 Safety locking device. Nicholls.
29100 Printing apparatus. Helliwell.
29101 Umbrellas. Potter.
29102 Revolving distributors. Adams.
29103 Sash bar joints. Hawken.
29104 Pins. Baker.
29105 Lamps. Howells.
29106 Cycle seats. Brooks.
29107 Holding device. Hodgson.
29108 Ticket holder. Barnett.
29109 Trucks. Wadsworth.
29110 Driving belts. Blythe.
29111 Motor hoods. Nicholson.
29112 Tobacco boxes. Baker.
29113 Dividing machine. Jackson.
29114 Electric wire device. Harris.
29115 Buttons. Edkins.
29116 Game. Barker.
29117 Tyres. Doran.
29118 Moulding device. Taylor.
29119 Clutch gearing. Spence.
29120 Dynamo electric machine. Kahn.
29121 Tiles. Greenwood.
29122 Electric current device. Hope.
29123 Air pumps. Quiggin.
29124 *Turbine regulating device. Banner.
29125 *Controlling device for electric light switches. Schiedemann.
29126 Tyres. Wilks.
29127 Motor cycle device. Hall.
29128 Jacks. Robertson.
29129 Display stands. Hamilton.
29130 Pencils. Sterren.
29131 Water-tube boiler device. Bennett.
29132 *Point mechanism. Pawel.

29133 *Tool sharpener. Newman.
29134 *Roller skates. Zverina.
29135 *Pressure gauges. Schweinert.
29136 *Can head device. Ellis.
29137 Ticket collecting device. Clifford.
29138 Binding device. Whitby.
29139 Waste preventers. Spurge.
29140 Flywheels. Miller.
29141 Non-waste candle device. Richardson.
29142 Snap fasteners. Hayes.
29143 Dyestuffs. Newton.
29144 Target. Kent.
29145 *Distilling vessels. Porges.
29146 *Car fenders. Hagan.
29147 *Improved baking device. Oetker.
29148 *Airship steering device. Oetker
29149 *Nut locks. Harvey.
29150 *Game apparatus. Jervis.
29151 Motor cycles. Reilly.
29152 Luncheon basket lining. Strong.
29153 Scaffolding. Schärer.
29154 Decorating devices. Ramsey.
29155 Chairs. Sears.
29156 Rifles.
29157 *Lathes. Potter.
29158 *Level gear tools. Potter.
29159 *Water tube boilers. Gerald.
29160 Distributing sand device. Davey.
29161 Electrical machines. Williamson.
29162 Boots. Loewenthal.
29163 Gas burners. Tooth.
29164 Knives. Pape.
29165 *Formates. Dubose.
29166 *Aeroplanes. Singer.
29167 *Disc plough. Fowler.
29168 Electric transmission of power.
29169 Carburetters. Cloudsley.
29170 Condensing vapour device. McCowan.
29171 *Rug fasteners. Williams.
29172 Stentering machine lips. Whitley.
29173 Tyres. Pryor.
29174 Gas retorts. Bird.
29175 *Flying machines. Drexler.
29176 *Clay cleansing apparatus. Bohn.
29177 *Hose reels. Montgomery.
29178 *Holding means. Turton.
29179 *Nut locks. Norlund.
29180 *Automobile construction. Walker.
29181 Tube connections. Myersons.
29182 Telephone receivers. Dicker.
29183 Hair curling machine. Sumner.
29184 *Aluminium bronze. Durville.
29185 Moving picture and talking machines. Donisthorpe.
29186 Separating apparatus. Sutcliffe.
29187 Separating apparatus. Sutcliffe.
29188 Separating dust device. Sutcliffe.
29189 Fuel. Allen.
29190 Index files. Longbottom.
29191 Heating device. Poullet.
29192 Couplings. Skaife.
29193 *Vacuum steam engines. Comstock.
29194 Gas manufacture. Johnston.
29195 Gears. Sheppard.
29196 *Cleaning gas. Brassert.
29197 *Braiding machine device. Wardwell.
29198 *Registering device. Arquint.
29199 *Cars. King.
29200 Winding machines. Watson.
29201 Tobacco machine. Platt.
29202 *Centrifugal fans. Eatwell.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

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The following Accepted Applications for Patents are open to Opposition up to January 23rd, 1911, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

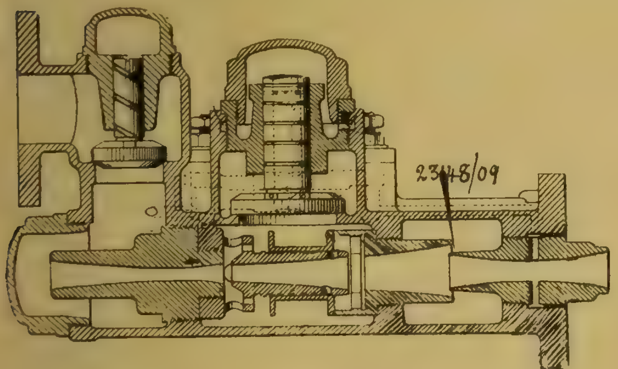
Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

18046 Queate and Todd: Tap for measuring and registering liquids delivered. [Post-dated February 7th, 1910.] 18672 Plant: Heeling machines. 18831 Seget: Semaphore signals for railway signalling. 18896 Kaufmann: Process of making organic antimony compounds. [Date applied for under International Convention, August 18th, 1908. Samples furnished under Section 2 of the Act.] 20183 Barclay and Barclay: Means for preventing the overwinding of pit cages. [Post-dated March 3rd, 1910.] 20854 Murphy and Bett: Propulsion of aeroplanes. 22347 Davy: Rotary engines. [Post-dated March 24th, 1910.] 22994 Barton: Reading desks. [Post-dated April 8th, 1910.]

23148 Brooke: Steam injectors.

This invention relates to injectors having an overflow valve adapted to be closed, or, after having been closed, to be maintained closed whilst the injector is at work by the pressure of a fluid acting thereon, and it has for its object to utilise the pressure of steam that is reduced in value compared with that entering the steam nozzle for controlling the operation of the overflow valve, the steam of reduced pressure acting primarily to prevent the valve being closed when not required, to hold the valve open when required, or to close the valve and hold it closed. The invention can be carried into effect in many different ways and applied with but slight constructional alterations to various existing types of injectors, as well as to specially constructed injectors. For example, this steam pressure may act to close the overflow valve when the injector is working, if not already closed, by being admitted to a pressure chamber containing a piston or diaphragm directly or indirectly connected to or engaging the overflow valve, the admission of steam to such chamber being prevented whilst the injector is starting and being effected automatically as soon as the pressure in the delivery or discharge chamber of the injector attains the working value for which the injector is designed.

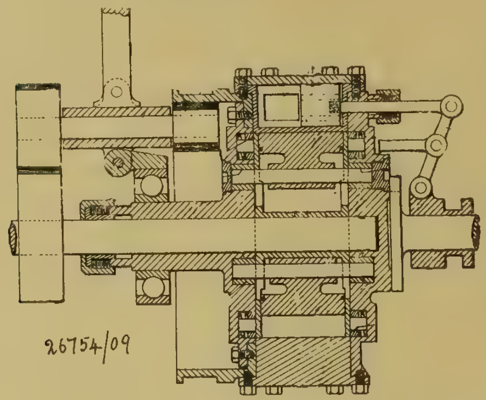


23748 Koenig: Purifiers and like machines used in milling. 25961 Liney: Clips and cards for use as toy building elements. 25993 Harrison: Gas and air-tight joints for furnaces and other structures. 26049 Galt and Marx: Paper-making machines. [Cognate Application. 11428, 1910.] 26067 Judge: Manf. of helically constructed metallic tube and the machinery employed therein. 26084 Moseley, Blick, and David Moseley and Sons Ltd.: Indiarubber or like water bottles and valves therefor. 26092 Young: Driving gear for the strainers of paper-making machines. 26097 Love: Method of propelling and steering aerial and marine vessels. 26113 De Fries: Process for finishing the lateral surfaces of short round, square, or polygonal articles, such as nuts and the heads of screws, bolts, spikes, and the like. 26133 Timmins: Vapour engines. 26167 Pace, Lamkin, and Hunter: Writing implements and the like. [Cognate Application. 2060, 1910.] 26168 Bond: Utilisation of whey for dietetic purposes. 26169 Grice: Suction or other gas producers. 26172 Cattee and Leak: Otter board for trawling gear. 26175 Pope: Means for making lead oxide. 26225 Gail: Machines for making chain for use in the construction of wire fabrics. 26236 Sargeant: Machinery for scarfing or cutting to a slope the ends of leather strips which are to be joined one to another and for roughening the surface of such sloping cuts. 26237 Greenhill: Printing and machinery therefor. 26264 Ormandy and Kay: Manf. of borax, soap, soap powder, soda crystals, soda ash, carbosil, and other articles of a similar nature so as to make them commercially more valuable or less liable to set into a hard mass. 26274 White (Taylor): Screw propellers. 26290 Gough and Preston: Automatic tensioning of suspension seats or saddles. 26294 Alexander: Axle joints of soup tureens, entrée dishes, and the like vessels. 26300 Cook and Charnock: Roving and the like frames. 26309 West and Lewis: Kilns or ovens for use in connection with the firing of bricks, tiles, pipes, china, and such like ceramic ware. 26342 Maurer: Process for fixing machines, parts of same, and other objects to the floor. [Date applied for under International Convention, April 15th, 1909.] 26376 Schwarz: Heat accumulators. [Application for Patent of Addition to 3881, 1908.] 26377 McDonald: Projectiles. [Date applied for under International Convention, February 9th, 1909.[26378 Gail: Machines for manufacturing wire fabric. 26395 Brothers: Ice skating rinks. 26406 Macfarlane: Electrically-driven centrifugal machines. [Cognate Application. 5178, 1910.] 26412 Schlenther: Spray carburetters for internal-combustion engines. 26428 Jones: Treatment of gases from coke ovens or gas retorts. 26453 Mirus: Typewriters. 26464 Fairweather (Elliott-Fisher Co.): Ink ribbon mechanism for typewriting machines. 26480 Justice (Plant): Sole-rounding machines. 26484 Campbell and Campbell: Valves and cocks. 26494 Riechelmann: Process for the metallic moulding of natural objects. 26495 Haffner: Furniture springs. 26497

Longbottom and Holt: Loom apparatus for producing patterns or effects in the weaving of fabrics. 26506 Miller: Collar or shirt stud. 26523 Percy: Skating rinks and tracks and appliances and the like for use in conjunction therewith. [Cognate Application. 11925, 1910.] 26531 Mavor and Coulson Ltd., and Mavor: Gravity conveyers for use on inclined workings in mines particularly adapted for use in mining coal. 26551 Johnson: Process and apparatus for the production of steel. 26563 Ricardo: Internal-combustion engines. 26567 Hensen: Propelling mechanism for airships. 26571 Seckington and Cutchey: Way-bill box or holder particularly for recording information relating to tickets issued on railways, tramways, and the like. 26576 Marks (McKinnon): Valves of internal-combustion engines. 26593 Dunn: Air tubes of pneumatic tyres. [Cognate Application. 29515, 1909.] 26597 Lake (Healy): Machinery for making wire-bound box blanks. 26604 Rees: Wedge for splitting coal and other substances. [Post-dated February 7th, 1910.] 26633 Richardson: Means of utilising liquid air as a motive power. 26650 Foster: Cleaning device for the barrels of firearms and for other tubes. 26659 Taylor: One or single trigger mechanism for double-barrel breach-loading small arms. 26683 Preston: Galvanic batteries. 26700 Bloxam (Akt.-Ges. fur Anilin Fabrikation): Manf of azo-dyes directly dyeing cotton. 26712 Akt.-Ges. Brown, Boveri, and Cie.: Steam or gas turbine. [Date applied for under International Convention, February 4th, 1909.] 26720 Hewitt and Davy: Bodies of motor cars and the like. 26741 Greenslade: Toilet or sanitary paper.

26754 Vincent and Harrison: Hydraulic clutches.

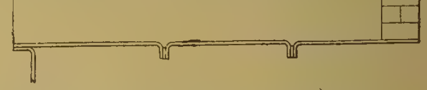
This invention relates to apparatus in which power is created by a suitable rotary pump, which pump will be working in oil, water, or any suitable medium and within a sealed case. The fluid or other desired medium is caused to operate in such manner that, when desired, the sealed case rotates at a speed varying from the speed of the pump within, thus the case is controlled so as to form a clutch, or otherwise may run in unison with the pump. The invention consists of a metal case of any desired shape in two or any desired number of parts designed suitably for the housing of a rotary pump. Means are adopted for allowing the shaft to pass through one side of the case and through pump and into the inner side of corresponding side case to form suitable bearings. Another shaft is cast on, or attached to outer side of above-mentioned case, to carry the case, consequently the power transmitted into the case by means of the pump within is further transmitted to the shaft. The case contains adjustable shoes or cut-offs to divide the pressure side from vacuum side. A suitable valve is fixed within the case, or it may be attached to outside of case if desired, and operated to regulate the flow from pressure side to vacuum side, the fluid or other medium passing through the valve and passage arranged within or without the case to do this. The valve is operated without by means of a lever connected to a loose collar on shaft having suitable grooves to engage valve lever, whilst another lever is arranged to engage in separate groove in the collar to operate the latter by giving it a sliding motion on shaft. This motion is conveyed through lever to valve, thus regulating the pressure within the case.



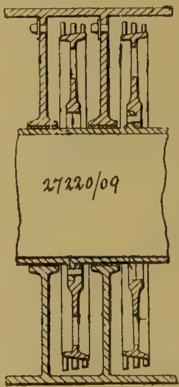
26768 Mackintosh and Walton: Combination tool for military and other purposes. 26802 Cooper, and British United Shoe Machinery Co.: Machines for compressing heels or the like. 26816 Bruhn: Combined apparatus for indicating fares and extras in taxameters. 26817 Bruhn: Apparatus for preventing overrunning of the cam wheel which controls the operation of the indicating discs in taximeters. 26818 S. M. Car Syndicate and Shave: Liquid fuel burners. [Cognate Application. 10921, 1910.] 26828 Fairweather (Underwood Typewriter Co.): Sheet-feeding devices for stencilling machines. [Request under Section 19 of the Act not granted.] 26848 Imrie (Schleifmaschinen-Verwertungs Ges.): Devices for grinding artificial granite or stone slabs and the like. 26888 Cowper-Coles: Construction of lamps. 26893 Montgomery: Side carriages for use with cycles or motor cycles. 26899 Bourne: "Four-way" and "off" electric light switch. 26915 Gohy: Loom harness operating mechanism. 26937 Robinson: Steering and driving arrangement suitable for garden and road rollers.

26953 Neil: Furnace grates of steam generators.

This invention relates to improvements in or connected with furnaces of steam generators of a type furnished with rocking firebars. In furnishing a furnace with a grate according to this invention, a frame is fitted within the furnace and supported so as to be free to expand longitudinally therein, the rocking firebars being mounted within the frame. In one form of construction the frame comprises a head, two side members, and a foot. This frame is set within the furnace with its head extending transversely across the front thereof, and is supported, for example, at its head and at its foot upon brackets projecting from the sides of the furnace, the head of the frame being preferably fixed to the face plate of the furnace, and its foot arranged to stand clear of but adjacent to the face of the fire bridge. By this arrangement longitudinal expansion will cause the frame to extend from its head and slide on its bracket supports towards the bridge. In construction the side members of the frame may be formed in separate parts, and the head and foot may extend between and be attached to lugs formed on the side members.



26964 Robert Dempster and Sons Ltd., and Toogood: Gas holders. 26972 Galloway and Wilson: Mechanism for actuating the valves of internal-combustion engines. 27057 Burton: Pumps. 27062 Webster and Lane: Apparatus for suspending painters' cradles and the like on the exterior of buildings. 27082 Murphy and Bett: Aeroplanes. [Application for Patent of Addition to 20854, 1909.] 27132 Johnson (Chemische Fabrik Griesheim Elektron): Melting and casting magnesium and alloys thereof. 27134 Baker and Boulnois: Machine for filling bags with tea or other loose material and closing the bags. 27147 Beldam: Pneumatic tyres. 27151 Shipman: Apparatus for displaying and exhibiting objects and scenic effects. 27176 Marsh: Apparatus for exhausting and removing dust and other light matter from carpets, floors, and the like. [Cognate Application. 7514, 1910.] 27217 Akt.-Ges. Brown, Boveri, and Cie.: Steam turbine blades made from pure iron and nickel. [Date applied for under International Convention, February



4th. 1909.] 27219 Akt.-Ges. Brown, Boveri, and Cie.: Stuffing box for steam or gas turbines. [Date applied for under International Convention, March 8th, 1909.]

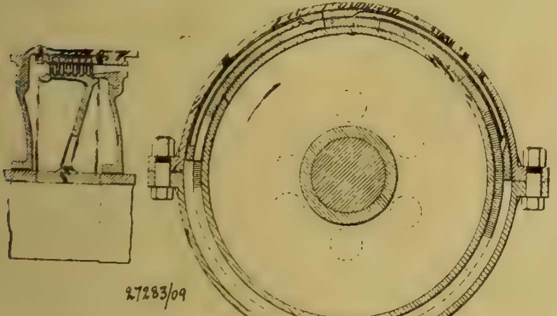
27220 **Akt.-Ges. Brown, Boveri, and Cie.**: Steam or gas turbines with disc wheels. [Date applied for under International Convention, March 26th, 1909.]

This invention relates to fastening or securing steam or gas turbine wheels, and its object is to connect the separate wheels with a drum or a shaft in a simpler and less expensive manner than was possible hitherto. For this purpose the invention consists in providing at given distances along the drum or shaft of the turbine a number of projecting flanges corresponding to the number of wheels to be attached to the drum or shaft, one or more ring sector portions of each flange being cut away, while each wheel is formed with an inward step extending circumferentially around one side of the wheel nave, and the remaining flange on the other side of the nave is cut away so that the cut out portions are preferably staggered in relation to those on the adjacent flange of the drum or shaft.

27249 Gwynne: Manf. of tin and terne plates. 27254 Browne: Surgical appliances for collecting discharges.

27283 Parsons and Cook: Turbines.

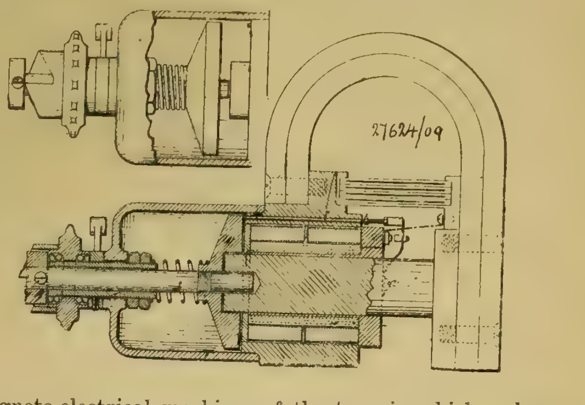
This invention relates to compound turbines of the type in which the steam is allowed to flow through a segmental portion only of the annulus between the wheel carrying the rotating blades and the casing carrying the fixed blades and in which the velocity of the steam through the successive rows of guide blades and rotating blades is maintained chiefly or entirely by dropping pressure small amounts at a time, as occurs, for instance, in the well-known Parsons type of blading, these small drops of pressure occurring in the fixed guide blades and/or rotating blades. The invention consists broadly in withdrawing steam from the rotating blades during their passage through one set of short end blockings and delivering it to the blades when passing through another set of short end blockings whereby increased economy is obtained. The invention also consists for this purpose in connecting the spaces between adjacent short end blockings one one side of an impingement zone by means of one or more passages with the spaces between adjacent short end blockings on the other side of the same impingement zone. By this means when the pressure of the steam in the impingement zone is higher than the pressure existing in the chamber, part of the volume of dense steam held between the rotating blades and which would otherwise enter the chamber is transferred through this passage and caused to fill up the blades which are running into the impingement zone from the chamber where the lower pressure exists. In the case when the impingement zone is at a lower pressure than the chamber, part of the volume of denser steam held in the rotating blades about to enter the impingement zone is transferred through this passage and caused to enter the blades again as they leave the impingement zone and are about to re-enter the chamber. Thus a certain amount of steam which would otherwise be carried over from the impingement zone into the lower pressure chamber or from the chamber into a lower pressure impingement zone and consequently lost, is being continuously restored to the part of higher pressure.



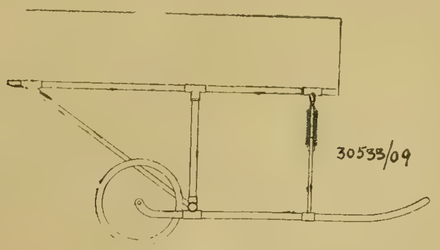
27449 Edan: Game. [Date applied for under International Convention, November 26th, 1908.] 27464 Ormandy and Higgins: Packages for soap and similar materials liable to damage from extraneous moisture or liable in themselves to lose moisture.

27624 Turner and Fenwick: Magneto-electrical machine.

This invention relates to an improved construction of magneto-electrical machine and accessories therefor, and its object is mainly a construction of magneto on the "homo-polar" principle and an arrangement of inductor, contact breaker, condenser, advance and retard device, etc., whereby are overcome many of the drawbacks common to magneto-electrical machines of the type in which a horseshoe magnet and a Siemens H or shuttle armature are used. The invention consists essentially in the provision of a field magnet, consisting of a fixed inner pole and a fixed outer concentric pole, and wherein the induction coil or coils, which are also stationary, are situated in the inter-polar space.



27868 Rose and Bellamy: Inverted incandescent gas burners. 27882 Dufty: House and other firegrates. 28051 Henriod: Internal-combustion engines. [Date applied for under International Convention, December 5th, 1908.] 28091 Mackay: Apparatus for indicating the trim of a ship, vessel, or the like. 28152 Lane and Sharp: Wheels for vehicles. 28185 Thomlinson and Thomlinson: Hatpins for ladies. 28259 Stockall and Ireland: Time recorders especially applicable for checking workmen and the like. [Post-dated June 3rd, 1910.] 28393 Bedford, Bedford, and Kirk: Fabric or material for clothing rollers used in spinning for the drawing of textile fibres. 28455 Persson and Hanson: Coaster brake hub for bicycles. 28471 Dunn, Nuttall, and Scrouther: Radiators for water cooling and similar services. 28804 Siemens Bros. Dynamo Works, and Holmes: Electrical propulsion of ships. 28827 Simpson: Hatpins and the like. [Post-dated June 2nd, 1910.] 28859 Thorn: Baking tin. 28903 Hoskins and Sewell Ltd., and Coleman: Distensible bedsteads, berths, and the like. 28984 Heath and Whittam: Carding engines. 29505 Hutchinson and Reynolds: Method and apparatus for selecting and separating granular bodies. [Cognate Applications. 10700, 1910, and 13926, 1910.] 29506 Bonnella and Bonnella: Wall and like plugs for electrical connections. 29515. *See* 26593, 1909. 29756 Gerstberger: Brake or tension apparatus for threads for use in winding and warping machines and the like. 29908 Tweedale, and Tweedales and Smalley Ltd.: Driving apparatus of ring-spinning frames. 30066 Falk, Stadelmann, and Co., and Elliott: Burners for incandescent gas lighting. 30090 Auger: Apparatus for attaching strips of fabric to the edges of sheets of paper, cardboard, and the like. [Date applied for under International Convention, December 24th, 1908.] 30207 Mathison and Wyatt: Gratings or screens for road gullies, sewer and drain traps, rain water inlets, and catchpits. 30261 Riley: Ladies' riding coats and mackintoshes. 30308 McKean: Stop motion for winding machines for yarns, threads, and the like. 30387 Keith and Keith: Pressure-regulating devices for controlling the supply of gas to gas burners. [Cognate Application. 11269, 1910.]



30533 Blackburn: Landing devices for aerial machines.

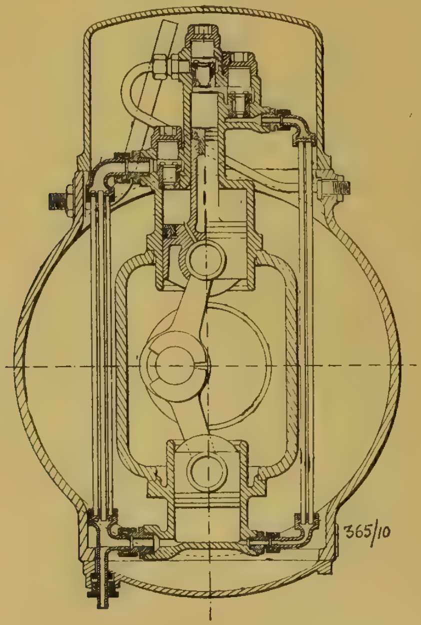
This invention relates to landing devices for aerial machines, and the object of the invention is to avoid or greatly minimise these risks and the consequent damage. For this purpose the bearings for the carrying wheels of the car or "fuselage" are placed at one end of a two-armed lever or levers, which latter is or are hinged most conveniently below or about the bottom of the front of the fuselage. The opposite or rear arm of the lever or levers is formed as a drag or ground brake, technically termed the skid, for which purpose the extreme end may be formed with a slight upward curve or bend. The skid is connected to a spring, conveniently a long rubber spring, which tends to lift up the arm and normally to keep the lever in a horizontal position, so that this end of the car is carried from the ground fully supported on the wheel or wheels.

1910.

110 Phillips: Lamps for cycles, motor cycles, and the like. 121 Kupfer and Mutter: Apparatus for heating, cooking, and storing food. 122 Reeck: Door and like checks. 137 Frommer: Automatic firearms. [Date applied for under International Convention, January 21st, 1909.] 144 Kessing: Pipe wrench or spanner. 227 White: Drying machines for wool and other fibres, textile materials, and the like. 328 Corbett and Goldsmith: Cleaning apparatus for turnips or other roots.

365 Reavell and Co., Reavell and Jones: Multi-stage machines for compressing air and other elastic fluids.

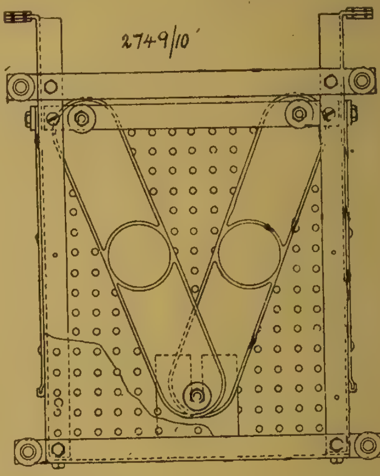
This invention relates to apparatus for compressing air or other elastic fluids in three or more stages, and its object is to simplify the construction and increase the efficiency of such apparatus. According to this invention the second or other cylinder of even number in the series is constructed without any inlet or outlet valves, the supply and delivery pipes communicating freely with the interior of the cylinder, so that the cylinder is always in free communication with the intercooler on ether side. Consequently during the compression stroke of the piston the two intercoolers form part of the compression space, the air is compressed therein, and consequently effective cooling takes place during compression, since the intercoolers consist of thin-walled pipes surrounded by water (though they might be air cooled). It will be understood that at the end of the compression stroke a portion of the air compressed and cooled in the intercooler on the delivery side enters the next cylinder in the series. During the subsequent return or suction stroke of the piston the air remaining in the intercoolers expands against the piston, thereby returning to it a portion of the work done during the compression stroke.



530 Peters: Band-sawing machines. 558 Marks (Soc. Anon. des Plieuses Automatiques): Machine for folding paper upon forms for shaping paper boxes. 561 Wessbecher: Method of connecting tubes. 582 Magee and Adair: Apparatus for generating motive power from the natural flow of water in streams, rivers, or the like. 640 Glover: Gas or oil lamps. 752 Nash, and Western Electric Co.: Electric magnetic relays. 762 Hughes: Apparatus for controlling aeronautical machines. 904 Ahronsberg: Receptacle for containing jewels, perfumes, pins, and other articles. 1021 Ingle: Production of preparations for use in the manf. of floor coverings, insulating materials, and the like. 1695 Thalimer: Attaching means for price tags and the like. 1724 Rose and Bellamy: Means for regulating the gas supply to incandescent and other gas burners. 1928 Fazan: Tin for warming preserved meat, fruit, soup, and the like. 1952 Smillie: Drawing compasses. 2039 Marks (Maxim): Explosives. 2060. *See* 26167, 1909. 2077 Kruger: Wedge-expanding device. 2198 Halford: Blouse and skirt holders. 2229 Clarke and Litchfield: Devices for operating sliding windows. 2355 Winter: Mudguard for road vehicles. 2412 Boult (Ford): Printing presses. 2513 Tate: Art of rejuvenating storage batteries. 2520 Justice (Veeder-Manufacturing Co.): Counting apparatus. 2557 Wells and Spry: Construction of bottle and cork to fit same to act as a check against fraudulent refilling. 2738 Niedballa: Mortise locks.

2749 Adams Manufacturing Co. (Cutler Hammer Manufacturing Co.): Rheostats.

This invention relates to rheostats, and particularly to resistance units, and to the method of mounting the same. The invention consists essentially of a plurality of elongated resistance plates mounted as regards their lower extremities on a common centre and thence inclined obliquely and alternately in opposite directions. The employment of resistance plates composed of strips of thin resistance material which extend in a straight line between their points of connection and whereof the edges are beaded or reinforced, and spacing resistance plates, consisting in forming their terminals with grooves and outwardly spreading the inner wall of each such groove so as to grip a collar formed or provided on the resistance plate.

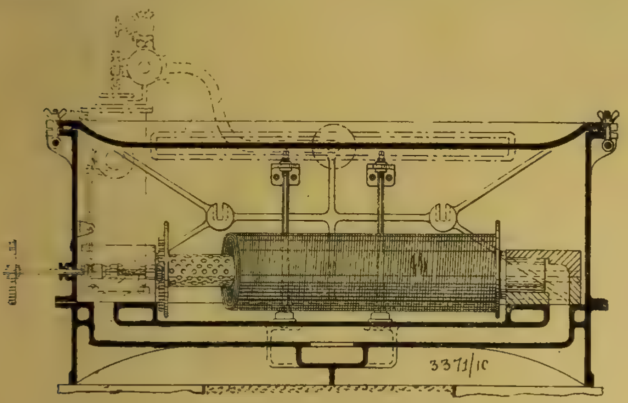


2794 Pike: Lifting dogs. 2847 Rowland, Hutchinson, and Wainwright: Conveying belts. 2919 Becks, and Handicrafts Ltd.: Fret sawing machines. 3080 Dewrance: Means applicable for use in lubricating. 3106 Mackenzie (Westmoreland Automatic Machine Co.): Boot and shoe-polishing machines. 3205 Tennant: Fishing reels. 3243 Fitzgerald: Appliances for raising, lowering, and regulating the depth attained by diving bells and the like. 3270 Hollingworth (Crompton and Knowles Loom Works): Bobbin spindles for shuttles employed in automatic weft-replenishing looms. 3310 Etablissements de Dion Bouton (Soc. Anon.): Electric ignition devices for internal-combustion motors. [Date applied for under International Convention, February 11th, 1909.]

3371 J. H. Riley and Co., and Riley: Beam dyeing machines.

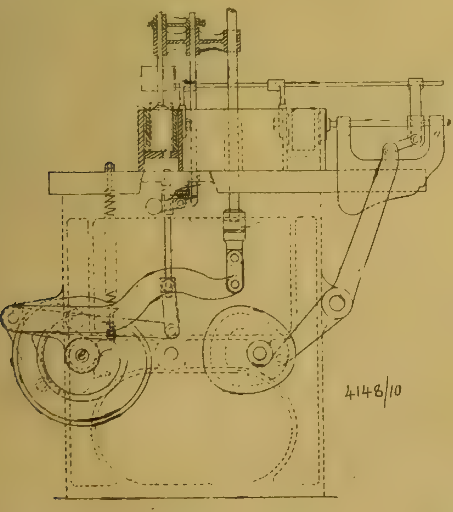
This invention relates to improvements in apparatus for dyeing yarn or warps wound on beams, or cops mounted on perforated beams or cylinders of the type in which the beam or cylinder is mounted upon a hollow bearing through which the liquor can flow and in which the beam can rotate, and consists of a geared shaft passing through the wall of the tank and projecting externally for rotating the yarn beam or cylinder within the tank or vat whilst the dyeing is being carried out. According to the invention the apparatus is constructed with a gear wheel on the end of the yarn beam or cylinder, a driving shaft with gear wheel meshing therewith, and a stuffing box in the side of the tank through which the driving shaft projects externally for rotating the beam or cylinder within the vat as the process of dyeing continues.

3419 Bailey: Roller skates. 3421 Soc. Anon. Electrometallurgique (Procedes Paul Girod): Method of supplying electric furnaces with triphase currents. [Date applied for under International Convention, August 26th, 1909.] 3514 Bambridge: Flexible couplings. [Application for Patent of Addition to 6263, 1908.] 3658 Philip: Ships' engine room bilge wells and bilge suction pipes and collecting and retaining waste oil and the like that occurs from the lubrication of marine engines or otherwise and reaches the bilge wells. 3822 Wolf, Bambury, and Bernardy: Lamp-supporting brackets, pendants, and the like. 3840 Trewent and Proctor: Apparatus for ejecting ashes and other refuse from ships. 3847 Henkel: Controlling devices for electric motors. 3894 Preston: Fittings for sash windows. 3895 Waite and Waite, and Saville Ltd.: Means for driving the cylinders of rotary off-set printing machines to ensure register. 4056 Hopper: Apparatus for teaching singing. [Post-dated April 7th, 1910.] 4064 Kings Norton Metal Co., Bayliss, Melville-Smith, and Brownsdon: Method for removing metallic fouling from the bores of guns. 4120 Southall: Hoods or canopies for cooking ranges.


3371/10

4148 Job Day and Sons Ltd., Day and Naylor: Packaging, wrapping, and other like machines.

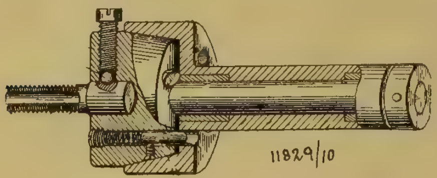
This invention relates to improvements in means or mechanism for use on or in combination with packaging or wrapping or other like machines in which the bags to be filled are placed in a trough and intermittently moved into position for receiving the contents, and afterwards shaking and folding or closing the ends of the same, or in which the bags are placed in separate boxes which are intermittently moved in a rectangular or other shaped trough. The invention consists in the combination with a packaging, wrapping, or other like machine of means for detecting and automatically ejecting and removing any bag or box which is deficient in contents whilst being packed or wrapped, the means comprising a detector in plate or boss form attached to a reciprocating part of the machine adapted to automatically release an ejector whenever the contents of a bag or box are below a predetermined level, and to raise the bag or box out of the trough or travelling box into a position to be removed by a reciprocating plunger.


4148/10

4199 Haddan (Soc. Anon. Manufactures Royales de Corsets P.D.): Corset attachments. 4284 Hand: Wrenches. 4337 Rosculet: Process of solidifying liquid hydrocarbons. 4445 Hillebrand: Gramophones and records for same. 4517 Grace: Device for reproducing representations of letters, designs, or the like by means of stencils, especially applicable to the marking of woven fabrics. 4524 Parkinson Stove Co., and Barralet: Water heaters. 4610 Vicars, Vicars, and Vicars: Dough rollers. 4724 Taylor: Hand tool for grinding and cleaning the commutators and slip rings of electric generators and motors. 4810 Boult (Royaards): Means for berthing boats on ships and elsewhere and for releasing and lowering out the same. 4982 Stanley, and Aublet, Harry, and Co. (in voluntary liquidation): Reversing gear, especially applicable for washing machines and the like. 4991 Gooch: Adding and listing machines. [Date applied for under International Convention, March 1st, 1909.] 5078 Birt: Certain kinds of tins or containers, particularly those for holding liquid polishes. 5140 Buscher: Braiding machine. 5178. *See* 26406, 1909. 5188 Cole: Vices. 5373 Maly: Cop or bobbin tubes for dyeing. [Request under Sections 19 and 91 of the Act not granted.] 5441 Waite, and Waite and Saville Ltd.: Means for driving the cylinders of rotary offset printing machines to ensure register. 5460 Anger: Bearing springs or spring bearing devices for road vehicles. [Application for Patent of Addition to 28954, 1909.] 5805 Dawson and Buckham: Cartridge feed belts for automatic guns. 5817 Hancock and Arnold: Carburetting apparatus. 5915 Sauve: Construction of gravity chutes for conveying goods from one floor of a building to one on a lower level. 6141 Foster and Smith: Combined cooker and strainer for peas and like leguminous seeds. 6258 White: Fireproof doors, shutters, or the like. 6439 Hateley: Sad irons. [Post-dated April 26th, 1910.] 6493 Jack: Caps for armour-piercing projectiles. 6650 Haddan (Lesperance): High-frequency ignition apparatus for internal-combustion engines. 6943 Bayley: Fire escapes. 6974 Acutt: Cigar and cigarette tubes or holders. 7170 Francis: Gummed strip serving apparatus. 7514. *See* 27176, 1909. 7532 Levy: Machines for cutting embroideries. [Date applied for under International Convention, March 27th, 1909.] 7534 Levy: Machines for cutting embroideries. [Date applied for under International Convention, March 27th, 1909.] 7859 Oliver and Ohlgart: Shoe-polishing machines. 7908 Brown and Berry: Boots and shoes. 7915 Brougham (Salvay et Cie.): Apparatus for removing tar from coal gases. 8166 Humphreys: Hats. 8187 Born: Steam and water separator. 8277 Barens: Baling presses. 8549 Quisling: Mechanism for igniting the explosive charge of projectiles. 8781 Atherton: Advertising machine. 8872 Maxwell and Cashen: Shoes. 8937 Akt.-Ges. vorm. Siedel und Naumann: Paper carriages for typewriters. [Date applied for under International Convention, February 5th, 1910.] 8940 Akt.-Ges. vorm. Seidel und Naumann: Typewriting machines. [Date applied for under International Convention, February 5th, 1910.] 9270 Wickel: Process and device for carrying out hot and relief embossing in gold, silver, metal, and body colours and the like by means of rollers. [Date applied for under International Convention, April 17th, 1909.] 9352 Frost: Method of galvanising, tinning, or otherwise coating tubes and tubular articles and appliances to be used therein. 9364 Bourck: Device for closing an electric circuit automatically at a temperature variable at will. 9382 Alkin: Dental hand pieces. 9525 Cerri: Cuff protectors. 9712 Oltmans: Brake for roller skates. 9762 Chatillon: Support for drying footwear. 9782 Sewart: Chair carriers. 9836 Gessner: Typewriters. 9953 Taylor: Motor vehicles for travelling on water. 9956 Bajer: Automatic brake for the warp beams of looms. 9959 Goodall and James: Pants, drawers, knicker drawers, and like articles of underwear. 10158 Sleeper and McGoffin: Grain shocker. 10373 Haasted: Means for indicating the position of points and other movable parts. [Date applied for under International Convention, April 28th, 1909.] 10532 Fowler: Check action door springs. 10586 Hochgurtel: Machines for counting and wrapping up definite numbers of coins of the same denomination. 10700. *See* 29505, 1909. 10826 Marks (California Valve and Air Brake Co.): Air brakes. 10900 Lutyens and Fowler: Domestic grates or stoves. 10907 Gruder Blank and Co. Ges. and Gruder: Gas regulation for gas burners and the like. 10921. *See* 26818, 1909. 11269. *See* 30387, 1909. 11294 Goldschmidt: Method for the production of high-frequency currents for use in wireless telegraphy and telephony. 11324 Jones: Apparatus for automatically exhibiting a series of lantern slides. 11428. *See* 26049, 1909. 11483 Nydahl: Means for admitting water to the combustion chambers of explosion engines. [Date applied for under International Convention, May 15th, 1909.] 11628 Justice (Plant): Rotary jacks for boots and shoes. 11688 Heybach: Weighing machines. 11717 Thomson and FitzGerald: Electric furnaces. [Date applied for under International Convention, May 13th, 1909.] 11748 McKenzie: Motor cycle adjustable stand. 11816 Clayton: Tobacco pipes.

11829 Hanwell: Chucks for machine taps.

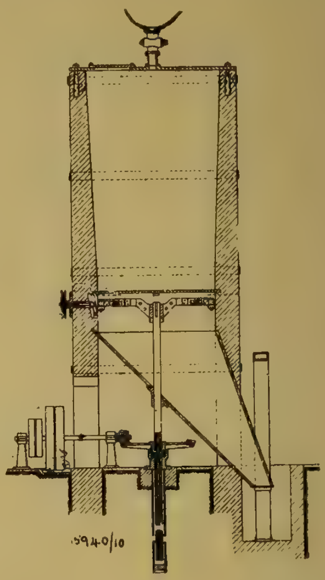
This invention relates to improvements in or relating to chucks for machine taps of the type wherein a socket portion is carried in the turret head of a turret lathe and in the socket portion is a tap carrier. According to the invention the socket member is provided with a shoulder that co-operates with a friction face on the tap carrier in such a manner that the latter is held stationary when the socket member is thrust forward, but is released when the tap is drawn forward.



11881 Urquhart (Akt.-Ges. der Maschinenfabriken Escher Wyss and Co.): Method of controlling an auxiliary driving agent temporarily introduced into a steam or gas turbine. 11925. *See* 26523, 1909. 12132 Sheahan: Water motors. 12143 Bowe: Lacing devices for boots, shoes, leggings, and the like. 12346 Podd: Device for use when cleaning buttons attached to wearing apparel and the like. 12403 Aron: Hoods of motor cars and other vehicles. 12444 Eggler: Protector for the lips, tongue, and cheeks, and holder for cotton wool rolls. 12708 Electric and Ordnance Accessories Co., and Collins: Time limit or retarding devices for use in connection with electric circuit breakers. 12770 Hieronimus: Extensible bridge piece for pince-nez. 12857 Inhoffen: Apparatus for measuring gas. [Date applied for under International Convention, January 25th, 1910.] 12861 Goldman: Conveyer for bottles. 12899 Philipp: Spring button fastenings. [Date applied for under International Convention, May 29th, 1909.] 12954 Anderson: Cigarette-making machines. 13112 Kouns: Levels. 13152 Melling: Controlling gear for winding and hauling engines. 13493 Elliott: Seals. [Date applied for under Rule 13, November 30th, 1909.] 13520 British Thomson-Houston Co. (General Electric Co.): Electric circuit breakers. 13706 Kahdemann: Non-slipping means for rubber-tyred wheels. 13715 Allen and Dimock: Manf. of machine screws. 13880 Weill and Gerbel: Fire-extinguishing apparatus. 13900 Lindemann (Geb. Korting Akt.-Ges.): Method of controlling furnaces or burners fed with liquid fuel. 13926. *See* 29505, 1909. 13943 Madler: Purses. 14108 Evans (Leo Lehmann and Co.): Relief writing apparatus for advertisement writing. 14116 Wolfram Lampen Akt.-Ges.: Process for decarbonising filaments for use in metallic filament glow lamps. [Date applied for under International Convention, June 26th, 1909.] 14274 Clarke: Contrivance for stirring the contents of culinary vessels. 14602 Avey: Feeding bags for animals. 14753 Fraser, and Chalmers Ltd. (Behr): Pneumatic ore stamps, hammers, and the like. 14896 Kneen: Disinfecting device for urinals. [Date applied for under International Convention, January 29th, 1910.] 14927 Shaw: Gear for the prevention of over-winding and for controlling the speed of winding and hauling engines and the like. 15037 Sweetser, and Electric Sign and General Advertising Co.: Electric switch apparatus. 15055 Philip: Sash windows. 15258 Harrison: Device for protecting plants from slugs and the like. 15305 West: Hydraulic presses. 15398 Howlin: Apparatus for automatically opening and closing cocks, valves, switches, and the like. 15402 McCabe and Payton: Automatic slack adjusting devices for use in connection with couplings and draw gear of locomotives, tenders, and vehicles. 15477 Tonks and Sparks: Mortise panic bolts. 15524 Lindemann (Geb. Korting Akt.-Ges.): Method of working steam heating apparatus. 15624 Mears: Germ, dust, and rain-proof milk and cream can. 15648 Scott: Hosiery, or like tubular-knitted webs, and means for making the same. 15706 Fried. Krupp Akt.-Ges.: Artillery vehicles. [Date applied for under International Convention, November 11th, 1909.]

15940 Marks (Freudenthal): Means for emptying super-phosphate chambers.

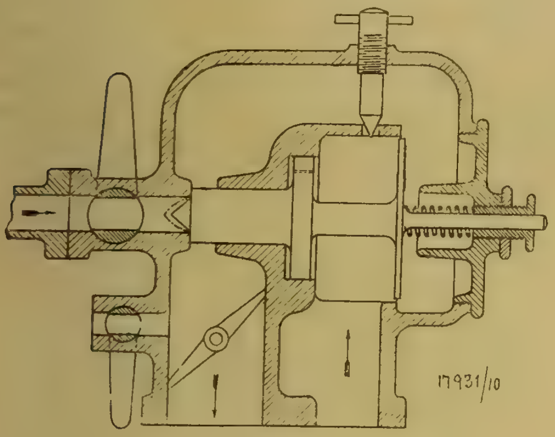
This invention relates to a superphosphate chamber which may be automatically emptied. The invention consists in a superphosphate chamber provided with automatic emptying means in which the entire bottom plate upon which the solid mass rests can be withdrawn, the walls of the chamber being constructed either cylindrically or slightly tapering in the downward direction in order to support the mass when the bottom plate is removed, the knives being adapted to act from beneath on the super-phosphate, thereby permitting the particles to freely fall clear of all obstructions.



16033 Sloan: Means for enclosing and displaying goods. 16297 Brampton: Means for attaching roller lever brake brackets to cycles. 16322 Pugh: Signs illuminated by gas. 16354 Eisenstein: Apparatus for producing electrical impulse charges for wireless telegraphy and telephony. [Application for Patent of Addition to 10019, 1908.] 16456 Leemans: Method of purifying vulcanised indiarubber. 16525 Reinecke and Buhring: Portable engines. 16563 Pumphrey: Hose supporter clasps. 16770 Leiberg: Barometers. 16826 Cottray: Starting devices for explosion engines. 17045 George: Metallic barrels. 17251 Schiller: Resilient tyres. 17270 Hocknell: Cheese vats. 17525 Fried. Krupp Akt.-Ges.: Breech mechanism for ordnance. [Date applied for under International Convention, December 8th, 1909.] 17892 Fairweather (Elliott-Fisher Co.): Keys for typewriting machines.

17931 Crossley and Webb: Automatic mixing valves of internal-combustion engines.

The invention consists of an automatic mixing valve for use with throttle-governed gas engines and the like, and consists in constructing the mixing valve in such a manner that the suction of the engine lifts an air valve of the disc type which is formed in one piece with the gas or fuel valve, the latter having a seating of the mushroom type, and being placed as near as possible to the throttle valve of the engine. The air valve above referred to is placed on the same vertical axis as the gas valve, and the port connecting the gas and air valves together is so arranged that the air first passes through the air valve and then passes the gas valve and mixes with the gas issuing therefrom. As the air valve and gas valve are formed in one piece, it will be understood that when the suction of the engine lifts the air valve it also lifts the gas valve. It will also be understood that when the engine is working at less than full power and the governor partly closes the throttle valve a smaller amount of air passes through the air valve, and the latter, together with the gas valve, opens therefore to a lesser extent. A dashpot is provided between and in one piece with the mixing valve to ensure silence in action.



18028 Stumpf: Shaft governors. 18075 Royce, and Rolls-Royce Ltd.: Steering and controlling of motor road vehicles. 18151 Haefely: Winding apparatus for coils or the like for electrical or other apparatus. 18249 Gaynor: Resilient vehicle wheels. 18313 Schaeffer: Point or switch-operating mechanism for tramways and the like. 18402 Stockel: Adjustable pencil cases. 18433 Rhonisch: Shoe drier. [Date applied for under International Convention, August 4th, 1909.] 18726 Morris: Means for securing railway rails to sleepers. 18901 Fuller and Mitchell: Device for threading needles. 18927 Mergener: Hair pins. 19143 Taylor: Automatic delivery machines. 19340 Johnson (Kalle and Co. Akt.-Ges.): Manf. of nitrogen compounds of acenaphthene and of colouring matters therefrom. 19397 Fried. Krupp Akt.-Ges.: Projectiles. [Date applied for under International Convention, December 31st, 1909. Application for Patent of Addition to 19345, 1908.] 19425 Van der Made: Filters. [Date applied for under International Convention, February 19th, 1910.] 19565 Cosnett: Fruiting ladders. 19680 Gorton: Metal cutting-off machines and the like. [Date applied for under International Convention, August 28th, 1909.] 19877 Harrison: Motor-driven lawn mowers. [Date applied for under International Convention, September 4th, 1909.] 19969 Siemens Bros. and Co., and Ferreira: Mechanism for operating railway points. 20042 Lundstrom and Henriksson: Clutches. 20493 Gotze: Manicuring appliance. 20762 Thorandt and Kohn: Collar supports and method of manufacturing the same. 20926 Hessling: Centrifugal fans and pumps. 21018 Bouracier: Means for manifolding on typewriters. 21385 Braidwood: Vehicle tyres. 21793 Fried. Krupp Akt.-Ges.: Fuses for projectiles. [Date applied for under International Convention, December 20th, 1909.] 22001 Murphy and Bett: Guidance and control of aeroplanes in the air. [Date applied for under Rule 13, September 11th, 1909.] 22125 Porri: Reinforced concrete railway sleepers. [Date applied for under International Convention, September 4th, 1909.] 19969 Siemens Bros. and Co., ing boxes. [Date applied for under International Convention, September 24th, 1909.] 23051 McMullin: Manf. of window glass. [Date applied for under International Convention, November 8th, 1909.] 23226 Leach: Machinery for forming yarns or threads into warps or like assemblages of yarns or

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threads and machinery for winding warps and like assemblages of yarns or threads. [Date applied for under Rule 13, November 9th, 1909.] 23913 Soc. Comptoir Financier Francais: Tyres for the wheels of vehicles. [Date applied for under International Convention, March 10th, 1910. Originally included in 16037, 1910.] 25698 Kaufmann: Process of making aromatic antimony compounds. [Date applied for under Rule 13, August 17th, 1909.]

PATENTS AND DESIGNS ACT, 1907.

Notice is hereby given that the Pontelec Welding Patents Limited, of Thanet House, 231, Strand, London, W.C., seek Leave to Amend the Specification of Letters Patent No. 18909 of 1905, granted to Adolf Frederick Rietzel, for "IMPROVED METHOD OF ELECTRIC WELDING SHEET METAL."

Particulars of the Proposed Amendment were set forth in the Illustrated Official Journal (Patents), issued on the 14th December, 1910.

Any Person, or Persons, may give Notice of Opposition to the Amendment (on Patents Form No. 18), at the Patent Office, 25, Southampton Buildings, London, W.C., within one calendar month from the date of the said Journal.

W. TEMPLE FRANKS,
Comptroller-General.

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THE
PRACTICAL ENGINEER
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VOL. 42. FRIDAY, DECEMBER 30, 1910. No. 1,244.

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RELIABILITY VERSUS EFFICIENCY.

COMPLEX machines or appliances not infrequently obtain extensive patronage, followed by an early failure to secure a market owing to the advent of simpler apparatus. In fact, this feature appertains to almost every new epoch-making invention, more direct means of performing the necessary functions being introduced as development takes place.

The most important point in connection with a costly machine is reliability, and purchasers are willing to give a higher price to secure this feature. Efficiency is naturally considered, but, where the difference is not great, the more reliable apparatus will be decided upon.

Now reliability is not necessarily dependent upon simplicity, as complex machines have often successfully competed with simpler apparatus of equal efficiency which has a reputation for being undependable.

The features essential for long periods of work without breakdown are well-designed details, suitable material and the best workmanship, the success of the complex machine being ensured by these means.

Such being the case, it is quite possible for the best and simplest machine for a certain purpose to remain in the background for years, simply because the details are badly worked out and indifferently made, whilst insufficient consideration is given to the materials used.

Sooner or later, however, the simpler machine will oust the complicated one, which will finally become extinct. A survey of the development of newly-established industries reveals the existence of certain types which have obtained favour owing to their freedom from breakdown. At the same time, the experienced engineer, who is able to compare the general features in different makes, can say with absolute confidence that certain of these machines will give place to others which have so far proved less successful.

From a financial point of view this feature is obviously of extreme importance, and it may easily be wiser in the long run to support an almost untried invention in preference to a machine for which a large sale already exists.

A demonstration of reliability and efficiency is not sufficient; the vital question is whether simpler apparatus has been devised or is likely to be invented in the future.

The capitalist cannot be expected to understand the intricacies of complex machinery produced by a concern he is asked to support, hence he must, if he be wise, obtain an independent opinion from an expert, the latter having had an extended experience of all kinds of machinery, whilst he is without prejudices of any kind.

A good illustration of the above contentions may be found in the high speed reciprocating steam engine. In this case a high efficiency involves complication, together with a greater risk of breakdown than obtains in the less efficient simpler types.

To obtain the highest economy in steam consumption, clearances must be cut down to a minimum, whilst complex valve gears and governing arrangements are resorted to. This type has been almost completely ousted by simpler engines with large clearances, piston valves and throttle governors, mainly on account of their freedom from breakdowns. This example may be further extended by inclusion of the steam turbine, which combines efficiency with simplicity and reliability, the extinction of the reciprocating engine being consequently within sight.

Similar developments may be seen in the reciprocating internal-combustion engine, which will undoubtedly be displaced by the turbine in a few years' time.

New Service of Steamers to Manchester.—A new service of steamers between West Norway ports and Manchester is announced by the Svithun Line, who intend to run fortnightly steamers between Manchester and Stavanger, Kopervik, Haugesund, and Bergen. This service will give shippers and importers increased opportunities of dealing direct with the West Norwegian ports, whose trade with this district has considerably expanded during recent years.

New Waterworks for Vienna.—Waterworks costing over £4,000,000, for the supply of Vienna, have been opened by the Emperor Francis Joseph at the Municipal Town Hall. The supply is obtained from sources 100 miles distant in the valley of the Styrian Salza, a number of delicious Alpine springs, at a height of some 6,000 ft. above sea level. The water is said to be of good quality and perfect purity. It is conveyed to its destination by means of aqueducts and through pipes, and in one locality tunnels had to be made through three miles of mountainous country. The water takes two days to reach Vienna.

City and Guilds of London Institute.—The Department of Technology of the City and Guilds of London Institute, in a recently-issued report for the session 1909-1910, states that the number of subjects in which examinations were set this year in the United Kingdom was 75, while the number of separate classes held was 4,329, being the largest on record. The number of students registered in classes with a view to institute examinations has increased to 53,227. Some 24,508 papers were worked, and 14,105 passes were awarded. In mechanical engineering 2,870 students were registered, being an increase of 324, as compared with the previous year. In boilermaking work there were 251 students, in motor car engineering 643, in engineers' quantities 72, in structural engineering 55, and in the various electrical subjects taken as a whole there were 7,536 students. In the last, however, a decline was shown, more particularly in electrical engineering and electrometallurgy. In various London centres 4,560 candidates were entered, with 2,552 passes. The Regent Street Polytechnic had 351 successful candidates, the Borough Polytechnic 308, the Northampton Institute 282, St. Bride Foundation Institute 252, and Battersea Polytechnic 173. The Municipal School of Technology, Manchester, had 1,087 successful students, the Bolton Municipal Technical School 391, the Liverpool Municipal Technical School 303, the Salford Royal Technical Institute 300, and the Birmingham Municipal Technical School 268.

Steamboats on Tributaries of the River Amazon.—The *Registro Oficial* contains a law approving a contract made betwen the Government of Ecuador and Senor Julien Fabre, representing the "Association Francaise pour l'Exploitation de Concessions Ecuatoriennes," for the colonisation of the "Region Oriental." The concessionaires undertake, among other things, to put on the rivers Santiago, Morona or Pastaza, tributaries of the Amazon, a fleet of not less than ten launches or steamboats. They are given preferential rights for the construction of a trans-Andine railway from a navigable point on one of the above-mentioned rivers to the Gulf of Guayaquil.

New Quay at Bergen.—H.M. Consul at Christiania reports that the Bergen Municipal Authorities have voted a sum of about £50,400 for the construction of a new quay to extend from the present fortress quay to the Skoltegrund mole, closing the present main entrance to Vaagen Harbour. All traffic will thus have to pass into the Vaagen Harbour by the western channel, which will accordingly have to be deepened. The width of the new quay will be 40 metres, narrowing to 30 metres at its outer extremity; the length of the quay will be 325 metres on its inner side, and 330 metres on its outer side; the depth alongside will vary from 8 to 10 metres below average water mark. It is estimated that the construction of the quay will take four years.

LUBRICATION IN MARINE ENGINES.

A lecture was given by Mr. J. Veitch Wilson, the well-known authority on oils, before the Institute of Marine Engineers on December 19th.

Opening with a brief account of the development of the steam engine, the lecturer stated that in 1850 Mr. James Young, a Scotchman, directed his attention to the discovery of some material from which liquid hydrocarbons could be artificially produced. The material sought for was found in the Boghead or Torbanehill mineral, of which considerable deposits were discovered in Bathgate in Scotland. Mr. Young took out his first patent in 1850, thus inaugurating the paraffin and petroleum industry of the world.

The best steam cylinder oils, Mr. Wilson observed, were produced from crude petroleum. These "natural" cylinder oils were very largely used, and generally gave satisfaction, but there were many cases in which they failed to do so. This was due to the presence of a carbon which was not entirely eliminated in the process of manufacture. It could be eliminated by distillation, but the distillate would be deficient in body and unsuitable for use in some cylinders. The best method was by filtration through charcoal, and the charcoal refined oils, from which the tar had been extracted, were less likely to leave deposits in the cylinders than those oils in which the tar was still present.

In the '70's, as a result of experiments, he found a method of producing compound oils containing mineral oil, which had body equal to or greater than the standard rape oil, and this was ultimately accepted as a standard marine engine oil. Afterwards, thickened vegetable oils were produced, with the object of them being mixed with mineral oil to neutralise the gumming tendency, but although these oils were now almost universally used, he was not convinced that the drying tendency of the thickened oils was entirely prevented. He was impressed by the idea that fatty oils had some mysterious virtues as lubricants which was not present in mineral oils.

For the lubrication of turbines, he found that the best results were obtained with good hydrocarbon engine oils, enriched by the addition of a small percentage of charcoal-refined oil. With internal combustion engines, makers invariably used compound oils, some having an extra percentage of fatty matter, others using nearly pure fatty oils.

The discussion on the lecture was adjourned until January 23rd next

THE PRINCIPLES OF IRONFOUNDING.

By Prof. A. Humboldt Sexton, F.C.S., F.I.C.

(Continued from page 766.)

Drying.

Cores and dry sand moulds have to be dried before they are used. By drying is understood the removal of the water necessarily present, and this is always done by heating in a stove or oven of some kind.

The water present is of two kinds—(*a*) that which is present in the free condition and which is generally called moisture, and (*b*) that which is present in a state of chemical combination, such as the water present in clay, and the hydrogen and oxygen present in the organic matter used, not necessarily present as water, but which is evolved as such when heat is applied. By drying is understood only the removal of the moisture, the term "firing" being used when it is intended to expel the combined water. It is, however, not always easy to draw a line between the two operations, since many substances begin to lose combined water at the ordinary temperature of drying.

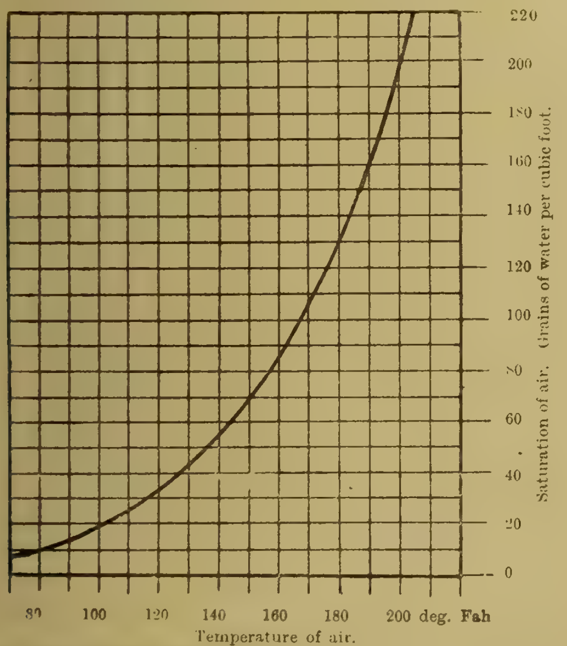


Fig. 112.—Diagram showing saturation of air at different temperatures.

If a wet cloth be exposed to the air it will rapidly dry under certain circumstances, the rate of drying depending on three conditions—

(1) The temperature.
(2) The hydroscopic condition of the air.
(3) The surface exposed to the air.

As is well known, the higher the temperature the more rapidly will drying take place, but if the surrounding air be perfectly dry complete dissociation or drying would take place in time at any temperature.

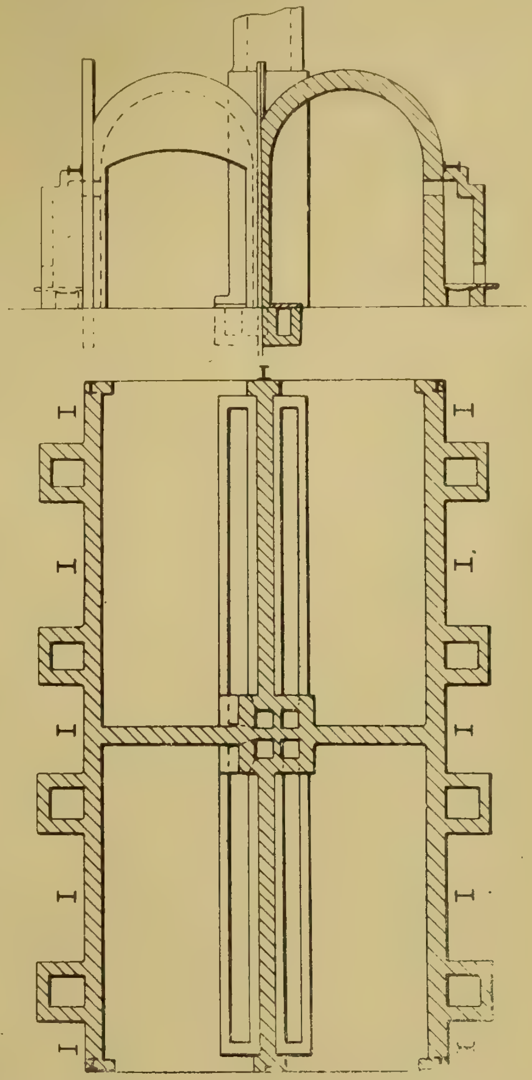


Fig. 113.—Four Chamber Drying Stove, each 25 ft. by 11 ft.

Drying is, of course, due to the evaporation of the water, the water passing into invisible vapour and mingling with the air. At low temperatures the amount of evaporation is small under ordinary conditions, and hence the drying takes place slowly, but as soon as the temperature reaches 100 deg. Cen. (212 deg. Fah.), *i.e.*, the boiling point of water, the evaporation becomes rapid.

The reason for this is easily explained. Water evaporates at all temperatures; indeed, even solid ice at a temperature below freezing evaporates slowly.

If a drop of water be passed up a barometer tube the mercury will fall to an amount which will depend on the temperature.

Ordinarily the mercury stands at a height of 760 millimetres (say 30 in.) at 0 deg. Cen. (= 32 deg. Fah.). At that temperature the column would be depressed by 4·569 millimetres, this being the tension of the aqueous vapour at 0 deg. Cen.; at 10 deg. Cen. (50 deg. Fah.) the tension would be 9·14 millimetres; at 50 deg. Cen. (122 deg.

Fah.), 54·865 millimetres, and at 100 deg. Cen. (212 deg. Fah.) it would be 760 millimetres. The pressure exerted is exactly the same, even if air be present, the water vapour mixing with the air and either increasing the total pressure or (if by free motion of the gas the pressure remains constant) displacing some of the air. The following table will be of use in this connection:—

Temp. t in C degrees.	Water vapour.		Relative volumes of water vapour and air in a saturated mixture.		Volume of air and water vapour by saturating one cubic metre of air with water vapour.
	Tension in mm.	Grammes of water taken up by one metre of dry air when saturated.	Air. Per cent.	Water vapour. Per cent.	
0	4·569	4·866	99·4	0·60	1 0060
5	6·507	6·948	99·14	0·86	1·0275
10	9·140	9·794	98·80	1 20	1·0491
15	12 674	13·64	98·33	1·67	1·0730
20	17·363	18·81	97·72	2 28	1·0981
25	23 517	25·69	96·91	3·09	1 1267
30	31·510	34·80	95·85	4·15	1·1578
35	41·784	46·81	94·50	5·50	1·1939
40	54·865	62·60	92 78	7·22	1·2363
45	71·362	83·38	90·61	9·39	1·2863
50	91·978	110·78	87·90	12·10	1·3468
55	117·516	147·17	84·56	15·46	1·4218
60	148·885	196·02	80 41	19·59	1·5179
65	187·103	262·77	75·38	24·62	1·6436
70	233·308	356 41	69·30	30·70	1·8137
75	288·764	493·04	62 00	38·00	2·0570
80	354·873	704·79	53 31	46·69	2·4268
85	433·194	1066·50	43·00	57 00	3 0516
90	525·468	1802·7	30·86	69·14	4·3102
95	633·657	4035·4	16·62	83·38	8·1121
100	760·0	∞	..	..	∞

If a vessel of water be exposed to air, say, at a temperature of 10 deg. Cen., the water vapour will exert a pressure of 9·140 millimetres, and as soon as this condition is reached no further evaporation is possible, but diffusion takes place; the water vapour diffuses away, and as the water vapour is lighter than air it tends to rise, so that as it passes away more water can evaporate, and so gradually the whole of the water will pass away in time. If a current of dry air be kept playing over the surface so as to carry away the saturated air very rapidly, the evaporation will be much quicker.

The higher the temperature the greater will be the pressure of the water vapour, till at the boiling point the tension is equal to the pressure of the air. At the slightest increase of temperature the water vapour or steam has a greater pressure than the air, and so can lift it away, and evaporation takes place very rapidly. The boiling point is defined as the temperature at which the tension of the vapour is equal to that of the external pressure. It therefore varies with the pressure. Up mountains, where the pressure is less, the boiling point is lower, and in a closed vessel the water may be much above its normal boiling point, and will be exerting corresponding pressure.

A glance at the table or at the curve (fig. 112) will show how rapidly the pressure rises and the rise of temperature.

It follows that the rate of drying will be much modified by the condition of the air into which evaporation takes place; if the air be already saturated with moisture no evaporation can take place. All know how hopeless it is to try and dry things in the air on a day when the atmosphere is saturated with moisture, *i.e.*, a damp day.

Evaporation can only take place at the surface, so that the larger the surface the more rapid will be the drying.

These considerations may be applied to the drying of any article, say a core.

The core is run into the drying store, and evaporation at once begins. The water from the outer layers is rapidly evaporated, and a dry surface is produced, but the drying can only go on in the deeper layers either as the heat penetrates the core or as the moisture is brought to the surface by capillary transfer to the dried portion. As the core is not a good conductor, and as capillary transfer is not very rapid, very quick drying is impossible by any increase of surface temperature. Owing to this the last traces of moisture are retained very tenaciously. To use an unduly high temperature will dry the outer layers too rapidly, and may even cause such a rapid evolution of steam that the core may be damaged, and if the heating is too rapid the irregular expansion of the outer layers before the inner layers are heated may cause the core to break up. The bad results of too rapid heating are to a certain extent mitigated by the fact that the boiling of the water absorbs a large quantity of heat, and thus tends to reduce the temperature.

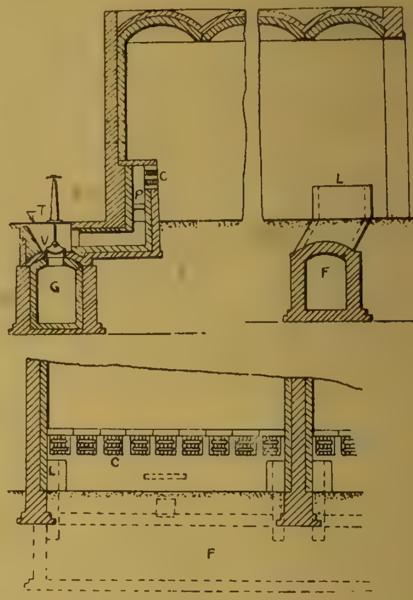


Fig. 114.—Gas-fired Drying Stove.

Speaking generally, the lower the temperature at which the drying can be carried out the better, and the slower the heating the less at any given moment will be the difference in temperature between the inner and the outer layers, and the less likely will the cores be to crack. The actual maximum temperature is that at which decomposition begins, and this for core gum, starch, or oil may be put roughly at 200 deg. Cen. (500 deg. Fah.), and straw and other organic matter will begin to decompose at a somewhat higher temperature. A temperature not much over 100 deg. Cen. for large work, and even a little lower for small cores, is probably the best, but as time is an important consideration, higher temperatures are usually preferred, but they must be used with judgment.

The loss of water may or may not cause shrinkage. In the case of clay there is considerable shrinkage due to the loss of water, but the solid material expands as it is heated, and, as the water is expelled at a fairly high temperature, rigidity is important at that temperature, and the core may slightly increase rather than decrease in volume, and, of course, it becomes much more porous.

If the heating be irregular, distortion is apt to take place.

It is not necessary to describe the construction of drying stoves, since they will vary so much according to the size of the article to be dried. Fig. 113 shows one of the convenient forms of a four-chamber stove, which is preferable to one very large single-chamber drying oven heated by coal fires. For large work they are usually chambers of firebrick, with a fire place at one end, heated either by coal or gas, sufficiently large to hold the largest core or box which will have to be dried. They are usually provided with large doors at the one end, and the cores or moulds are run in on trucks.

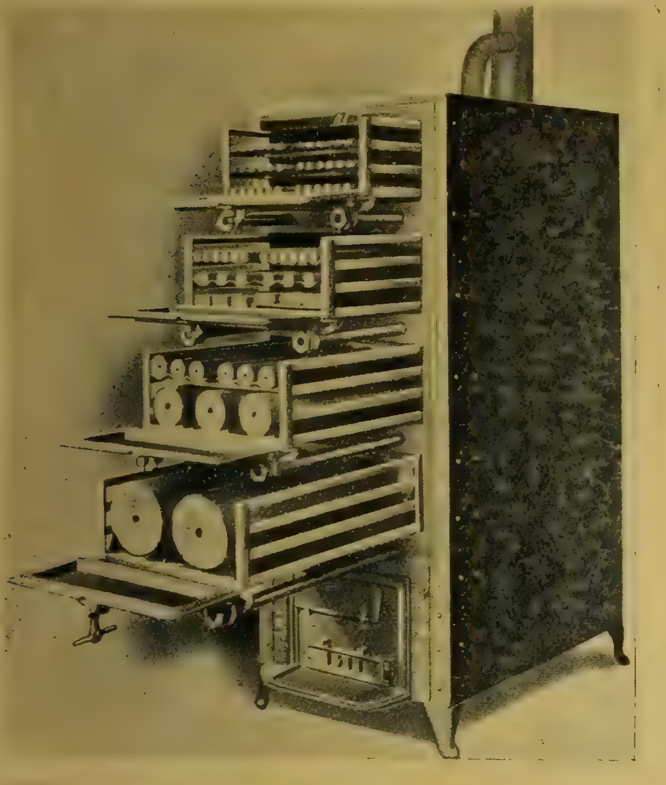


Fig. 115.—Portable Core Drying Oven.

Fig. 114 shows a form of drying stove employing gas firing, which is much cleaner, and gives a steady, moderate temperature. The gas main G has a controlling valve V to regulate the mixture with the air drawn in at the inlet T. The ignition takes place as the gas and air leave the passage P by the hot checker work, and the moisture and product of combustion pass away to the flue F.

For smaller work enclosed iron stoves are used, these being heated by a fire at the bottom, the articles to be dried being placed on shelves consisting either of grids or perforated plates, so as to allow free passage of the air, as shown in fig. 115, which is a portable form provided with drawer shelves, and able to utilise the space inside better than the swing shelf. The essentials of a good stove are:—

(1) It must be easy to raise the temperature very gradually, to regulate the temperature to any required point, and to maintain the temperature steadily, since variation in the temperature interferes seriously with the uniformity of the drying. Most of the large stoves, especially those fired by coal, are very defective in this respect, and for this reason gas-fired stoves are to be preferred. For small stoves gas heating is also advantageous.

(2) The hot gases must actually circulate round the articles being dried. Many stores are very deficient in this respect, but hot gases pass from the fire place or gas port to the chimney, and do not circulate round the articles, and thus the heating is slow and irregular and the waste of fuel is considerable. It is not easy to avoid this with coal-fired stoves, but with gas-fired stoves, that is, stoves in which gas is made in a separate producer and delivered by mains, it is easily avoided. The best arrangement is probably to deliver the gas at the top of the stove and draw it off at the bottom, or in small stoves, as is usually done, to deliver at the bottom.

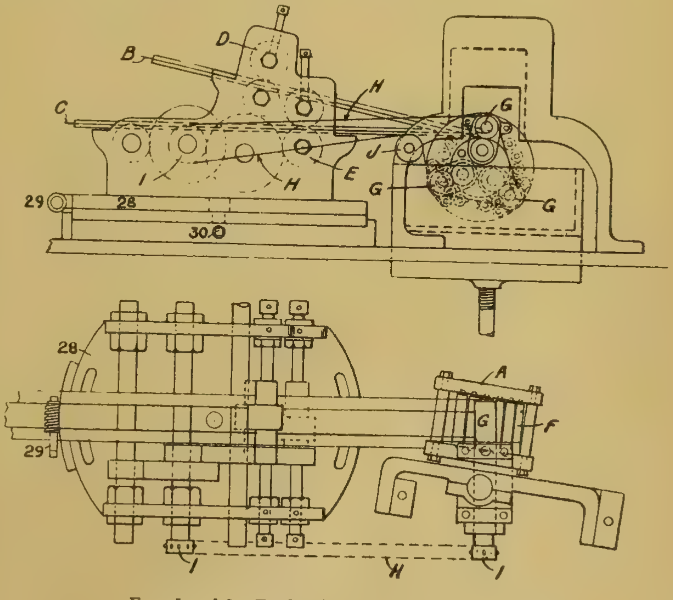
(3) Gas must not be allowed to stagnate round the drying articles, but must be kept in motion, so that the water vapour, as soon as it is given off, is drawn away.

(4) It must always be borne in mind that the products of combustion contain a large quantity of water vapour, and where the drying of small articles is to be conducted at a temperature of 100 deg. Cen. or less, the stove should be so constructed that only heated air and not the products of combustion can come in contact with the articles being dried.

(To be continued.)

IMPROVED MACHINE FOR THE MANUFACTURE OF HELICALLY-CONSTRUCTED METALLIC TUBE.

The improved machine described below for the manufacture of helical metallic tube comprises the use of feed rollers and tapering rollers in the coiling chamber, the use of hot air blasts for returning excess of solder to the bath, and the method of and mechanism for cutting off lengths of tube without stopping its travel. The process may be briefly described as follows: Two strips of thin metal (preferably steel) and of equal width are passed simultaneously through two pairs of feed rolls and the end of one strip is laid half way over the end of the other and secured in such position by a rivet, or welding, or the like. The two strips are forced forward by the rolls through a stationary coiling chamber, from which they issue in tubular form and with a rotary motion.



Figs. 1 and 2.—Feed Rolls and Coiling

When leaving the coiling chamber the tube passes through a bath of molten solder (by which the strips are united) and passes forward up an inclined support consisting of two revolving parallel rods or tubes. In order to clear the tube from any superfluous solder which might otherwise adhere to it from the bath, a strong blast of hot air is applied to the inside and outside of the tube surface, which drives back the excess into the bath.

While the tube is travelling up the inclined support it is necessary to cut it into the desired lengths without stopping, and this is accomplished by a circular cutter with all its several movements self-acting, namely, starting to cut, travelling with and at the same speed as the tube, rising out of the cut, and returning to its first position until the next cut is due. The improvements are the invention of Mr. Arthur Judge, engineer, of Mushroom Lane, Sheffield, and the essential parts of the mechanism are shown in our illustrations, fig. 1 being a side elevation of the feed rolls and back elevation of the coiling chamber, and fig. 2 plan of same. Fig. 3 a side elevation of cutting off apparatus, and fig. 4 a plan of same and of the trip action for reversing movement. Fig. 5 an end elevation of cutting off apparatus, with supporting rolls and tube.

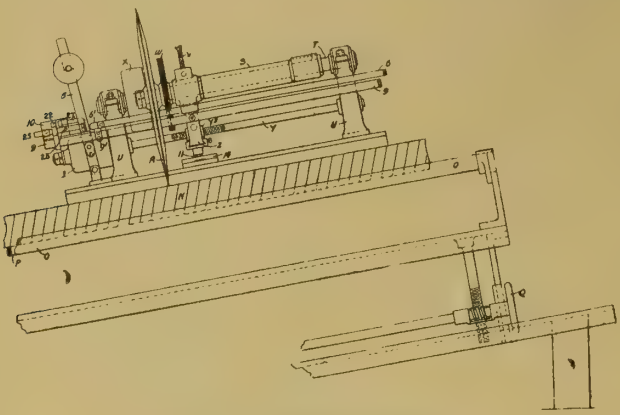


Fig. 3.—Cutting-off Apparatus

Referring to the coiling chamber A into which the two strips B and C from which the tube is to be formed are fed forward by the grip of their respective rolls D and E, one pair is located above the other in the housings, both being at the same side of the coiling chamber. They may be driven by any suitable gearing, and are carried upon a centrally-pivoted base plate 28 controlled by a worm and rack 29. This base plate is carried upon cross slides, one of the traversing screws being marked 30. The improvement consists firstly in using tapered anti-friction rollers F within the coiling chamber (the taper being too small to be shown) and fixing them at a right angle to the strips, and also in the use of one or more pairs of driven rollers G, preferably three pairs as shown, for the purpose of keeping the entering strips taut and preventing the tendency to buckle, and also to aid the strips in passing through the molten solder. These rolls G are conveniently driven by a perforated steel bolt H in conjunction with pin wheels I upon each pair of rolls driven from the mechanism of the feed rolls. The steel belt passes over a guide roller J, and engages with all the three rolls G. K is a stationary guide block within the coiling chamber, round which the strips pass and by which the tube is forced forward through a bath of molten solder to the inclined supports.

Secondly, in the method of clearing the tube of any superabundance of the molten solder which may be carried forward from the bath by the revolving tube as it issues therefrom, which would not only cause a waste of solder, but would leave a rough interior, and so depreciate the value of the tube.

Attempts have been made, but without success, to accomplish this by brushes or scrapers. For this purpose compressed hot air is employed conveyed in tubes to suitable hollow nozzles L somewhat resembling the head of an axe, the cutting edge M being the outlet.

One of these nozzles is applied to the inside and the other to the outside surface of the tube N, where it leaves the bath of molten solder. The edge next to the tube is also made to act as a scraper. Any excess of solder is released by the scraping action as the tube revolves, and the blast of hot air issues with sufficient force to drive it back into the bath, thus leaving the surface clean and smooth both inside and outside.

Thirdly, in the apparatus employed for cutting the soldered tube into desired lengths for commercial purposes, and it is necessary to accomplish this while the machinery is running and the tube travelling up the inclined delivery supports O and P, which consist of solid or tubular rods carried in bearings and caused to revolve by gearing of any suitable construction; these rods can be raised and lowered by the hand wheel Q, and moved apart by screws O^2 and P^2, to accommodate tubes of different diameters.

The actions of the cutting off apparatus are all automatic, and consist in lowering the cutting disc from its normal or raised position, so as to bear upon the tube, travelling at the same speed as the tube until it is cut through, rising to its normal height, returning to its original position and restng until the required length of tube has passed.

A swing arm S is carried upon a shaft T supported on pedestals U, and carries the cutting disc R, which consists of two side plates which grip between them a circle of segmental pieces of thin steel, which form the cutting edge. The swing arm and disc are counterbalanced by a weight not shown attached to the cord V, the disc is driven by chain W running on wheels *w* and w^1, the shaft being driven by the pulley X. The short longitudinal travel to and fro of the disc carrier S upon its shaft T, while cutting is produced by a screw Y passing through the nut Y^2, carried by the bracket Z, affixed to the underside of the arm S. The screw Y is turned in either direction by the reversing bevel wheels enclosed in the casing 1, which are driven by gearing 2, bevel wheels 3, and shaft 4, which receives its motion from any suitable source.

Briefly the reversing action is as follows: The end of the advancing tube N comes in contact with the trip mechanism, causing the trip rod 6 to throw over the lever 5, which is in an initial position of stable equilibrium, thus moving the clutch into gear with the left bevel wheel, causing the cutter to travel to the right and to commence cutting. The travelling part 10 carried by the bar 9 then throws the lever over to the right and reverses the traverse. This gradually draws the clutch out of gear, leaving the lever 5 in its initial position, and arrests the traverse action until the fresh-cut edge of the tube reaches the trip mechanism and repeats the action above described. The trip rod is drawn back by a weight not shown.

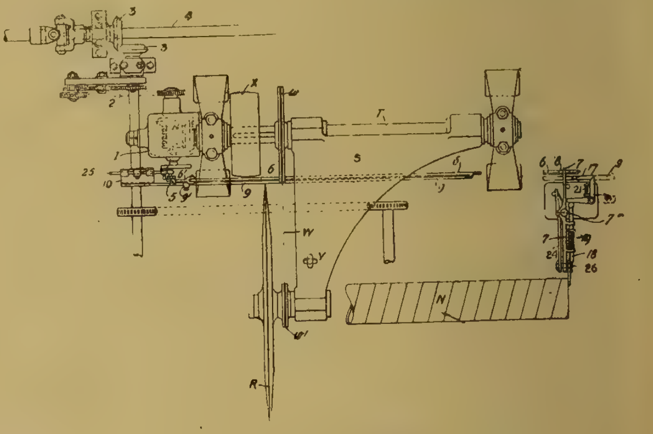


Fig. 4.—Cutting-off Apparatus.

Referring to the trip mechanism, which is located at the outer ends of the rods 6 and 9—the slide 18 is provided with a flattened end projecting into the path of the tube N. It is provided with a hole to receive the end of a short pin 26 (carried by a pivoted spring-actuated lever 24), by which the slide 18 is retained against the pull of the spring 19 until the forward movement of the tube turns the lever 7 and the connected slide 18 upon their common pivot 7*a*, and thereby draws out the pin 26. The released slide 18 is then pulled back by the spring 19, turning also the bell crank 20, the duty of which is to replace the slide in its original position, this being accomplished by the stud 17 upon the rod 9 on its left return movement. A small spring 21 keeps the crank in contact with slide 18. When the lever is turned as above described its shorter end engages with the stud 8 on the trip rod 6, and, moving the rod to the left, causes its pivoted end 6^1, supported by the finger 9^1, to tip over the lever 5, causing the screw to rotate and to traverse the cutter bracket and attached bar 9, which carries with it the plate 10. This traverse carries the finger 9^1 from under the end 6^1—which falls out of the path of the lever 5.

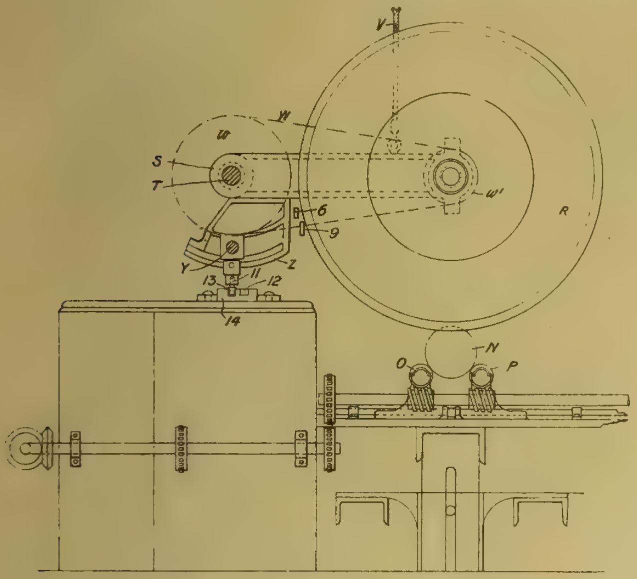


Fig. 5.—Cutting-off Apparatus.

The part 22 carried forward by the plate 10 strikes against the stud 23 upon the arm 25 of the lever 5, and throws over the said lever and the clutch into the right-hand bevel wheel, reversing the screw, and eventually the headed slide bar 27 withdraws the clutch out of gear and raises the lever to its initial position. During the return of the cutter bracket the finger 9^1 again moves under and supports the end 6^1 in its raised position in readiness for a repetition of the action on the completion of a further length of tube.

To raise and lower the arm S and the cutting disc R for the purpose of cutting through the thickness of the tube (about ⅛ in.), the device shown in fig. 5 is employed. It consists of a travelling pin 11 carried underneath the bracket Z, which, when the machine is at work, is caused to travel first on one path 12 and then on the other path 13 formed in a block 14, and thereby raising and lowering the disc carrier S. A wall separates the two paths, at each end of which there is a spring gate 15 and 16, which permits the passage of the travelling pin 11 in one direction only, the one 15 when the pin from path 12 has passed through forcing the pin on its return movement to take the path 13.

Shipbuilding in the United States.—At the works of the Toledo Shipbuilding Company one vessel of 3,000 tons and 3,600 H.P. was built this year, as compared with one vessel of 5,448 tons in 1909.

INCREASING THE LIFE OF STEAM HAMMER PISTON RODS.

By Hammerer.

The problem propounded in the above title is capable of being dealt with in a number of ways. There is the selection of material, the discussion of which could be carried on indefinitely, and there is also the design and proportions, etc., of the same. The method adopted in this short article is quite distinct from the above considerations, whilst at the same time being quite independent of them.

However careful one may be in the selection of his material, or the form of his design and the proportions of the same, the inevitable day always arrives when the piston rod breaks and has to be discarded.

It will be found in the majority of cases that the rod breaks at the top of the hole in the tup or hammer head (fig. 1). Owing to this fact it seems rather extravagant to have to throw away the whole rod, which may only have some 10 in. or 12 in. broken away, when this can be used again at very small expense.

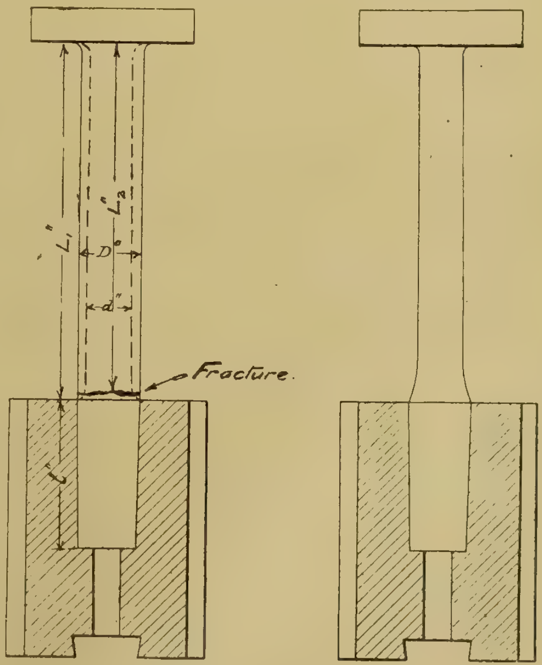
The method adopted by the author is to take the broken rod and swage it out again to its original length by reducing its diameter, leaving enough of the original diameter at the end to be again fitted into the tup (fig. 2).

This means, of course, that an extra gland and stuffing box has to be kept on stock, but, in spite of this, it has proved itself quite economical in the long run.

The method of arriving at the largest diameter of rod, which can be practically adopted from the old one, can be found from the following formula:—

$$d = \mathrm{D}\sqrt{\frac{\mathrm{L}_2 - l}{\mathrm{L}_1}}.$$

(The actual diameter would, of course, be slightly less than above by the amount taken off by turning.)



Figs 1 and 2.

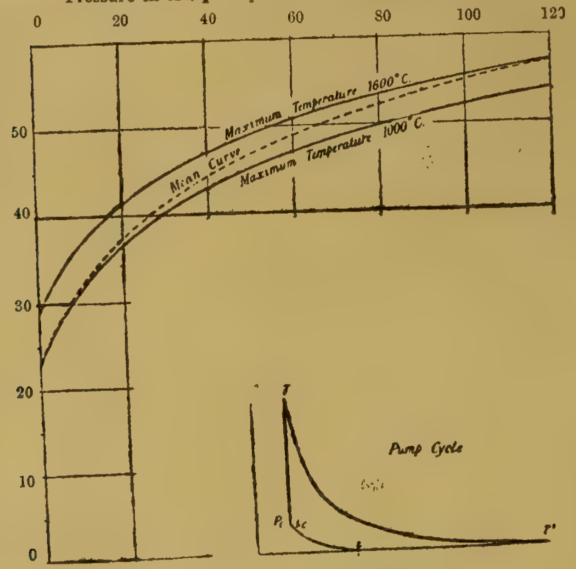
Of course, when the thinner rod again breaks it is replaced by a thick one, which in turn is reduced on breakage. The hammer therefore uses a thick rod and a thin one alternately, and it will be found that by adopting this method a considerable economy is effected in the cost of piston rods by so lengthening their working life.

HUMPHREY PUMPS AND COMPRESSORS.*

(Concluded from page 811.)

Turning now to the question of thermal efficiency, the curves shown in figs. 20, 21, and 22 are taken from the Institution of Mechanical Engineers' Paper, and show the relative efficiency as between the Humphrey pump cycle and the ordinary Otto cycle calculated upon the usual formula, and upon the assumptions stated on the diagrams. These calculations are based on the assumption of the constant specific heat, but Professor Dr. Eugen Meyer, of Charlottenburg, has made the very laborious calculations involved when taking the true specific heat of each constituent of the gas mixture, and allowing for the variations of the temperature involved at each point on the curve. The absolute results are affected, but the relative results remain approximately the same, and for present purposes it is sufficient to take the curves as here given.

Theoretical Efficiency Curves, Pump Cycle, Air Standards Compression Pressure in lbs. per square inch above atmosphere.



Formulæ for Pump Cycle Diagram.

$$\text{Efficiency} = 1 - y\,\frac{T^1 - t}{T - t_c}$$

$$T^1 = t\left(\frac{T}{t_c}\right)^{\frac{1}{y}}$$

$$t_c = t\left(\frac{P_c}{P}\right)^{\frac{y-1}{y}}$$

T = (for curve at 1000 deg. Cen.) = 273 deg. + 1000 deg. Cen. = 1273 deg. Cen. abs.

T = (for curve at 1600 deg. Cen.) = 273 deg. + 1600 deg. Cen. = 1873 deg. Cen. abs.

$y = 1{\cdot}508$

t = suction temperature = 17 deg. Cen. ·0 = 290 deg. Cen. abs.

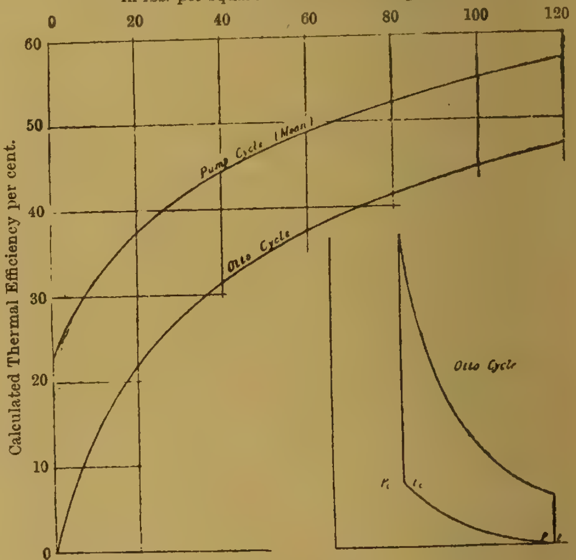
Fig. 20.—Adiabatic Compression and Expansion.

It may be mentioned, however, that with a compression pressure of 11 atmospheres absolute the theoretical thermal efficiency of the Humphrey cycle is 52·5 per cent, whereas that of the Otto cycle is only 40 per cent when all corrections for varying specific heats are allowed for. Such compression pressures have not yet been adopted by the author, but they will be employed on the 1,000-H.P. German pump already referred to. In the meantime when using only very moderate compression pressures of under 50 lbs. per square inch, an actual thermal efficiency of over 23 per cent has been obtained on a four-cycle Humphrey pump. This corresponds to 0·95 lb. of anthracite coal per water horse power hour, and was obtained on a lift of only 35 ft. It may be expected, therefore, that as the compression pressure increases the efficiency will also increase, and there is every reason to believe that when the compression pressure reaches that employed in ordinary gas engines the best efficiencies attained in gas engines will be reached and probably surpassed by the Humphrey pump.

A large scale experiment is to be tried in which a Humphrey pump will be used to drive a water turbine coupled to an electric generator. The advantages of such an arrangement over the ordinary gas engine arise chiefly from the simplicity of the working parts, the absence of all troubles arising from contraction and expansion due to heating and cooling, the freedom from cyclic irregularity, thus enabling alternators to be driven in parallel, and, finally, the high efficiency and the low cost of upkeep. Also, the apparatus may be started and stopped immediately, and can indeed be entirely controlled from a switchboard. One has to face the loss due to conversion of water power into mechanical energy, but the efficiency of well-designed turbines can be guaranteed at over 80 per cent at full load, and in a central station there is no need to run any of the pumps at less than full load, since they can be so easily started and stopped. Moreover, if blast furnace gas or producer gas derived from cheap fuel is used, the loss of 20 per cent of the energy is not important, as compared with the advantages gained by the adoption of the gas-hydro-electric system, and the absence of the need for any lubrication would alone more than compensate.

In concluding this paper, which has already somewhat exceeded the usual limits, a brief reference may be made to the application of the Humphrey pump for the purposes of marine propulsion. The theoretical efficiency of the jet propeller is well known and admitted. The trouble has been to find a pump which would be at once pump and engine combined, and which would handle large quantities of water so that the area of the jet at the point of exit might be comparable with the area of the water acted upon by an ordinary screw propeller. The Humphrey pump fulfils the required conditions, and the diagram of fig. 23 shows one possible arrangement in skeleton form. The double-barrel pump with cylinders A, B discharges simultaneously in two directions through equal lengths of pipe C, D leading to air vessels E, F. The suction occurs

Theoretical Thermal Efficiency Curves—Air Standard Compression Pressure in lbs. per square inch above atmosphere.



Formulæ for Otto Cycle Diagram—

$$\text{Efficiency} = : 1 = \frac{t}{t_c}$$

t = 273 deg. + 17 deg. Cen. = 290 deg. Cen. absolute.

$$t_c = t\left(\frac{P_c}{p}\right)^{\frac{y-1}{y}}$$

$y = 1{\cdot}403.$

Fig. 21.

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* Paper read by Mr. Herbert A. Humphrey, M.I.C.E., before the Manchester Association of Engineers.

through the side of the ship and passages G, H, as shown. The water from one air vessel E is brought back to air vessel F through a pipe J, and the common discharge is then through the pipe K, which opens into the surrounding water at the stern of the ship. Means for diverting the jet as it leaves the vessel either to the right or to the left, or through a complete turn of 180 deg. so as to drive the ship backwards, are not shown, as they have been worked out by many experimenters.

Practical efficiency curves, 0·71 of air standard.

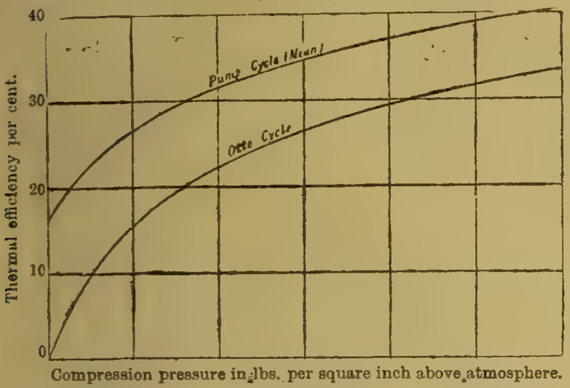


Fig. 22.

The arrangement indicated in the figure prevents all vibration, since the stresses due to the moving water are equal and opposite, the pump being situated in the centre between the air vessels. Also, the air vessels keep the discharge continuous so that there are no jerks, the result being a system in which full power, either ahead or astern, is available instantly, and the ship so fitted has a radius of action owing to the fuel economy equal to at least twice that which can be obtained by any other system. Since jet propellers become more wasteful with increasing velocities of propulsion, it may be found advisable to limit the application of the system now proposed to cargo steamers of moderate speed, but, for such vessels requiring, say, 2,000 H.P. to 3,000 H.P., the scheme contains all the elements of success. It may eventually prove that a pump having pre-compression of its gas and air will be more suitable for the larger sizes, and, when one remembers the small space occupied by two or three 1,000-H.P. pumps of this type, the outlook is distinctly promising.

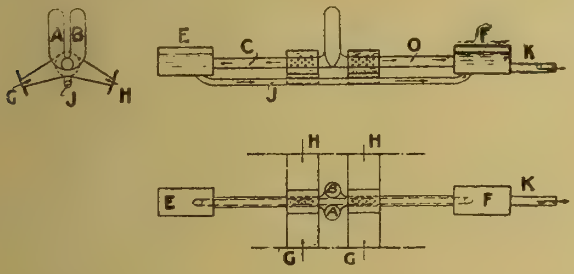


Fig. 23.

NOTICES OF MEETINGS, &c.

1911.

January 10th.—The Institution of Civil Engineers. Ordinary meeting at the Institution, Great George Street, Westminster, S.W.

The Institution of Electrical Engineers (Glasgow Local Section). Third ordinary meeting at 207, Bath Street, Glasgow.

January 11th. — Incorporated Institution of Automobile Engineers. Paper by Mr. C. E. Larard on "Castellated Shafts," illustrated by Cinematograph, at the Institution of Mechanical Engineers, Queen Ann's Gate, S.W.

Yorkshire Local Section of the Institution of Electrical Engineers. Third general meeting of the session at the University, Leeds. Address by Dr. Henry Stroud, on "Radio Telegraphy."

THE PRINCIPAL DIMENSIONS OF STEAM TURBINES.

By Rankin Kennedy.

It will be seen by reference to the article under the above heading, which appeared in our last issue, that the curve shown in fig. 1, giving the steam velocity for any given drop in British thermal units, calculated according to the formulæ given in the article, was, unfortunately, omitted, as also was fig. 2, which shows a diagram of a convergent divergent nozzle. These illustrations we now give.

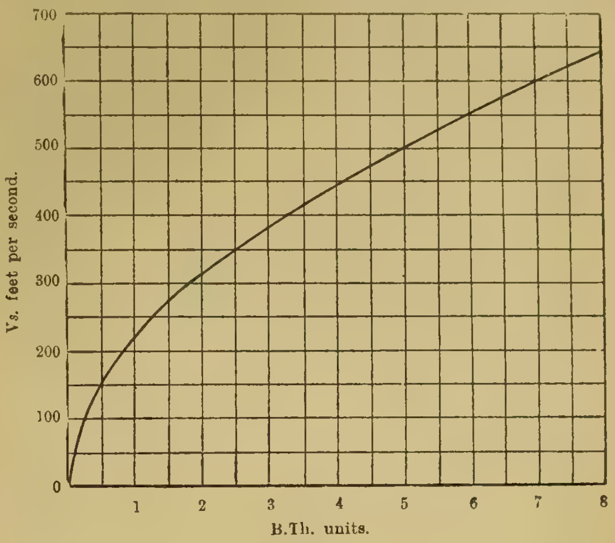
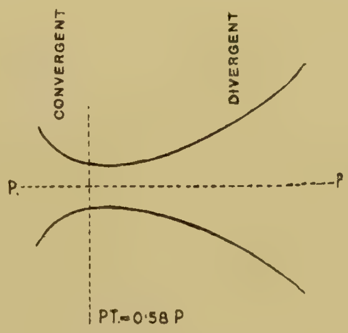


Fig. 1.



Convergent Divergent Nozzle.
PT. pressure at throat = 0·58 P.
Fig. 2.

Japanese Navy.—The announcement of the placing of an order in England for a battleship came as a surprise generally throughout Japan. Some criticisms might have been directed at the authorities, because of this departure from the policy announced some time ago, by which the Government is pledged to build war vessels in the Japanese shipbuilding yards. The Navy Department has issued a statement in which it is set forth that the Navy Department thought it necessary to secure the latest model of battleship and specimen of the art of shipbuilding. The armament of the new vessel, the construction of which commences this year, is kept a profound secret. The following figures give the expenditure to be paid out for naval reconstruction in the fiscal year 1909-10, and after:—

	For Ships. Yen.	Armaments. Yen.	Total. Yen.
1909-10 ...	6,400,409	2,289,177	10,687,586
1910-11 ...	9,182,004	4,507,582	10,689,586
1911-12 ...	7,831,909	4,107,677	10,939,586
1912-13 ...	7,440,409	3,849,177	11,289,586
1913-14 ...	7,758,632	3,330,954	11,089,586

FLYWHEELS FOR INTERNAL-COMBUSTION ENGINES.

In looking up material relative to the design of flywheels for gas engines, the searcher is impressed by the scarcity of really usable and practical material on the subject. In works which go into the subject at all deeply the effects of the reciprocating parts, the piston, connecting-rod, etc., are all taken into consideration. This does very well, and it is necessary to make such an analysis for large engines, but the average designer of small engines needs some practical formulæ which he is usually unable to find.

This article, which appeared in our contemporary *Machinery* (New York), refers only to internal-combustion engines of the single-cylinder, single-acting, four-cycle type with two flywheels. The formulæ and deductions which are here presented have been worked up from data from several manufacturers of this type of engine, and may be considered to represent average practice.

Diameter.—In designing a flywheel the first point to be settled is the diameter. The practice of different concerns varies considerably on this point, some using a large wheel with small rim, others preferring a small wheel with heavy rim. Of course, other details of the engine influence this to some extent. Engines designed especially for electric lighting have wheels heavier than the ordinary, and also usually larger in diameter; this will be spoken of later. The formulæ in this article refer to the average engine designed for farm or manufacturing use. When average values are taken, the relation between the diameter and the speed is found to follow very closely a certain law. This law for diameters is expressed in the form of the following equation:—

$$D = \sqrt{\frac{44{,}000{,}000{,}000}{N^3}} \quad . \quad . \quad . \quad . \quad (1)$$

where D = outside diameter of the wheel in inches,
N = number of revolutions per minute.

The peripheral velocity V in feet per minute of such a wheel will be

$$\frac{\pi D N}{12},$$

or substituting in formula (1),

$$V = \frac{\pi}{12}\sqrt{\frac{44{,}000{,}000{,}000}{N}} \quad . \quad . \quad . \quad (2)$$

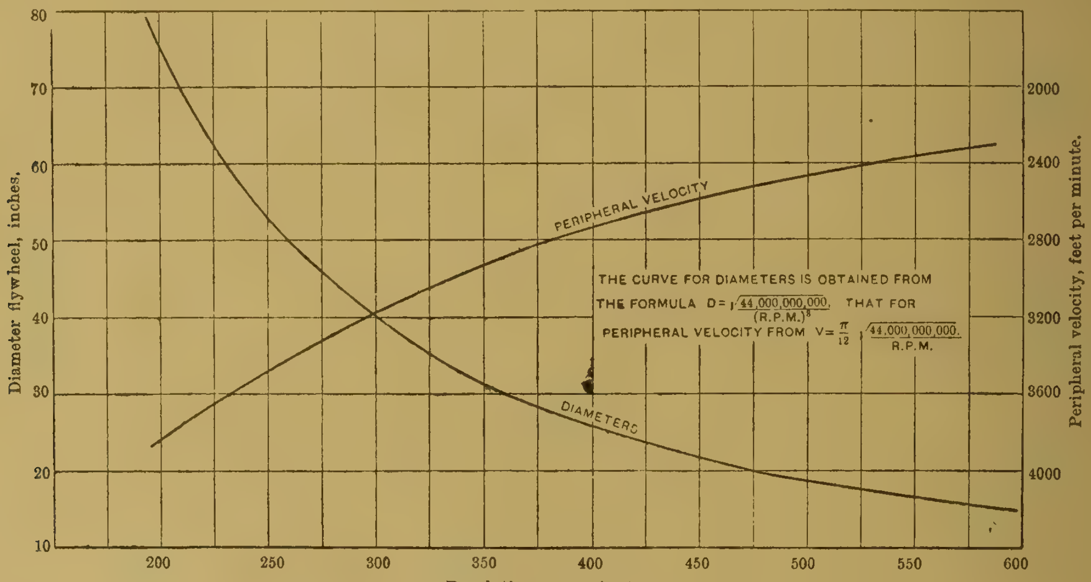


Fig. 1.—Diameter of Flywheel for Single-cylinder, Single-acting, Four-cycle Engines.

For convenience in using, curves have been plotted from the equations as given for the diameters, and also for reference for the peripheral velocity (see fig. 1). The velocity curve has been plotted with increasing values downward, so as not to cause confusion with the other curve. It will be noticed that the peripheral velocity varies from 2,000 ft. per minute in the smaller sizes to about 4,000 ft. in the larger. All these velocities are well below what are considered safe values, from 5,000 ft. to 6,000 ft. per minute.

Weight—Rim Dimensions.—The fundamental purpose of a flywheel upon an engine is not necessarily to maintain a perfectly constant speed, but to keep the speed variation within certain limits determined by the work being done. When an explosion takes place in the cylinder of an internal-combustion engine, were there no flywheel to absorb some of the energy the momentary speed would rise very high, and then the engine would, in all probability, stop, as there would be nothing to carry the reciprocating parts over the next compression stroke. The flywheel may keep the speed constant over certain intervals, as, one minute; that is, the number of revolutions in one minute will be the same as that in the following one. However, the speed over short intervals is constantly changing. On the explosion stroke the speed of the engine increases slightly, while on the compression stroke it is decreased. On the explosion stroke this increase in speed is according to certain laws, in proportion to the amount of energy developed in the cylinder. The amount of this energy is proportional to the area of the cylinder, or to the square of the bore, and to the stroke. When a compression stroke occurs the speed is slightly lessened, and a certain amount of energy stored in the wheel by reason of the excess speed is now given up and the speed decreased. The weight of the wheel must be so proportioned that these variations in speed are not objectionable for the purpose for which the engine is used.

The energy of a moving body is proportional to the square of its velocity, but the peripheral velocity of the wheel is directly proportional to the diameter and to the number of revolutions per minute. For a given amount of energy in the wheel due to rotation, the weight could be decreased directly as the squares of the diameter and revolutions per minute were increased.

The idea that a large flywheel gives an engine more power is, of course, erroneous, though held by some. It is true that with a large flywheel, as has been shown, the speed will not drop as quickly, yet it will take just that much longer for it to regain its normal speed.

Expressing the above laws in symbolic form, we have

$$W \text{ is proportional to } \frac{B^2 S}{D^2 N_2},$$

or

$$W = \frac{C B^2 S}{D^2 N^2} \quad . \quad . \quad . \quad . \quad . \quad (3)$$

where C = a coefficient determined by practice,
W = weight of the wheel in pounds,
B = bore of the cylinder in inches,
S = stroke of the piston in inches,
D = diameter of the flywheel in inches,
N = number of revolutions per minute.

For simplicity in the calculations the weight of the flywheel may be considered as being concentrated at the rim, and the mean diameter taken as the outside diameter of the wheel. This, of course, credits the rim with more than its actual weight, but as no allowance is made for the arms and hubs, the assumption is sufficiently accurate for all practical purposes. The weight of the rim is equal to π D multiplied by the area of the rim section and by 0·26 (0·26 is the weight in pounds of one cubic inch of cast iron).

Substituting in (3) we have

$$A \text{ (area of section)} = \frac{C}{0{\cdot}26\,\pi} \times \frac{B^2 S}{D^3 N^2} \quad . \quad (4)$$

Referring to fig. 2, W_1 is the width or thickness of the rim, while D_1 is the depth. D_1 is usually made about 1·9 W_1.

$$D_1 = 1{\cdot}9\,W \quad . \quad . \quad . \quad . \quad . (5)$$

The area of the section of the rim may be said to be equal to $D_1 W_1$ or $1{\cdot}9\,W_1{}^2$. This is another assumption, but the metal added at the extreme outer diameter to produce the widened rim is about equal to that cut away from the inner side of the rim to form the rounds.

Substituting in formula (4)

$$W_1 = \sqrt{\frac{C}{1{\cdot}55} \times \frac{B^2 S}{D^3 N^2}} \quad . \quad . \quad . \quad (6)$$

The values of the coefficient C in the above equation were worked out for a large number of wheels both by substituting the dimensions of the section in formula (4) and also using the weight of the wheels in formula (3). These values averaged quite closely, and 110,000,000 was chosen as representative of good practice. Where engines are to be used for electric lighting, or where a closer speed regulation is desired than that afforded by the ordinary engine, it is recommended that a coefficient of 160,000,000 be used. The diameters D of such wheels are also usually increased from 10 to 20 per cent. For common practice formula (6) then becomes

$$W_1 = \sqrt{\frac{110{,}000{,}000}{1{\cdot}55} \times \frac{B^2 S}{D^3 N^2}} \quad . \quad . \quad (7)$$

By means of this formula the dimensions of the rim can be obtained directly. See fig. 2 for references.

W_2 is usually made equal to W_1 plus one-half to one inch.

$$W_2 = W_1 + (\tfrac{1}{2} \text{ in. to } 1 \text{ in.}) \quad . \quad . \quad . \quad (8)$$

The depth of the widened portion is made from ½ in. in the smaller sizes to 1½ in. in the larger. The radii of the rounded portion are one-third the width or $W_1/3$.

Arms.—The arms of flywheels are usually six in number, though in the smaller sizes five are sometimes used, while above 60 in. to 70 in. eight are employed. A cross-section through the arms is in the form of an ellipse, this making a strong and neat appearing shape.

It is best to give the dimensions at each end of the arm, as then the patternmaker can shape these, and then taper the arm gradually from one to the other. To give a symmetrical appearance to the wheel, the dimensions of the arms should be made a function of the diameter.

The width of the arm at the hub should be

$$b_2 = 0{\cdot}058\,D + 0{\cdot}4 \text{ in.} \quad . \quad . \quad . \quad . \quad . \quad (9)$$

The width at the rim is eight-tenths that at the hub:

$$b_3 = 0{\cdot}8\,b_2 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (10)$$

The thickness of the arm is 0·55 times the width, or

$$t_2 = 0{\cdot}55 b_2 \quad . \quad . \quad . \quad . \quad . \quad (11)$$

$$t_3 = 0{\cdot}55 b_3 \quad . \quad . \quad . \quad . \quad . \quad (12)$$

In drawing the section for the elliptical arm, a radius should be used at the ends of this major axis equal to one-sixth the width of the arm. The longer radius should then be so determined that the arc drawn will pass through the end of the minor axis and be tangent to the other two arcs. For rounding the arms into the rim a radius one-third width of arm is used.

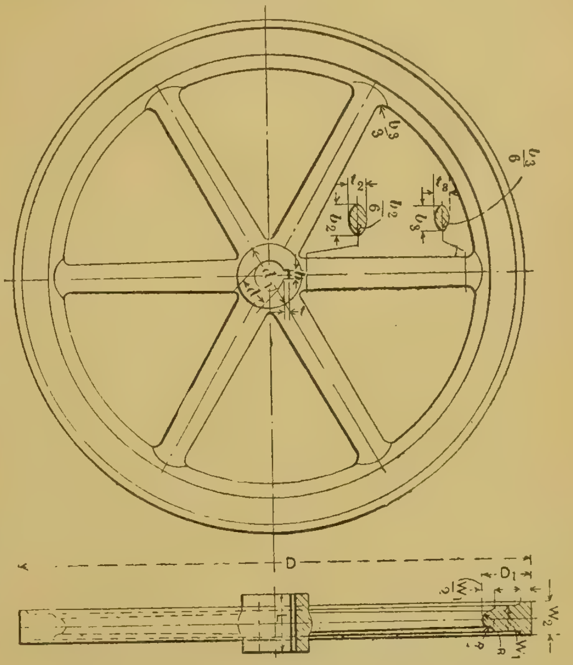


Fig. 2.—Proportions of Flywheels for Single-cylinder, Single-acting, Four-cycle Gas Engines.

Hubs.—The diameter of the hub should be approximately twice the diameter of the shaft, or

$$d_1 = 2d \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (13)$$

Length should be from 1·75 to 2 times the shaft diameter

$$L = (1{\cdot}75 \text{ to } 2)\,d \quad . \quad . \quad . \quad . \quad (14)$$

Many firms use the split hub, that is, a slot is cored through the hub separating into two parts. One advantage of this type of construction lies in the fact that rather loose fits on the shaft may be quite readily tightened. In putting on the wheels it also facilitates the operation somewhat. A wedge is driven into the slot, expanding the bore of the hub, when the wheel may easily be slipped into place, and the hub bolts then tightened. With this type of hub it is also possible to use straight keys, thus dispensing with the cutting of the taper keyway, although the advantage of this is somewhat dubious. Where hubs are bored the proper size for the shaft, and the finishing tools are kept the proper diameter, shafts being standard, the solid hub is perhaps as good as any, except for the larger sizes.

Keys.—For the solid hub wheels it is necessary to use taper keys to prevent endwise movement on the shaft. In order to extract the keys readily they should be provided with gib heads. Wedges may then be driven in behind the key, and it may be removed without difficulty. When driving keys it is not necessary to use the largest sledge that can be obtained, with the consequent danger of breaking the hub; they should be driven with the ordinary-sized hammer, and if properly fitted will hold indefinitely. The end edges of the keys on the bottom should be slightly rounded, so that either in driving or removing they will not cut into the shaft. The keys should be so fitted that the gib heads are within from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. from the end of the hub. Nothing is more unsightly than to see a key projecting a considerable distance from the wheel, and, by the way, nothing is much more dangerous either, besides occupying a lot of good space which should be used for the pulley hub.

One concern uses a square key, having a taper of $^3/_{16}$ in. per foot. The keyway is cut about four-tenths of the total depth in the shaft and six-tenths in the wheel.

The key width may be made according to the formula:

$$b = 0{\cdot}17\,d + 0{\cdot}15 \text{ in.} \quad . \quad . \quad . \quad (15)$$

Nothing has been said as to the practice of attaching pulleys to the flywheel, as the author does not favour this construction. This is a cheap construction, as it does away with the long crankshaft, but it requires a special pulley, which can only be obtained from the manufacturer of the engine.

THE LATE MR. ALBERT SULZER.

We regret to have to announce the death of Mr. Albert Sulzer, of the firm of Gebrüder Sulzer, of Winterthur, Switzerland, which occurred on the 14th November last. Mr. Albert Sulzer, who was born the 23rd January, 1841, has survived his elder brother, Mr. Heinrich Sulzer, by four years. Mr. A. Sulzer had only retired to take a well-earned rest and to make room for the younger generation in the present year, but he was not destined to enjoy repose, and endured much suffering before being relieved by death. Mr. A. Sulzer, who was especially a foundry expert, acted as chief of the foundry department, and took charge of the purchase of materials. He was also head of the benevolent institutions. The deceased served his time as an apprentice in his father's foundry, and in 1860 attended the Technical High School at Karlsruhe. Subsequently he served for some time in a bank at Basle, worked at Messrs. Schneider's works at Creuzot, and passed three years in Manchester studying the practice in English foundries. On his return to Switzerland he became partner in the firm of Gebrüder Sulzer, then consisting of his father and his uncle Solomon. After 1872 Messrs. Heinrich and Albert Sulzer were the sole partners.

Mr. Albert Sulzer took his full share in the rapid development of the firm.

The Society of Engineers (Incorporated).—The first annual general meeting was held on the 12th inst., at 17, Victoria Street, Westminster, Mr. Diogo A. Symons, M.Inst.C.E., President, in the chair. The result of the ballot was the election of Mr. F. G. Bloyd as President. The following awards were announced:—The President's Gold Medal to Mr. W. C. Easdale for his paper on "Sewage Disposal Ideals"; the William Clarke Prize, value £5 5s., to Mr. S. M. Dodington for his paper on "Public Slaughter-houses"; the Bessemer Premium, value £5 5s., to Mr. C. W. V. Biggs for his paper on "The Inspection and Testing of Engineering Materials and Machinery"; the Nursery Premium, value £3 3s., to Mr. Henry C. Adams for his paper on "Current Professional Topics"; a Society's Premium, value £3 3s., to Mr. A. H. Allen for his paper on "Electricity from the Wind"; a Society's Premium, value £3 3s., to Mr. C. R. Enock for his paper on "Engineers and Empire Development."

BOILER EXPLOSIONS.

Abstracts from Recent Board of Trade Reports.

Explosion from a Main Steam Pipe on board the s.s. "Auchenblae."

Report of Preliminary Inquiry, No. 1,964.—The explosion occurred on the 8th December last, when the vessel was about 50 miles from Durban. The vessel is owned by the Auchen Steam Shipping Company Limited, of which Messrs. Purdie, Glen and Millar, 55, West Regent Street, Glasgow, are the managers. No person was injured by the explosion. The pipe which failed was the steam pipe connecting the stop valve chest on the starboard main boiler to the main engine stop valve. It was made from a brazed copper tube, $5^1/_{16}$in. in internal diameter, No. 3 L.W.G. in thickness, and about 10 ft. 9 in. in length. The ends of the pipe were fitted with brass flanges brazed on in the usual manner. The form of the pipe is shown on the plate. The pipe fractured circumferentially at the neck of the flange next to the starboard boiler stop valve, and was forced by the steam pressure entirely away from the flange. The steam pressure at the time was 80 lbs. per square inch. The explosion was due to the material being unable to withstand the stresses set up by the excessive movement and vibration of the engines, caused by a bent high-pressure piston rod and loose engine seating.

Explosion from a Vertical Boiler at a Creamery.

Report of Formal Investigation No. 1,965.—The explosion occurred on the 12th October, 1909, at "The Creamery," Dewsnup Street, Ardwick, Manchester. William Mather, an assistant at "The Creamery," was severely scalded and died in hospital. Joseph Scanlon and Ernest Cheetham, who are also assistants, were scalded. The boiler was of the vertical type, with internal fire-box and uptake. It was about 7 ft. 6 in. in height, including the ashpit, and 3 ft. 3 in. external diameter. The fire-box was 2 ft. 8 in. diameter, and 4 ft. in height, with three cross tubes. The boiler was fitted with the usual mountings, including a safety valve loaded by a lever and weight, for a working pressure of 60 lbs. per square inch. There was also a fusible plug fitted in the crown of the fire-box, the diameter of the opening covered by the fusible metal being 1 in. The exact age was unknown, but it had been in use since 1890. The lead disc which was fitted into the brass plug upon the crown plate of the furnace melted, and fell into the furnace, the steam in the boiler escaping through the opening thus formed into the fire-box, the fire-door of which was standing open. The assistants who were scalded were sitting in front of this door. The explosion was caused by the lead disc which was fitted into the plug melting, owing to the water in the boiler having fallen below the level of the said disc, and thus exposed it to the action of the heat from the furnace.

Explosions from an Economiser.

Report of Preliminary Inquiry No. 1,970.—The explosions occurred on the 27th June, 1910, at the Solway Mills, Silloth, near Carlisle. No person was injured by the explosions. The economiser consists of 192 cast-iron pipes arranged in two groups, 12 rows being in each group, and each row containing 8 pipes. The length of the pipes is 8 ft. 11 in. between the sockets, their external diameter $4^9/_{16}$ in., and their thickness tapers from $^5/_{16}$ in. at the top to $\frac{3}{8}$ in. at the bottom. They are placed vertically, and those in each transverse row are connected at their ends to horizontal cast-iron boxes. The tubes are turned with a slight taper at each end, and forced into the boxes by hydraulic pressure. Cast-iron expansion bends are fitted between each group of tubes. Each of the lower boxes is bolted at one end to a horizontal pipe placed longitudinally, which is attached at one extremity to the feed pipes leading from the main feed pump, while a blow-off valve is attached to the other end. The upper boxes communicate with a similar horizontal pipe, placed on the opposite side of the economiser; a safety valve, 2 in. in diameter and loaded by lever and weight to 165 lbs. per square inch, is fitted at one end of this pipe, and through the other end the feedwater passes from the economiser to the boilers. Tapered lids, drawn into position by bolts, are fitted to the upper side of the top boxes, so that the internal surfaces of the vertical tubes can be cleaned and examined when the lids are removed. The taper on these lids is such that friction only should hold them in place when once screwed up. The economiser is set in brickwork, and there is a door on the side of the soot chamber to afford facilities for cleaning. Dampers are fitted at the inlet and outlet of the economiser chamber, and at the entrance of the direct flue to the chimney. By these means the waste gas can be made to travel either through the economiser chamber or direct to the chimney. Change valves are fitted to the feed range to enable the feed, if necessary, to be passed direct to the boilers instead of through the economiser. All the tubes and branch pipes were satisfactorily tested by water pressure when new to 350 lbs. per square inch at the makers' works. The economiser was nearly six years old. The complete economiser was tested in place by hydraulic pressure satisfactorily after its erection in 1904, but the date cannot now be ascertained. Since its erection two tubes have been renewed. The economiser has been under the inspection of the Vulcan Boiler Insurance Co., and the last thorough inspection by one of their inspectors was made on the 18th March, 1909. It was also inspected by the resident engineer at the mills on the 16th December, 1909. Two holes about $\frac{3}{8}$ in. in diameter were formed in one tube, about 1 ft. from the lower end, and another tube fractured for a length of 3 in. just above the bottom socket, and through these openings the contents of the economiser escaped. The explosions were due to external corrosion of the tubes, until they became too thin to withstand the working pressure.

Explosion from a Cast-iron Steam-pipe Range.

Report of Preliminary Inquiry No. 1,971.—The explosion occurred on Monday, the 27th June last, at Olympia Oil and Cake Mills, Selby. No person was injured by the explosion. The range of steam pipes from which the explosion occurred was in that part of the mills known as the refinery, and conveyed steam to the plant used in the process of refining oil. It consisted of one vertical and two horizontal sections, made up of cast-iron pipes of various lengths. The horizontal sections were connected to the vertical section, one near the top end and the other about 17 ft. down, and branches were fitted from these to the various tanks in the building. The vertical section was about 27 ft. 6 in. in height, being 6 in. in internal diameter up to the lower horizontal section, and 4 in. in internal diameter above. The upper and lower horizontal sections were about 48 ft. and 64 ft. in length respectively, and were 4 in. in internal diameter, being supported by wall brackets and beams at intervals of about 9 ft. A separator was fitted at the lower end of the vertical section, to which the main steam pipes from the boilers were connected, and a drain, $1\frac{1}{2}$ in. in diameter, was led from the separator to a steam trap. Five of the pipes failed, four being situated in the upper vertical and horizontal sections, the other being in the lower horizontal section near the black grease tanks. They were all $5\frac{1}{4}$ in. in diameter externally, and 4 in. in diameter internally. One of them was 7 ft. 6 in. and the others 8 ft. in length, having flanges 1 in. in thickness cast on at each end, and they were secured together by six bolts $\frac{5}{8}$ in. in diameter. The steam pipes had only been in use for about three hours when the explosion occurred. The pipes were examined and tested by water pressure to 250 lbs. per square inch before being dispatched from the makers. After erection they were tested by steam pressure, and while under pressure they were inspected by Mr. Weston, chief engineer, and Mr. Pickles, engineer of the mills. The explosion occurred with a loud report, and the refinery was filled with the escaping steam. A stop valve in the mills was closed, shutting steam off the range, and it was then found that the pipes had fractured, and three lengths had fallen from the upper part of the range. The explosion appears to have been caused by the failure of the upper length of pipe in the vertical section, due to its being defective and unable to withstand the stresses set up by the expansion of the horizontal sections of the range.

Explosion from a Cast-iron Steam Pipe.

Report of Preliminary Inquiry No. 1,973.—The explosion occurred on the 3rd July, 1910, at Margaret Pit, Bunker Hill, Fence Houses, county Durham. No person was injured. The pipe, which was made of cast-iron, was 9 ft. long, 13 in. in internal diameter, and nominally $\frac{7}{8}$ in. thick; but the actual thickness was about $\frac{3}{4}$ in. at the side where rupture took place and about 1 in. at the other. The flanges were $20\frac{1}{2}$ in. in diameter, $1\frac{3}{4}$ in. thick, and stiffened by eight ribs at the back. A short branch with $\frac{7}{8}$-in. bore was cast on at one end. The pipe was about 10 years old at the time of the explosion. The explosion was not of a very violent character, but a piece of metal, 30 in. long by 8 in. wide, was blown clean out from the side of the pipe, and the pipe cracked for the remainder of its length. Through the opening formed water and steam escaped. The pressure at the time of the explosion was about 40 lbs. per square inch. The explosion was due to water-hammer action on a faulty pipe, the section of the piece blown out showing about 50 per cent of "cold shot" metal.

Explosion from the Main Boiler of a Steamship.

Report of Preliminary Inquiry No. 1,974.—The explosion occurred on the steamship Ethelbert on the 12th July last, when the vessel was about 16 miles north-east of the Longstone Light. No person was injured by the explosion. The boiler was made of steel, and was of the ordinary single-ended marine type, with two plain furnaces. It was 9 ft. 3 in. long, and 9 ft. 3 in. in internal diameter. The furnaces were 2 ft. 10 in. outside diameter and $^{9}/_{16}$ in. thick, and the seams were welded. The shell plates were $^{11}/_{16}$ in. and the end plate $^{29}/_{32}$ in. in thickness. The combustion chamber backs and wrapper plates were $^{17}/_{32}$ in. thick, and the bottoms $\frac{5}{8}$ in. in thickness. All the usual mountings necessary for a marine boiler were fitted, including two spring-loaded safety valves, adjusted for a working pressure of 130 lbs. per square inch. The boiler was about nine years old. In May, 1910, the boiler was retubed, and in June, 1910, several rivets were renewed in the bottom of the starboard combustion chamber. The boiler was inspected on the 19th May, 1910, on behalf of the Total Loss Mutual Steamship Insurance Association, Sunderland, and it was again partially examined by Mr. Alexandra Davidson, Superintending Engineer and Ship Surveyor, Aberdeen, on the 21st June, 1910. A hole about $\frac{3}{8}$ in. diameter was formed at the side of one of the rivets in the bottom of the port furnace, at the back end, through which the contents of the boiler escaped into the stokehold, the pressure at the time being about 100 lbs. per square inch.

The explosion was due to corrosion, set up internally by pitting, and externally by leakage from one of the rivets which secured the angle iron stiffener to the bottom of the furnace. The plate adjacent to this rivet thus became too thin to withstand the ordinary working pressure.

Explosion from a Pan for Boiling Sugar.

Report of Preliminary Inquiry No. 1,975.—The explosion occurred on the 16th July, 1910, at the South Vale Confectionery Works, Carlisle. No person was injured by the explosion. The pan was an open vessel, and was made of copper, the upper portion being cylindrical, and the bottom hemispherical in form. It was 29 ft. in diameter, and 25 in. in depth, and was fitted with a jacket, a space of ⅜ in. separating the jacket from the pan to form a steam space. The rim of the pan was beaded over an iron rod ½ in. in diameter, and the jacket, which came to within 8 in. of the top of the pan, was secured to the latter by copper rivets ⅜ in. in diameter, pitched 1½ in. apart, and the joint above the riveting was soldered. The pan and jacket were each made of three pieces of plate with brazed seams, two plates forming the cylindrical portion, and one plate the hemispherical portion. The original thickness of the pan was ·128 in., and of the jacket ·104 in. Under the beading at the top of the pan were fitted a couple of iron half straps 1½ in. deep by 1½ in. thick, bolted together. To these were bolted four iron legs 1 in. diameter, on which the pan was supported, the total height from the ground being 34½ in. The steam inlet, which was attached to the jacket about 5 in. from the top, was through an ordinary screw-down valve ¾ in. diameter. The outlet was at the bottom of the jacket, and was fitted with a valve ½ in. in diameter, to which an open-ended pipe was attached, so that the drain was always in sight. A safety valve ½ in. in diameter, of the three-wing type, loaded by a lever and weight, was also attached to the jacket. The works' boiler was made for a working pressure of 180 lbs. per square inch, but the safety valves are adjusted to lift at 160 lbs. Between the boiler and the pan a reducing valve is fitted to the steam pipe, which is supposed to reduce the pressure to 60 lbs. per square inch, and on the low steam side of this reducing valve a relief valve is fitted, which should lift at that pressure. The pan was nearly 12 years old at the time of the explosion. Before leaving the maker's works it was tested by steam pressure to 90 lbs. per square inch. About seven years ago a valve was fitted to the steam outlet in place of the drain cock originally fitted by the maker. The steam inlet valve seat has also been renewed occasionally, the last time about six months ago. There has been no thorough inspection of the pan at any time since it was made. The pan collapsed over an area 18 in. in diameter, the maximum deflection being 9 in., and fractured in two places for lengths of 8 in. and 9 in. respectively; through these openings steam escaped violently. The explosion was due to the pan being subjected to a greater pressure than it could withstand with safety.

Hardening Twist Drills.—The following remarks re the hardening of twist drills are given by a correspondent of the *American Machinist* in relation to a query which lately appeared in that journal: If a piece of steel or drill is heated to 2,300 deg. Fah. in order to harden it, and then raised to 400 deg. to temper it, the result would most certainly not be the same as hardening at 1,900 deg., or 400 deg. less than 2,300. If the drill was hard enough at 1,900 deg., the result of heating to 2,300 deg. would be to enlarge the grain crystals, and thus tend to injure the steel, and if the steel was injured or the grain crystals enlarged, it would have to be heated to the recalescent point to refine the grain, and certainly 400 deg. would not do that. The manufacturer knowing the alloyed contents of the steel certainly should know the relascent point.

LARGE GAS ENGINES AND THEIR TROUBLES.*

(Continued from page 702.)

A four-cycle cylinder, having only half as many explosions as a two-cycle cylinder at the same speed of revolution, has obviously a much lower temperature than the latter. Again, the mean gas temperature may be reduced by using a weak charge and by keeping down the maximum pressure and temperature attained on explosion. These devices are, in fact, adopted in all large gas engines, the maximum pressure—and with it also the maximum temperature—being reduced by keeping the compression low; present values being distinctly lower than was the case a few years ago; whilst the mean effective pressure—which is determined partly by the strength of the charge and partly by the value of the compression—is not allowed to greatly exceed 70 lbs. per square inch. This value should not be maintained for more than a few minutes at a time—less if the engine is internally dirty—and is considerably reduced for continuous running.

The diameter of the cylinder affects the temperature of the gases in the following way: The gases near the walls are colder than those in the body of the combustion chamber because of the cooling action of the cylinder walls. This cooling action obviously decreases as the ratio of the wall surface to gas volume decreases, and therefore is less marked in a large than a small cylinder. The action is not strictly proportional to this ratio, or it would be easy to show that a 25 in. cylinder was twice as effective a cooler as a 50 in. cylinder. Still, the action exists, and partly accounts for the fact that in engines of similar design very few cylinder troubles were experienced with engines developing about 250 B.H.P. per cylinder, whilst most serious troubles were met with when from twice to four times this power was developed per cylinder. This applies to cylinders of the earlier designs, great improvements having been effected within the last year or two. The bad effect of the metal thickness on wall temperatures is too evident to call for comment, but it should be pointed out that this thickness increases in direct proportion to the maximum pressure expected in the cylinders, and also to the diameter of the cylinder. Hence another reason why low compression pressures are being adopted, and also why makers hesitate to build cylinders as large as their shop equipment would permit.

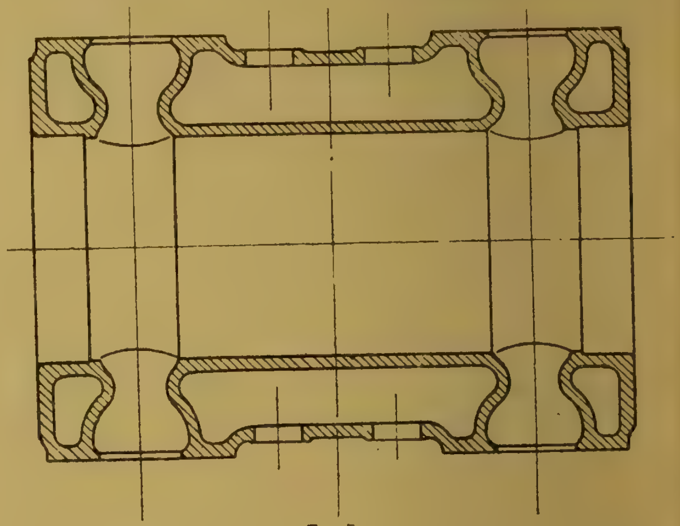


Fig. 7.

So far we have spoken mainly of the average temperatures of the gases and walls, but the same remarks apply in most cases to the maximum temperature. An exception is, of course, that the two-cycle engine has only a slightly higher maximum temperature than a four-cycle engine. In some respects the maximum temperature is of more importance than the mean. Many of the cracks in gas-engine cylinders are caused by surface-heat stresses. Thus, if the mean temperature of the wall surface is 500 deg. Fah., the actual value may fluctuate between, possibly, 300 and 1,000 deg., and the surface layer will tend to contract and expand correspondingly. The body of the metal prevents this contraction and expansion, so that tensile and compressive stresses are set up in addition to the stresses arising from gas pressure, casting strains, or unequal distribution of temperature between the various parts of the cylinder. These surface stresses are just equal to the stresses required to produce a degree of compression equal to the amount of the expansion prevented from taking place. Hence these stresses are directly proportional to the coefficient of expansion (with temperature) of the metal and the modulus of elasticity. Thus, taking the hypothetical temperatures given above and ignoring changes in the modulus, etc., with temperature, the free expansion from the mean value would be about 0·003 in. per inch of length for cast iron and 0·0033 in. for cast steel. The compressive stresses produced by resisting the expansion would be about 19 tons per square inch for cast iron and 43 tons per square inch for steel. It will be seen that steel, by reason of its high modulus of elasticity, is more highly stressed than cast iron, and may give inferior results, as in fact frequently happens where heat stresses are very important. It should be noted that excessive surface cooling, such as is produced in badly-designed cylinders, with scavenging sets up serious tensile stresses, which are very dangerous with cast iron. It will be seen that local surface failure of the metal may easily occur. Once failure has taken place the tensile stresses due to gas pressure enlarge the crack by tearing, so that the ultimate failure may be due to mechanical rather than thermal causes.

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* Paper read by Mr. Frank Foster, M.Sc., at the Manchester Engineering Exhibition, October, 24, 1910.

Leaving the subject of surface stresses and cracks, we pass to the general defects encountered in gas-engine cylinders, which are all directly or indirectly due to heat. Fig. 7 shows a typical large gas engine, as formerly made by Messrs. Ehrhardt and Sehmer, of Saarbrucken, Germany. This cylinder, like a great many other Continental designs, was cast in one piece. There were two concentric barrels tied together by the two end flanges, and the neck pieces of the four main valves, the four igniters, and the four air-starting valves, not to mention any ribs there might be connecting the two barrels.

(*To be continued.*)

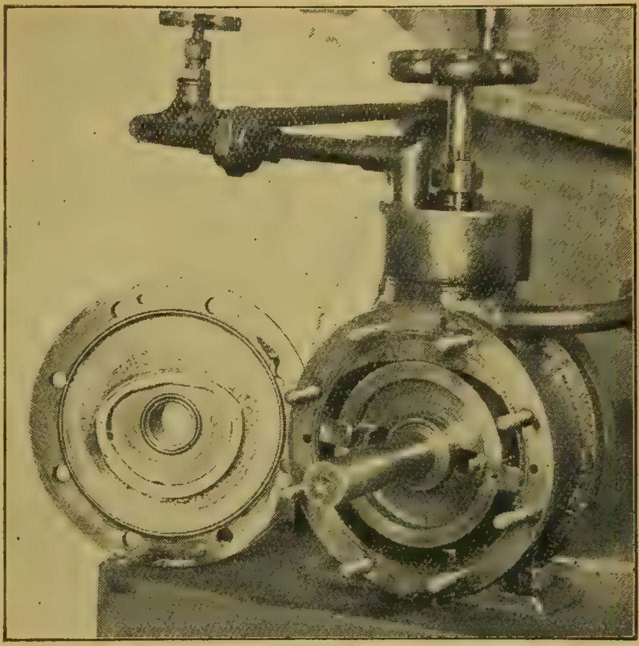
A NEW ROTARY PRESSURE ENGINE.

This engine, shown in our illustration, consists of a rotor or drum which rotates in a cylindrical chamber, and is slotted for the reception of two vanes. In the upper part of the cylinder is a projecting part, against which the rotor bears, and which forms a seal to prevent steam passing. On both covers of the engine are fixed ring cams, which engage slots in the vanes, so that as the rotor rotates the vanes are drawn inwards in order to pass the seal and then pushed out again to take the steam pressure. The steam is admitted through one or the other of the two ports on either side of the seal by a valve operated by hand at the top of the cylinder. By merely moving this valve the engine can be started, stopped, and reversed without link motion.

The inventors state that in this engine the steam pressure is always acting at a leverage equal to the distance of the vane from the centre of the rotor, there is always one vane taking the pressure, and there are no dead centres, as is the case with the reciprocating engine, and no energy is wasted in driving cranks, eccentrics, connecting rods and valves.

The new engine is claimed to differ from the turbine in that the former uses the pressure of the steam, whereas the latter derives its energy from the speed of the steam. It is also said to differ from other rotary pressure engines which have been got to work more or less efficiently in that the rotor is always concentric with the cylinder; there is no counterbalancing pressure to reduce the efficiency, and, moreover, the engine is simple in construction, only three working parts being employed, and no springs or the like.

According to the makers, a test of an engine of this type, having a single cylinder 4½ in. in diameter and 2 $^9/_{16}$ in. wide (weight 22 lbs.), gave 2·01 B.H.P., with a boiler pressure of 87 lbs., and at 665 revolutions per minute. The I.H.P. was 2·02, and the efficiency practically 100 per cent. The weight of the steam was considerably less than one-half that used by a reciprocating engine developing a corresponding power.



"Cherry-Bush" Rotary Pressure Engine.

Starting with a cylinder of the size mentioned above, and using the steam expansively through six cylinders and a condenser, the maximum consumption of steam is given as 5 lbs. (five) per B.H.P. per hour. Compared with a minimum of 15 lbs., which is the best obtainable with turbine or reciprocating engine, this shows a saving of at least two-thirds steam and fuel, and by employing a cylinder larger in diameter than the above, it is claimed that considerably better results can be obtained.

The makers also state that in addition to the large saving in coal that would be effected by the use of this engine, the first cost is considerably less, the engine being extremely small and its boiler less than a third the usual size. It can be adapted for use with gas or petrol.

The rotary engine, which is called the "Cherry-Bush," is the invention of Mr. Walter Robbins Cherry and John Bush, of the Auto Controller and Switch Co., and can now be seen working under load at the Simplex Works, Vienna Road, Jamaica Road, Bermondsey.

Calendar.—From Messrs. Stewarts and Lloyd, Ltd., 41, Oswald-street, Glasgow, we are favoured with date-case for 1911, mounted in leather. It is suitable for the desk or wall.

NOTES ON DIESEL OIL ENGINES.

[SPECIALLY CONTRIBUTED.]

The Diesel oil engine is, of course, an internal-combustion engine, and as such can attain to higher overall thermal efficiencies than are even theoretically possible in the majority of steam plants. Owing to the obviation of the preignition danger in Diesel engines (by injecting the fuel into the cylinder only at the moment when combustion is desired) this type of engine can be built for much higher horse powers than are conveniently obtained by other gas or oil engines, and the enormous compression ratio possible—in fact, necessary—makes the engine the most economical prime mover yet known. At present, standard Diesel engines cover a range of horse powers from 35 to 1,000 B.H.P., but larger units will no doubt be manufactured in the near future. It is well known that the thermal efficiency of an internal-combustion engine depends directly upon the compression ratio employed, and when it is remembered that the compression in Diesel engines rises to 700 lbs. per square inch or more, while 100 lbs. per square inch is a good limit for those engines which compress *an explosive mixture*, the superiority of the former in this respect will be obvious. The high pressures employed in the Diesel engine are at once the source of its efficiency and the reason for its comparatively high capital cost and the care needed in its manufacture. It must be remembered, however, that since the fuel is blown into the cylinder gradually during an appreciable fraction of the working stroke, there is no "peak" pressure such as is met with in ordinary gas and oil engine "cards." The maximum pressure in the cylinder of a Diesel engine does not greatly exceed the compression pressure, a fact which conduces to very smooth running and minimum vibration and depreciation. It is easy in these engines to govern by varying the amount of fuel injected per stroke, and much better results are thereby attained than by the "hit and miss" system, which is usually most convenient for gas engines.

Fuel.—The Diesel engine is essentially a heavy oil motor; it burns cheap "crude" petroleum, and it is not the least of its advantages that any class of oil, from "crude" to refined (so long as it is free from tar and acids), can be equally efficiently utilised without any structural alterations in the engine. The fuel consumption varies from 0·5 lb. per brake horse power hour on full load to 0·8 lb. per brake horse power hour on quarter load, assuming the use of average "crude" petroleum. On large engines yet more favourable results can be attained; thus in a particular high-speed 300-B.H.P. Diesel engine the fuel consumption fell to 0·42 to 0·46 lb. per brake horse power hour at various loads from $\frac{1}{3}$ to $1\frac{1}{3}$ by rated output.

Taking crude oil to be 60s. per ton, the fuel costs per brake horse power hour in the case of small engines should vary from 0·16d. at full load to 0·26d. at quarter load. In general, the fuel cost per brake horse power hour = C = 0·00536 *k*.S. pence where S – cost per ton of oil (shillings), and

k (small engines)......	0·50 ...	0·52 ...	0·60 ...	0·80
(large engines)......	0·40 ...	0·42 ...	0·45 ...	0·62
Load	1·00 ...	0·75 ...	0·50 ...	0·25 × full

High-speed Diesel engines are liable to be somewhat less efficient, thermally and mechanically, than the low-speed patterns, but the difference is very slight in a properly managed plant, and is more than compensated for by the lighter build of the engine and the greater convenience of the higher speed for many services.

In some recent tests on a high-speed Diesel engine (300 to 400 B.H.P.; 400 revolutions per minute) it was found that, of the total heat equivalent of the fuel supplied, some 30 to 33 per cent was converted to useful work at the crankshaft, 40 to 50 per cent being converted to "indicated" work in the cylinders (4 in number), 10 to 20 per cent was absorbed by frictional losses and by the air compressor, 25 per cent was rejected in the exhaust gases, and 30 to 35 per cent was rejected in the cooling water from the jackets.

It will be seen that the air compressor, for injecting fuel into the working cylinders, absorbs an appreciable, though not great, amount of energy. This auxiliary is usually mounted directly on the engine crankshaft, and is, of course, essential to the working of the main engine.

General.—Diesel engines are manufactured in vertical multi-cylinder units. Though the following figures are only representative of a few particular cases, they form a useful guide to the usual relation between horse power and number of cylinders:—

H.P. of engine.	No. of cylinders.	H.P. per cylinder.
50–100	2	25–50
100–200	3	30–70
200–400	4	50–100
500	6–8	80–120
100–150 (pinnace engines).........	4	825–40

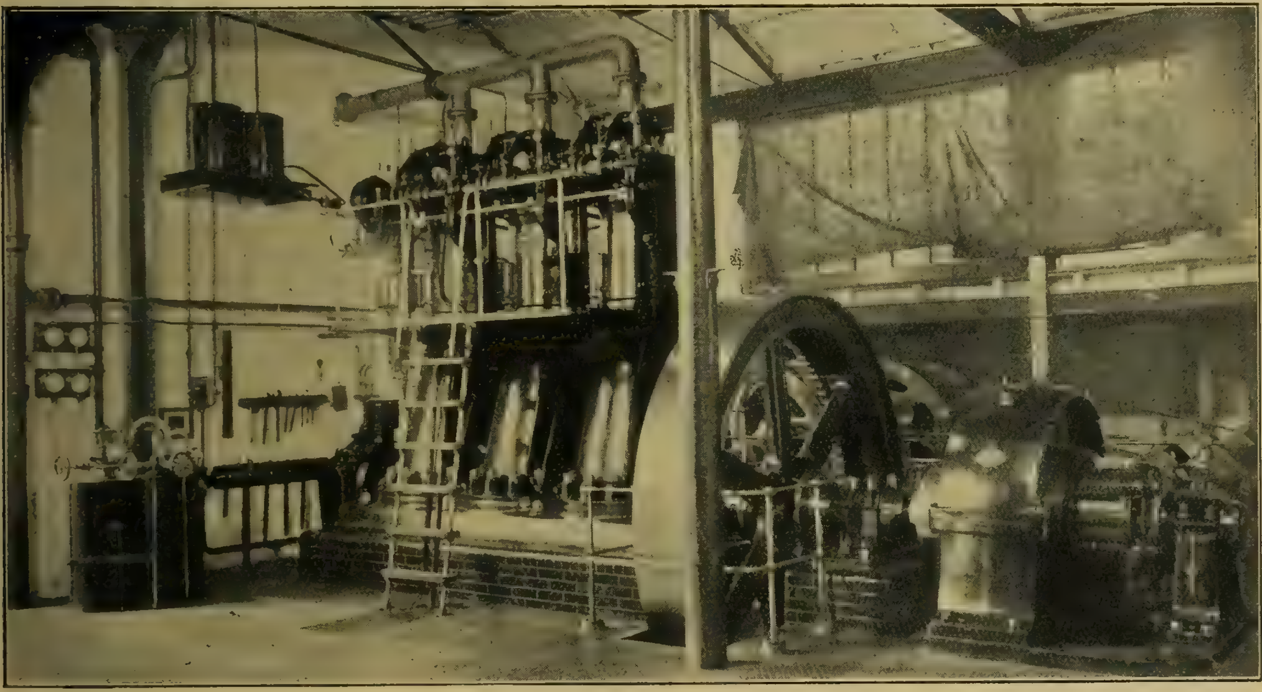
The vertical arrangement of the cylinders enables a powerful unit to be installed in a very limited space. Unique advantages of Diesel over other internal-combustion engines are: (1) The absence of all "ignition" devices. (2) Ability to cope automatically and efficiently with any load variations (however sudden) within the maximum capacity of the engine. Like all internal-combustion engines, however, the Diesel engine has a more limited overload capacity than a similar steam engine, though a certain 300-B.H.P. (rated) engine took continuous loads approaching 400 B.H.P. without difficulty.

Over "producer" and similar gas engines the Diesel oil engine has the important advantages of needing no auxiliary piping or equipment (beyond the self-contained air compressor), and of being free from all stand-by losses. This type of engine can be started and shut down with equal rapidity and completeness. The storage of oil fuel is compact, simple, and, in the case of the heavy oils used by the Diesel engine, safe. The freedom from boilers and all coal and ash-conveying and storage plants is a great advantage over steam installations, particularly in the average small works where power "generation" is a necessary evil, and must be made as simple and unobtrusive as possible. Owing to its self-contained nature, a Diesel engine requires a minimum of attendance, and repairs are found to be very low. Great care must be paid to the ample and proper lubrication of these engines, and the cost of lubrication may reach the comparatively high value of 2½ per cent of the fuel oil cost.

On Ship-board.—Diesel engines have a great future before them. Already they are largely used on many liners and on most modern battleships for driving electric lighting dynamos, a service to which they are specially adapted by their efficiency, compactness, cleanliness, and reliability. The constant speed required exactly suits their characteristics, and these engines enable the complete shut-down of the steam plant in harbour, when it would otherwise be necessary to keep steam up in one boiler for lighting and ventilating purposes. High-speed patterns are preferable for such duty, since they are themselves lighter and smaller, and since the higher speed enables the use of a smaller dynamo for a given output.

It is rather early as yet to form any definite opinion regarding the applicability of Diesel engines to marine propulsion. Already such engines have proved their merits in the driving of launches and pinnaces, but there are several difficulties in the way of their application to larger vessels. One of the chief of these is the inflexibility of the engines as regards speed variation and, in all probability this difficulty will have to be overcome by employing electro-mechanical transmission from the engine to the screw shaft. Certain transmission losses would thus be avoided, but the weight and cost of the dynamo, variable-speed motor (or motors), and the electric control gear would go far towards removing the advantages obtained by the abolition of the boiler installation and the substitution of the oil engine for the more bulky steam engine. The advantages of more rapid "coaling" (or "fuelling"), of fuel storage in otherwise waste spaces (thus increasing the cargo carrying capacity of the vessel), and of increased sea distance per "coaling" owing to the four or six times greater energy equivalent of the liquid fuel storable in a given bunker space).

Before many years have passed the internal-combustion engine—probably of the Diesel oil-fuel type—will be at least experimentally installed on: (*a*) "Tramp" steamers, in which fuel economy and rapid coaling are of transcendent importance, and matters for which some flexibility of speed control may well be sacrificed; (*b*) war vessels, in which wide range of action, rapid "coaling," high speed, freedom of decks from funnels (thus making an inconspicuous target and a very effective gun platform), and immateriality of high capital cost, all combine to favour the innovation.



DIESEL ENGINE SET.

A Diesel Engine for Electric Supply.

An interesting example of the application of the Diesel engine to the generation of electricity for public supplies has recently been set to work at Felixstowe. Until this last addition to the plant, gas engines have been exclusively used for supplying power, the earliest installation, laid down in 1899, being dependent upon town's gas, whilst the more recent plant includes two producers.

The new engine is a three-cylinder "Diesel," supplied by the Diesel Engine Co., and built by Messrs. Willans and Robinson Ltd., from the designs of Messrs. Sulzer Fréres. This type of engine is so well known that a full description is unnecessary, but a few especial features are worthy of mention. The air compressor, for instance, is of Messrs. Reavell's well-known design with three stages, and it is direct coupled to the crankshaft, the regulation of the pressure for fuel injection being effected by hand-worked relief valves between stages according to the load. Another interesting feature is the fixing of a permanent thermometer in the jacket water outlet of each cylinder. These instruments show any irregularity in the working by the temperatures; thus, if the water heats up unduly from one cylinder without the others, something must obviously be amiss.

As water is derived from the town supply at 2s. 1,000 gallons, a cooling tower has been erected on the roof to reduce the consumption down to that lost by evaporation, this "make-up" water, which amounts to about 6 per cent of the quantity circulated, being passed through a "Paterson" softener to avoid scale in the jackets. A motor-driven centrifugal pump raises the water to the top of the tower, from whence it falls into a storage tank of 5,000 gallons capacity, the quantity circulated per brake horse power hour being 2·85 gallons.

The engines run on crude Texas oil, costing about 47s. a ton, this fuel being stored in an old Cornish boiler, from whence it is pumped by hand to tanks in the engine room. One governor-controlled fuel pump supplies oil to all three cylinders, the consumption, according to a recent official test, being ·68 lb., ·671 lb., and ·828 lb. for full, two-thirds, and one-third load respectively.

A 150 k.w. dynamo running at 195 revolutions per minute is direct coupled to the engine, this machine being of the six-pole shunt-wound type built by the General Electric Co. Suitable switch gear mounted upon a marble panel has been supplied by Messrs. Bertram Thomas Ltd.

In addition to economy in fuel, even for light loads, this plant has distinct advantages over suction gas as regards attendance, space, and consumption of water, whilst certain accessories are eliminated. Although gas producers need much less space and attendance than steam boilers, these items are quite appreciable; moreover, mechanical ventilation is often necessary. Then, again, the consumption of water is seldom much under three gallons per brake horse power hour, which may be a serious item when a town supply is the only available source. It is interesting to note that the Suffolk Electric Supply Co., who are responsible for the management of the Felixstowe undertaking, established an electric supply system at Stowmarket by overhead method in conjunction with internal-combustion engines, as far back as 1896. The company have more recently laid down similar plant at Diss, all these concerns having been originated by Mr. Napier Prentice, the engineer and manager, to whom and to the Diesel Engine Company we are indebted for the above particulars and illustration.

INVOLUTE CUT GEARING AND METHODS OF PRODUCING SAME.*

It is somewhat surprising that up to the present the subject of machine-cut gearing has not found a place among the topics which have been brought before this association, especially as it enters so largely into almost every phase of engineering work, and is one of the most interesting subjects in the field of mechanics.

The author well remembers, when serving his apprenticeship with one of the most eminent firms of machine tool makers in this district, the light in which a cut gear of any description was regarded. In designing a new machine, the wheel pattern book was first consulted for something that was suitable, and afterwards the pattern itself inspected to ascertain if the teeth looked something like. It was only rare occasion and extreme necessity that called for the extravagance of a cut gear. All this is now a thing of the past, every gear being, or at least should be, machine cut.

It is not the author's intention to go into the history of gearing, noting the stages of its development, but rather to give the results arrived at and the practices adopted for its production at the present time.

The function of teeth is to transmit motion between wheels as nearly as practicable with the same regularity of motion as would be the case if the wheels were revolved by frictional contact between two smooth surfaces, coinciding with their pitch faces, and the whole subject of odontics is to provide these imaginary surfaces with teeth, whereby they can take advantage of the strength of their material and transmit power. These teeth must possess certain curves or straight lines, having definite mutual relations, and the fundamental rule lying at the basis of all correct gearing is that whatever curves or lines are adopted they must fulfil the following conditions, viz., in any position of mutual contact of the teeth, the common normal of the two engaging curves at the point of contact must pass through the pitch point, the pitch point being that point at which the two pitch circles meet. This curve is termed an odontoid.

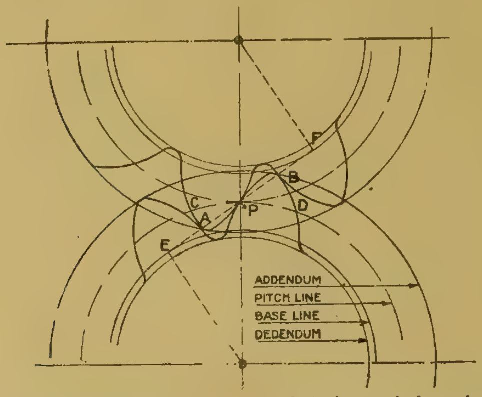


Fig. 1.—The diagram shows teeth of a somewhat abnormal shape, but fulfilling the required conditions. The common normal being E F, to the two curves C A—B D.

Hence for a system of interchangeable gear two odontoids are necessary to the formation of the tooth shape, one above the pitch line termed the face, and one below termed the flank of the tooth. It would be quite feasible to have a system of gearing with one side of the tooth composed of entirely different odontoids to the other side, and consequently either side of the tooth a totally different shape to the other. This is the case with the buttressed tooth, but if one of these gears were reversed they would not mesh; hence for a system that shall be fully interchangeable the tooth must have an odontoid both above and below the pitch line, and similar odontoids on the other side of the tooth.

The portion of the tooth above the pitch line is referred to as the addendum ,and the portion below as the dedendum.

The first accurate gearing in general use was the cycloidal form. This is a system whereby the odontoids were produced by the rolling of a circle on the pitch line, a point on this rolling circle generating the tooth curve. By rolling on the outside of the circle the face odontoids were produced (termed epicycloids), and rolling on the inside the flank curves or hypocycloids; hence two curves of opposite directions formed the tooth side, these curves meeting at the pitch line. In consequence the system is sometimes referred to as the two-curve system. When produced as a rack both curves as alike.

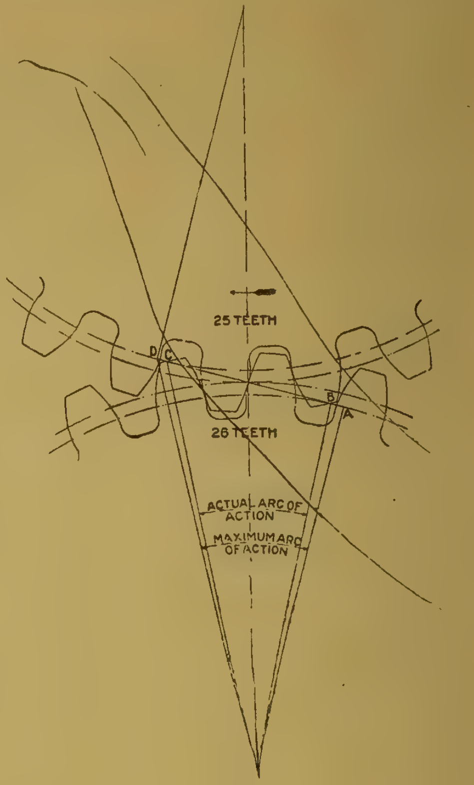


Fig. 2.

The great defect of the cycloidal system is that the pitch circles must be always at exact centres, because the curves of the odontoids change at the pitch line. Failing this condition, all rolling action is entirely lost, and noise, friction, and wear result. There need be no hesitation in stating that the time has arrived when this system might be dropped altogether; the only reason for its existence at the present day seems to be that it was first introduced and still lingers on.

Another feature of cut gearing which should be entirely done away with is that of circular pitches, being both clumsy and unsatisfactory, this again being a survival of early custom. All concerns making a speciality of gearing will welcome the day when it is defunct. In passing it may be well to mention that the more correct term would be the pitch arc, that being what the circular pitch literally is, and in pinions with a small number of teeth there is an appreciable and practical difference.

The standard at the present day and one that is quickly superseding the older system is the involute tooth and the diametral pitch. After making a statement like the foregoing it is as well to state the reasons. The circumference of a circle in terms of its diameter is 3·14159, etc., an incommensurable fraction, therefore measuring the tooth in an arc of circle, one of two inconveniences arise. Either the pitch must be an inconvenient fraction or else the pitch diameter, and consequently the centres, for the gear must have a definite number of teeth. Gear users know the difficulties arising from this, and it is needless to enlarge upon it.

Dealing with the diametral pitch first, this is strictly a ratio rather than a measurement, being the number of teeth in the gear divided by the pitch diameter of the gear. Thus a gear of 80 teeth, 20 in. diameter, is 4's pitch. The advantages are so apparent that it is quickly becoming universal. It may be defined as the number of teeth in 1 in. of the diameter. Then, again, to obtain the blank diameter two teeth are added and divided by the pitch. Taking the above example,

$$\frac{80 + 2}{4} = 20{\cdot}5 \text{ blank diameter.}$$

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* Paper read by Mr. S. H. Rowley, M.I.Mech.E., at the Manchester Association of Engineers, on the 26th November, 1910.

The system in vogue on the Continent is the metric, all dimensions being in millimetres, the module being the addendum, or the pitch diameter in millimetres divided by the number of teeth in the gear. The pitch diameter is the module multiplied by the number of teeth in the gear.

The so-called standard tooth of to-day is the involute curve with the 14½ deg. of obliquity or pressure angle.

Let us trace briefly the developments of the regular form of tooth and the reasons for its adoption. Reverting to the cycloidal tooth, the angle of obliquity along the path of contact varied from zero at the pitch point to about 23 deg. at the end of a rack tooth and 20 deg. on a pinion tooth, the mean being about 15 deg. In the evolution of the involute system 14½ deg. angle of pressure was adopted as the basis, probably on account of its convenience in setting out, the sine of this angle being practically one fourth.

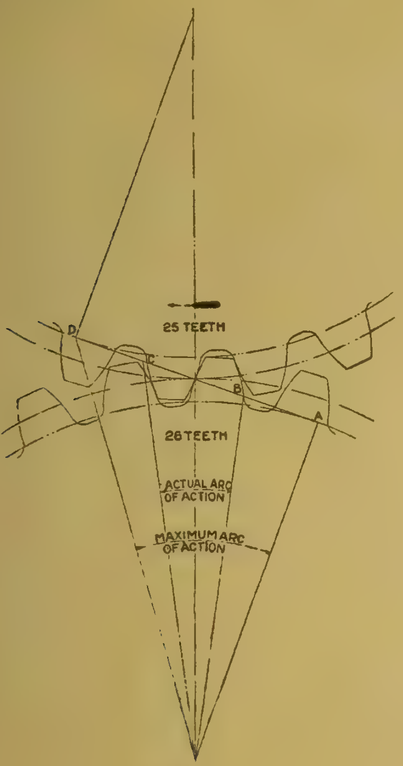

Fig. 3

The length of tooth should be sufficient to give an arc of contact between two meshing teeth at least equal to the pitch arc, with the smallest pinions, 12 being the minimum in practice. This enables one pair of teeth to keep in contact until the next ones are in position for taking up the load. It naturally results therefore that there is a fixed relation between the obliquity of the line of action and the length of tooth.

A length of tooth beyond that which is necessary to ensure a continuity of action produces undue friction and wear, the best results being obtained when the arc is from 1¼ to 1½ times the pitch arc.

One of the most valuable features of the involute curve is that the centres of two gears may be varied to such an extent that they only engage at the points and will work together in perfect contact, the lines of action and the pitch line moving with the curves, resulting only in excessive backlash. This rule, however, only holds good where both gears are above a certain number of teeth. In pinions the arc of action must not be reduced below the equivalent of the circular pitch, nor must the curve go beyond the limit line or line of interference when the centres are closed in.

The 12-tooth pinion is the smallest that will have an arc of action as great as the pitch, but 11 and even 10 teeth may be used, the error being practically negligible. It is possible to design teeth on this system with as few as three teeth in the pinion. Such a pinion, however, would require a special wheel to gear with it, and would not form part of an interchangeable system.

Conditions which refer to spur gears apply equally to internal or annular gears, but what is tooth in the one becomes space in the other. It is possible to make a pair of wheels of which the pinion has only two teeth less than the internal. This is effected by omitting the face of the teeth of either gear, either by making the pinion tooth all dedendum and the wheel all addendum, or *vice versa*.

In practice it is found desirable to make the pitch diameter of an internal wheel somewhat larger than standard—that is, assuming the wheel forms part of a train, say, with a central pinion and intermediates.

The motor car industry has done much for the development of accurate cut gearing during recent years, exclusively high speeds, great strength, and noiseless running being necessary. To obtain these results has called for the closest study of the action of the teeth, extreme accuracy in the cutting, and the elimination of undercut in pinions. The latter point will be dealt with later on.

We are apt to regard the present tooth as a fixed law, but this is not the case, and there has within the past few years been introduced by the Fellows Gear Co., a system of gearing termed the stub tooth, which is growing more and more in favour, although it is as yet little known to general engineers. It is therefore proposed to go somewhat fully into this, the author being convinced that it possesses great merit, and is worthy the consideration of all gear users, and in making the following comparisons he is indebted to the Fellows Co.

There is one phase of gearing that has received but scant attention, and that is the co-relative effect of the angle of obliquity, or pressure angle, and the length of the tooth upon the efficiency and wearing qualities of the tooth itself. It can be shown that an excessive sliding takes place at a certain portion of the tooth action between gears having teeth of the standard or 14½ deg. angle, and that by increasing this angle it is possible to so shorten the tooth that only such portions of the curve are used as will give nearly a complete rolling action. An increase in the angle of obliquity has often been advocated, but its advantages are very limited if a tooth of the standard length be retained.

Figs. 2 and 3 show comparisons of the tooth form of a gear of the standard and of the stub tooth, the driver having 25 and the driven 26 teeth. If, in the diagrams, the gears are supposed to rotate in the direction of the arrow, the theoretical action begins at A and ends at D, the line A, D being termed the line of action. It is obvious that the action can only begin at B, where the outside diameter of the upper gear intersects the line A, D and ends at point C. Drawing the radial lines from these points to the centre O, the triangle A, O, D defines the maximum or the greatest possible arc of action, and B, O, C the actual arc of action.

In fig. 4 is shown the involute curve of 14½ deg. obliquity of each of the gears, the curves being of sufficient length to cover the maximum arc of action, and drawn to the same scale as figs. 2 and 3. The alternately shaded divisions of the curves show the portion of each that is in contact with its mate during an equal angular movement of the gears.

In fig. 5 is seen a similar diagram for a tooth having an angle of obliquity of 20 deg.

In figs. 6 and 7 we have the same involute curves developed into straight lines, the points corresponding to the divisions of figs. 4 and 5 being connected by cross lines.

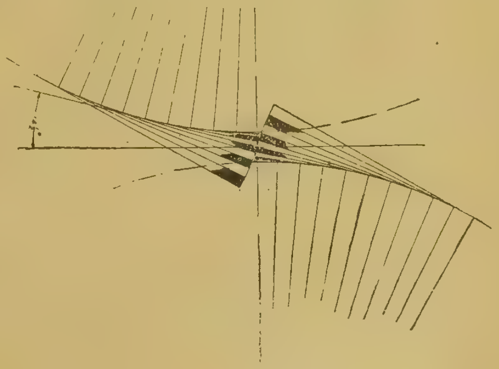

Fig. 4.

To anyone who has been under the impression that if the two involute curves of a pair of gears are correct, the action is nearly a rolling one; a comparison of these diagrams will be both interesting and instructive. It proves that there practically is no rolling whatever.

It will be noted that although the divisions of the base circles are equal those of the involute decrease as the base is approached, showing that the wear is concentrated at this point. When, however, it is considered that the contact is between the flank of the tooth and the point of its mate, it is seen that the condition is not ideal.

Figs. 6 and 7 show that the portion of actual contact, denoted by the shaded part, includes in the case of the 14½ deg. tooth cross lines that have a considerable angularity showing an excessive sliding action, while the corresponding lines of 20 deg. teeth are nearly parallel, denoting that the action is nearly a rolling one.

Again, referring to figs. 2 and 3 as showing a comparison of the two systems, we note two points in which they differ.

First, on account of the greater angle of the line of action of the stub tooth the maximum arc of action is much increased.

Secondly, the ratio of the actual to the maximum arc of action of the stub tooth is much less than in the standard.

This latter point is a very important one, as contact is eliminated at both ends of the line of action. When we realise that this is the portion in which the greater part of the sliding takes place with corresponding wear, it is a good thing to cut it out if possible.

The point of the tooth which wears out the flank of its mate is removed with the adoption of the stub tooth, and this reduces the friction and increases the efficiency. A comparison of figs. 6 and 7 shows that the action of the stub tooth is nearly a rolling one. It is, of course, impossible to entirely eliminate the wear between the teeth of gears working under a load, but if the wear can be evenly distributed over the entire working face of the tooth the correct form of tooth is retained indefinitely, and a worn-out gear should, aside from excessive backlash, run as well as a new gear. If this wear can be evenly distributed, the durability of any gear will be increased.

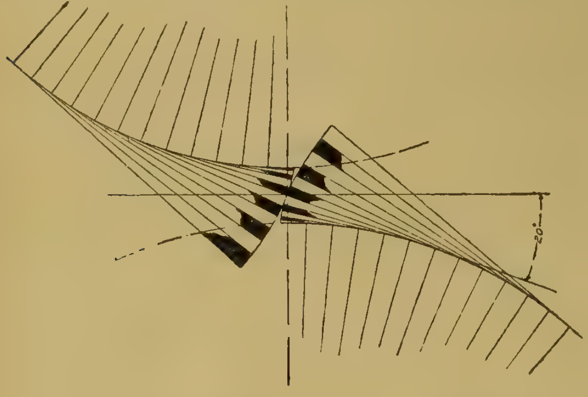

Fig. 5.

There is another advantage of the stub tooth over the standard form, which is entitled to consideration, viz., increased strength, because the tooth has been shortened and at the same time widened at its base.

The increased angle of obliquity is an essential part of the stub tooth system, and with this increased angle the effective arc of motion is as long as that of the 14½ deg. tooth.

A short time ago one of the most exacting firms of motor car makers gave the author's firm an experimental order for a set of stub tooth change-speed gears to substitute standard gears. Complaint was made of excessive backlash, and a thorough investigation resulted. The gears were tested and found to be practically perfect in the cutting. The old gears were replaced and the backlash was not noticeable. On inquiry it transpired that the practice of the firm was to make the centres ·002 in. full. The cause of the trouble then became apparent, and may be stated as follows: The smaller the pressure angle the less the backlash when the gears are slightly separated, and what was correct for the standard tooth was excessive for the stub tooth, simply on account of the difference in the angle of obliquity. This is a point to be wary of.

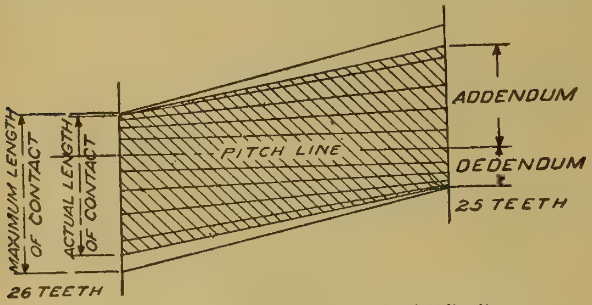

Fig. 6.—Standard Tooth 14½ deg. Angle of Obliquity.

It is now proposed to indicate the method of producing involute cut spur gear. The first system of accurate interchangeable cut gearing was made practicable by Messrs. Brown and Sharpe, of America, who introduced sets of relieved disc cutters which could be sharpened without altering their shape. There are eight cutters in the set.

A rack having teeth with straight sides at an angle of 29 deg. forms the basis of the system, 12 teeth being taken as the smallest pinion. The teeth were based on the correct involute form, but when a pinion so made is rolled in a rack it is found that to avoid interference the flanks of the teeth must be considerably undercut, producing a very weak tooth; further, it would have been impossible to cut them with a disc cutter. Interference is most apparent between racks and pinions, and is due to the path described by the point of the rack tooth crossing the involute face of the pinion near the base line. An important part of the acting face of the pinion has therefore to be cut away to clear the rack, and consequently a loss of a large portion of the arc of action. It was therefore decided to make the flanks radial. This necessitated a modification of the involute on the tops of the teeth faces of the wheels, resulting in a compromise, and from its introduction about the year 1874 the system has been modified from time to time. The result at the present day is an evolution by a trimming process from errors which have become apparent from time to time in the past and is to some extent a trade secret. For moderate speeds excellent results are obtained, and to further increase the efficiency it is possible to get 16 cutters to the set, or even specific cutters for specific numbers of teeth.

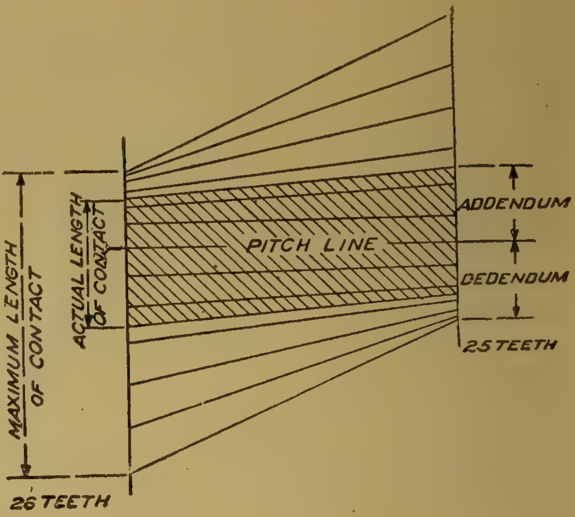

Fig. 7.

Another method of producing spur gears is to plane the teeth, using an enlarged former as a copy.

(To be continued.)

BOARD OF TRADE EXAMINATIONS.

The following is a list of marine engineers to whom certificates of competency have been issued during the week ending 22nd December, 1910.

Cardiff.—*First class:* T. A. Hopkins, A. Gunn, R. H. Newsham, F. H. Barnes, E. H. Pengelly. *Second class:* W. D. Lewis, W. E. Segar, F. G. Brookes, E. W. Humphreys, W. H. M. Portch, W. Thomas, A. Glen, J. P. Russell.

Glasgow.—*First class:* A. Murray, A. Lawrence, A. McGregor. *Second class:* R. T. Armour, H. Borland, P. C. McIntyre, T. H. Smith.

Leith.—*First class:* A. G. Riddle, W. T. Findlay, J. S. Moodie. *Second class:* M. Abernethy, T. Cleghorn, A. W. B. Cockburn, T. Dawson, J. Theologis.

Liverpool.—*First class:* E. J. Rowlands, W. C. Johns, E. Butler, J. Dean, J. Sanderson, T. Jones. *Second class:* F. Bell, A. J. Brent, W. L. Donaldson, W. H. Howell, S. A. Shingler, W. Skinner, M. F. Thayer.

London.—*First class:* R. Lawson, A. V. Johnson, W. A. Harvey. *Second class:* W. Bayley, A. E. Cunningham, T. F. Lloyd.

North Shields.—*First class:* F. G. Lugrin, A. Thomson, V. J. P. Farina. *Second class:* W. H. Vincent.

Plymouth.—*First class:* J. H. Collings.

Southampton.—*Second class:* G. H. Alford.

West Hartlepool.—*First class:* J. L. Macdonald, B. J. Lemmon, V. Cummins. *Second class:* P. A. P. Brunn, J. B. Laverty, A. Smurthwaite, J. Watt.

TRADE NOTES.

Railway Material.—H.M. Consul at Bahia reports that a concession for the extensions of the federal railway system in the State of Bahia has been granted to a French Corporation, under the name of the "Companhia Viacao General de Bahia." The company will also take over the working of all the federal lines in Bahia. The *Diario* of 13th November publishes the following decrees: No. 8351 approving the plans and estimate of 633,634 milreis, submitted by the Leopoldina Railway Co. Ltd., for the construction of 5½ miles of line on the "Estrada de Ferro do Norte"; No. 8353 approving plans and estimate of 11,444,000 milreis, submitted by Ibirocahy and Co., for the construction of 90 miles of line, viz., from Rosario to Itapicuru, Sao Luiz to Caxias, and a branch to Itaqui. H.M. Minister at Mexico City reports the grant to the "Compania del Ferrocarril Sud-Pacifico de Mexico" of a concession for the construction and working of a railway 560 kiloms. (about 350 miles) long from a point situated between Orendain and Guadalajara to the City of Mexico, passing by way of Zamora and Morelia. Seven years are allowed for the completion of the line. In addition to the foregoing, the concessionaires are empowered under the terms of the contract to construct the following lines of railway: From the River Santiago to Tepic, Tepic to Magdalena, Orendain to Guadalajara, Tonichi to a point between San Bernardino and Agua Prieta, from the confluence of the rivers Yaqui and Moctezuma to Nacozari, Empalme to Guaymas, and various other sections.—*Board of Trade Journal.*

Messrs. David Bridge and Co., Ltd., Rubber Engineers, Castleton, Manchester, have been successful in booking an order for a special hydraulic vulcanising press, 14 ft. long by 54 in. wide, to have 12 rams, *i.e.*, six pairs, and to work at a high pressure. The press will have three platens, *i.e.*, two daylights complete with hydraulic charging and discharging appliances. This press is for the extensive works of Messrs. The Premier Reforming Co., Ltd., Walthamstow, for the manufacture of sheeting and other mechanical goods by their special process. Messrs. Bridge have also installed three of their special heavy grinders, each electrically driven, *i.e.*, for the grinding up of old rubbers into a state required by the Premier process, besides special machinery to cope with their increasing business.

Proposed New Railways.—The Russian *Official Messenger* notifies that at a meeting recently held by the North-Eastern Ural Railway Company, the question was discussed as to the construction of the following lines:—(1) Taborinsk to Ekaterinburg via Turinsk and Irbit, and (2) from the Alapayevsk iron works to Bogdanovich via the Egorshinsk mines. The total length of line would be 309 miles, and the cost of construction is estimated at 27,720,000 roubles (about £2,926,000).

Railway Material.—The *Diario Official* publishes the following decrees:—No. 8,371, approving the plans and estimate of 6,531,000 milreis, submitted by the "Companhia Estrada de Ferro de Goyaz" for the construction of a section of railway between Perdicao and Palestina; No. 3,386, granting, in favour of the Ministry of Communications and Public Works, a credit of 400,000 milreis for the construction of the Itacurussa branch of the Central Railway of Brazil; No. 8,391, approving the plans and estimate of 2,345,000 milreis, submitted by the Director of the Central Railway of Brazil, for the construction of 37½ miles of the Monte Claros extension; No. 8,387 approving the plans and estimate of 11,542,000 milreis, submitted by the "Companhia Estrada de Ferro de Goyaz" for the construction of a section of line 160 miles long from Ipamery to Antas; No. 8,392, approving a contract with the "Companhia Estrada de Ferro Sao Paulo Goyaz" embodying a concession for the construction of a railway, 120 kiloms. (75 miles) long, from Monte Azal, in the municipality of Bebedouro, State of Sao Paulo, to the borders of the River Grande, passing by way of Cresciuma, Portao do Ceo and Corrego Rico. The concession carries with it a subsidy of 15,000 milreis per kilom.

Buoy Steamer.—The *Daily Witness* (Montreal) notifies that tenders are invited by the Dominion Department of Marine and Fisheries for the construction of a twin-screw buoy steamer for the St. Lawrence River. The vessel is to be of the following dimensions:—Length between perpendiculars, 170 ft.; breadth, 31 ft. 6 in.; depth, 15 ft. 6 in. It must have a draught of 10 ft. 6 in., and a speed of 11 knots per hour.

Dock Pumping Plant.—The Imperial Trade Correspondent at Auckland reports that tenders are invited by the Auckland Harbour Board for the supply of a new pumping plant for Calliope Dock, at an estimated cost of about £10,000. Tenders, marked "Pumping Plant for Calliope Dock," will be received by the Chairman of the Auckland Harbour Board, Auckland, up to 7th March. Tenders will be considered only from firms who have previously undertaken similar work successfully. The whole plant, with all fittings, must be entirely of British manufacture. Delivery is desired as early as possible. Specifications may be obtained and plans seen by prospective tenderers at the offices of the London Agents of the Harbour Board. Tenders are also invited for the construction of the following lines of railway:—S. Pedro to S. Luiz and S. Borja; Jaguarao to Basilo; Alegrete to Quarahy; S. Sebastiao to Sant' Anna do Livramento via D. Pedrito Tenders, which will be opened on 12th January, should be accompanied by a deposit of 20,000 milreis, and addressed to the "Directoria Geral de Obras e Viacao, Ministerio da Viacao e Obras Publicas," Rio de Janeiro. Any foreign material required in the construction of these lines will be exempt from customs duties. Offers may be made for one or more of the above sections. Three years are allowed for the carrying out of the work.

LAUNCHES AND TRIAL TRIPS.

Mediterraneo.—The steamship Mediterraneo, built by Messrs. Wm. Doxford and Sons, Ltd., Pallion Yard, Sunderland, to the order of the Societa Anonima di Navigazione a Vapore "Lussino" of Lussinpiccolo, was launched on the 15th December. She has been built to Lloyd's and Austrian Veritas class under special survey. She carries 7,500 tons deadweight on 23½ ft. draught, and steams 10 knots, being fitted with triple expansion engines and boilers with Howden system, also built by Messrs. Doxford.

Maloja.—The twin-screw steamer, the Maloja, built by Harland and Wolff, Ltd., for the Peninsular and Oriental Steam Navigation Co., was successfully launched at Belfast on the 17th December. The Maloja is a passenger and mail steamer of the highest class, and the largest vessel yet built for the P. and O. Line. The launch of this vessel appropriately completed the tonnage output of Harland and Wolff, Ltd., for the year, making up a record total of 115,861 tons and 100,130 I.H.P. The new vessel is 569 feet long by 62 feet 9 inches beam, with a gross tonnage of about 13,000, and in her construction and design she will represent the latest and most approved practice. She has two steel pole masts and two funnels, ten watertight bulkheads carried up to the spar deck, seven steel decks, and the double bottom extends right fore and aft, the depth and strength being increased under the engine-room, giving great rigidity to the structure. The Maloja will have accommodation for over 450 first-class and about 220 second-class passengers. The arrangements for working the ship and cargo will be of the most approved type, including ten hydraulic cranes, anchor crane, and steam windlass. The steering gear is of the builders' well-known make, and capable of being worked by telemotor from flying bridge. The vessel has large insulated cargo holds. She will be fitted throughout with electric light, and provided with an installation of wireless telegraphy, the Marconi house being on the promenade deck near the officers' house, the captain's house being on the boat deck above the officers' quarters. The Maloja will have two sets of quadruple expansion engines arranged on the "balanced" principle, also constructed by Harland and Wolff, Ltd.

Ascanius.—The new twin-screw steamer, Ascanius, left Belfast harbour early on the 21st December and proceeded to Carrick Roads for adjustment of compasses, after which the machinery tests and speed trials over a measured mile course in Belfast Lough took place The Ascanius is a sister vessel to the Æneas, which left Belfast a few weeks ago, and is intended for service in the new line of steamers which Messrs. A. Holt and Co. are establishing between Great Britain and Australia. The new steamer is 509 feet in length, with a gross tonnage of 10,050, and has been built and equipped to comply with the British Board of Trade requirements for a first-class passenger steamer. The six cargo holds are, by the adoption of the girder system of construction, capable of receiving the largest type of cargo, such as boilers and machinery. One of these holds and the after 'tween decks have been insulated and prepared for the carriage of frozen meat, dairy produce, and fruit. For the preservation of these cargoes and the stewards' perishable stores, a complete plant of refrigeration machinery on the carbonic anhydride system has been fitted. Each of the cargo hatchways, which have been made extra large, are equipped with steam winches, derricks and other appliances necessary for dealing expeditiously with a full cargo. The propelling machinery consists of two sets of triple expansion engines carefully designed, so as to reduce vibration to a minimum. The auxiliary machinery includes steam pumps arranged for various duties, electric light machinery, and refrigerating plant. Steam is generated in three large double-ended steel cylindrical multitubular boilers working under forced draught.

QUERIES AND REPLIES.

Communications intended for insertion should be addressed to The Editor, "Practical Engineer," 55 and 56, Chancery Lane, London, W.C. They should be written on one side of the paper only, and in all cases be accompanied with name and address. This column is intended for the mutual assistance of engineers in their daily work. We cannot, under the pretence of answering a query, be made the medium for gratuitous puffing, nor can we undertake to reply to queries by post.

Answers received and inserted that have entailed research or labour will be paid for according to their merit. Books or other publications referred to or recommended in this column can be obtained from the Technical Publishing Co. Ltd., 55 and 56, Chancery Lane, London, W.C.

2279. Composition for Filling Floats.—Can any reader of *The Practical Engineer* give the writer particulars of the composition used for filling floats ?—W. M.

2282. Safety Valve Design.—Will any reader give the main points to take into consideration in safety valve design ? How is the area of the valve determined ? Also outline the design of a spiral spring type valve for a 6 ft. Lancashire boiler, 150 lbs. pressure.—K. T.

2286. Conical Steel Tubes.—Could any reader inform me where I could obtain conical-shaped steel pipes as follows: Inside from 6 in. to 14 in. diameter, $\frac{3}{8}$ in. thick, with flanges 12 in. and 18 in. diameter; length of pipe, flange to flange, 12 in. ?—A Reader of your Paper.

2291. High-pressure Water.—Will some experienced reader give me detailed information concerning the cost of high-pressure water and its value as a source of power ? What are the average efficiencies and plant factors of various hydraulic engines ?—Hydric.

2292. Wastage for Steel Plates and Bars.—Would some reader kindly give me the wastage for steel plates and bars to cover rolling heats and scrap.—E. F.

2296. Strength of Flexible Steel Wire Rope.—Can any reader give me a more accurate formula than the usual $2\frac{1}{2}c^2$ for calculating breaking strength of flexible steel wire rope of 1 in. to 6 in.; also what factors should be taken for the working and proof loads ?—W. G. G.

2297. Safe Load on Gear Wheels.—What is the safe load on gear wheels of the following particulars: A spur wheel in eight segments fastened to the arms of a balance wheel, 208 cogs, 2·777 in. pitch, 7 in. wide, webbed entirely on one side, 40 revolutions per minute; and a pinion wheel gearing into the spur wheel, 74 cogs, 2·777 in. pitch, 7 in. wide, $112\frac{1}{2}$ revolutions per minute, the teeth neither shrouded nor webbed. Velocity of gearing at pitch line 1,925 ft. per minute. The flywheel has eight arms, and eight wrought-iron stays between the arms, and also an extra boss; approximate weight of flywheel 13 tons. These wheels are on a single McNaught beam engine, driving a cotton factory, and are made from cold blast cast iron ?—Mill Manager.

MISCELLANEA.

Excellent progress has been made with the extensive scheme undertaken by the Blyth Harbour Commissioners for improving the fishing trade facilities at the South Harbour. In the building of new quays, smoke houses, and the covered-in market, etc., the commissioners have expended £25,000 this year.

The Board of Trade labour exchange system is to be extended by the opening of offices at Aston, Bedford, Chester, Darlaston, Ilkeston, Keighley, Kidderminster, Newark, Salisbury, Shipley, Stafford, and Stirchley. Counting the exchanges that were already open, this would bring the total of the Government offices to nearly 150.

At Messrs. Gio Ansaldo, Armstrong and Company's works at Sestri Ponente, Italy, a torpedo-boat destroyer and a passenger and cargo steamer for the Italian Government railways were built this year, the output being 3,731 tons, as against 2,004 tons a year ago. The firm is well supplied with work for the ensuing year.

Students' Meetings.—At the students' meeting of the Institution of Civil Engineers, held on 16th December, Mr. R. N. Mirza read a paper on "Calculation of the most economical Ratio of Steel in Reinforced-Concrete Beams and Slabs." The author, basing his calculations upon the usual stresses of 600 and 17,000 lbs. per square inch in the concrete and steel respectively, evolved a formula from which could be estimated the total cost of a structure, having given the ratio of cost of concrete and steel per unit.

Castings to Withstand High Pressure.—At a meeting of the Institution of Mechanical Engineers, held on the 16th December, Professor H. C. Carpenter, of Manchester University, submitted a paper upon "The Production of Castings to Withstand High Pressures." The object of the investigation was to get a non-ferrous alloy capable of giving regular castings capable of being used in high-pressure hydraulic pumps, etc., without cracking, or if possible even leaking, after being a short time in use. The experimental work was done in collaboration with Mr. C. Edwards in the Matallurgical Department of Manchester University, and the first series of tests dealt with a gun metal of the phosphor bronze type, which when freshly cast gave quite satisfactory results, but owing to a change in the structure of the alloy it "aged" rapidly, becoming weak and leaky. The chief part of the researches dealt with aluminium bronzes. These were made with about 10 per cent of aluminium and cast both in chill and dry sand moulds. The tests showed that it was possible to cast cylinders which are not burst by water pressures of 18 tons per square inch, the only drawback being that stretching began at about 10 tons pressure. The precautions which were found necessary to give best results were summarised as being—(1) to prevent oxide inclusions the alloy must be poured very slowly; (2) the casting temperature should be not more than 1,100 deg. Cen., which is about 50 deg. above the point at which freezing begins; (3) risers are essential to overcome the shrinkage of the alloy, which is very considerable. Heavy drossing during melting is inevitable, but if the pouring is done with as little agitation as possible the tenacious film of alumina, characteristic of these molten bronzes on exposure to the air, is utilised to protect the remainder of the fluid metal. The tensile tests of the 10 per cent aluminium bronzes average over 20 tons per square inch; the homogeneity is very satisfactory, as the small freezing interval prevents segregation, and as the corrosion is extremely slight either in fresh or sea water, the authors consider these various properties as likely to make this bronze very serviceable in replacing other alloys where chronic difficulties have been encountered.

The Yorkshire Boiler.—The following notes formed part of a lecture given by Mr. W. H. Casmey before the Rochdale Association of Engineers on Dec. 17th: The design of the boiler is such that every square foot of flue heating surface is active, thereby making it possible to reduce the heating surface 30 per cent and the grate area 15 per cent, as compared with a Lancashire boiler, and still secure the same hourly evaporation and a higher thermal efficiency. The Lancashire boiler is now generally made 30 ft. long and 8 ft. to 9 ft. 6 in. in diameter; the furnace flues, two in number, run parallel from the front end where the furnaces are situated to within 5 ft. of the rear, from which point they taper, and at the extreme end have a sectional area about 30 per cent less than at the front. In the case of the Yorkshire boiler, the length, as a rule, is two-and-a-half times the diameter, and the shell is fitted, as in the Lancashire boiler, with two furnace flues, but these expand from the furnaces to the rear end of the boiler so that more water is located over the first 7 ft. than the last 7 ft., conditions which are quite the reverse. In actual practice 700 square feet of heating surface in a Yorkshire boiler transmits as much heat as 1,000 square feet in the Lancashire type. The length of the "Yorkshire" is, as a rule, two-and-a-half times the diameter, the two flues being expanded at the rear, the maximum being reached three feet from the downtake. The idea is to produce a more uniform transference of heat to the water over the whole length of the boiler. A comparative test was made last year by one of our Boiler Insurance Companies between a 24 ft. by 9 ft. Yorkshire and a 30 ft. by 9 ft. Lancashire. The latter was covered with composition, the Yorkshire was bare, and the actual hourly evaporations were: Yorkshire, 1,195 gallons; Lancashire, 1,023 gallons. If we add 8 per cent to the Yorkshire to make up for the lack of covering, the evaporation stands at 1,290 gallons per hour. In connection with the actual performance of the Yorkshire boiler, it is interesting to note that every boiler is sold under the following guarantee: "That a 20 ft. Yorkshire boiler will evaporate as much water per hour as a 30 ft. Lancashire of the same diameter, and that a 24 ft. Yorkshire boiler will evaporate 15 per cent more, maintaining the same efficiency." This guarantee is supported by a further agreement to submit to a penalty of £10 per 1 per cent shortage.

OSRAM·LAMPS

PATENTEES' CHRONICLE

OF

Applications for British Patents.

*The following is a Complete List of Applications for Patents made during the past week. Where a Complete Specification accompanies an Application an asterisk is suffixed, thus.**

DECEMBER 16th, 1910.

29203 Speed gear. Spence.
29204 Clips. Monk.
29205 Firelighters. Ross.
29206 Signalling device. Irwin.
29207 Cricket bats. Gradidge.
29208 Razor strop. Cox.
29209 Pens. Dittmar.
29210 Turning tractor. Groome.
29211 *Axles. Hartung.
29212 *Cash boxes. Schaeffer.
29213 *Saws. Muir.
29214 Kettle. Moorhouse.
29215 Display busts. Richards.
29216 Binding files. Lavender.
29217 *Hinges. Palethorpe.
29218 Life saving apparatus. Berman.
29219 Ladles. Peech.
29220 Seats. Hunter.
29221 Receptacles. Bell.
29222 Engines. Fraser.
29223 Water elevator. Sayer.
29224 Wheels. Howarth.
29225 Bolts. Lazarus.
29226 Type bar machines. Walker.
29227 Polishing machine. Spooner.
29228 Mustard pots. Warren.
29229 Tools. Priestman.
29230 Horse shoes. Withnell.
29231 *Aerial machines. Blackburn.
29232 Watches. Douglas.
29233 *Ball bearings. Tonks.
29234 Chemical device. Taylor.
29235 Tins. Sherburn.
29236 Golf balls. Hall.
29237 Boilers. France.
29238 Rifles. Martin.
29239 Hand bag. Harvey.
29240 Flying machines. Downing.
29241 Lamps. Nicholson.
29242 Wireless telephony. Matthews.
29243 Pianos. Browne.
29244 Set screws. Trier.
29245 Paint cleaner. Newcombe.
29246 *Non-inflammable material.
29247 *Fuel blocks. Wetter.
29248 Controlling device. Andrews.
29249 Horse shoes. Boer.
29250 Hamster trap. Beinlich.
29251 *Wheels. Harras.
29252 Bill of fare. Paul.
29253 *Advertisment clocks. Sprügel.
29254 *Iron foot rags. Schubert.
29255 *Shaft governors. Kiblbeck.
29256 *Ticket cramps. Chatwin.
29257 Camera device. Death.
29258 Bed printing machines. Payne.
29259 Stamps. Eckersley.
29260 *Plastic device. Selke.
29261 Electro-plating device. Cowper-Coles.
29262 Cleaning apparatus. Cowper-Coles.
29263 Goffering machines. Whitehead.
29264 *Motor controlling device. Royston.
29265 *Hydrographs. Cumbor.
29266 *Gun sights. Conrady.
29267 Disinfectants. Maw.
29268 Sailing vessels. Caton.
29269 Indicators. Lloyd.
29270 Electric switches. Joyce.
29271 *Mono-telephonic relays.
29272 Blind rollers. Hunter.
29273 *Printing type device. Bacigalupi.
29274 *Carts. Ochaner.
29275 Bottle stopper device. Mitford.
29276 *Fireplaces. Trotman.
29277 *Ramming machines. Marks.
29278 Door lock. Sturman.
29279 Internal-combustion engine. Wilson-Fox.
29280 *Moistening apparatus. Schwarzhaupt.
29281 *Hammer.
29282 *Gases. Schlougk.
29283 Metal presses. Brüninger.
29284 Flying machine. Kent.
29285 *Vacuum cleaners. Harvey.
29286 *Railway wagons.
29287 *Temperature change device. Köpj.
29288 *Game. Scarcerieau.
29289 Looms. Silbermann.
29290 Box lids. Fiske.
29291 Radiators. Craven.
29292 Fastening devices. Morgan.
29293 *Storing paper device. Sola.
29294 Heating device. Still.
29295 Milling grain. Woosnam.
29296 *Electric signalling system. Mathys.
29297 *Printing telegraphs. Mathys.
29298 *Oil burners. Golby.
29299 *Furnaces. Serpek.
29300 Artillery sighting apparatus. Fulton.
29301 Tyres. Austin.
29302 Electric switching devices. Hatfield.
29303 Screw nut gearing. Sweet.
29304 Alarm systems. Leduc.
29305 Fluid pressure engines. Harris.
29306 Paraffin wax treatment. Von Groeling.
29307 Coal washing machinery. Sheppard.
29308 Bottles. Williams.
29309 *Electric motors.
29310 Turbines.
29311 Internal-combustion engines. Stevenson.
29312 Sheet metal rollers. Thomas.
29313 Trunks. Bratt.
29314 Lamp suspenders. Smithson.

DECEMBER 17th, 1910.

29315 Neckwear. Mason.
29316 Railway wagon device. Huntley.
29317 Boots. Perkins.
29318 Compasses. Shaw.
29319 Garment fabric. Rushworth.
29320 *Speed gear. Coulter.
29321 Caster top. Burns.
29322 Chemical adding device. Bell.
29323 Tube connections. Tetlow.
29324 Gramophones. Mitchell.
29325 Filter. Laurie.
29326 Hatpin. Thornber.
29327 Billiard cues. Lupane.
29328 Collar supports. Adams.
29329 Dough moulding apparatus. Rees.
29330 Friction clutches. Carter.
29331 Shaving brush. Taylor.
29332 Internal-combustion engines. Binks.
29333 Conveyors. Wallwork.
29334 Training animal device. Bennett.
29335 Airships. Hughes.
29336 Gas meters. Orme.
29337 *Pneumatic milking device. Henrichsen.
29338 Lamp shade fixing device. Townley.
29339 Electric controlling apparatus. Hirst.
29340 Platen printing presses. Scholes.
29341 Electrical fuse. Darley.
29342 Linen airer. Eales.
29343 Stone screens. Baxter.
29344 Ship coaling device. Trevithick.
29345 Loom picker. Frew.
29346 Lavatory water device. Adams.
29347 Firegrates. Willetts.
29348 Firegrates. Willetts.
29349 Enamelled ware. Chamberlin.
29350 Geometrical instrument. Hobling.
29351 Internal-combustion engines. Beeby.
29352 Dyes. Newton.
29353 Gas lamps. Breeden.
29354 Tyres and wheels. Hewer.
29355 Pail. Clark.
29356 *Mercantile book-keeping. Barker.
29357 Pumps. Rees.
29358 *Cuff buttons. Herzog.
29359 Bottles. Hurst
29360 Tyres. Richardson.
29361 Boot sock. Daniels.
29362 Bed lasting machines. Ward.
29363 *Gas lighting.
29364 *Aeroplanes. Zorra.
29365 *Printing apparatus. Correll.
29366 *Boot making machine.
29367 Gaseous fuel production. Reynolds.
29368 *Dyes. Imray.
29369 *Lace. Bäumer.
29370 *Purses. Gaedke.
29371 *Sheet folding device. Kienast.
29372 Decorations. Bare.
29373 Pigments. Thompson.
29374 Pneumatic grain elevator. Cramp.
29375 Cue tips. Fagan.
29376 *Metal casting. Weiss.
29377 *Tool.
29378 *Electrical controlling mechanism. Lohay.
29379 *Fireplaces. Platts.
29380 Scaffolding erection device. Bullmore.
29381 Textile fabrics treatment.
29382 Traction engines. Burrell.
29383 *Settling apparatus. Dorr.
29384 Cassava plant treatment. Duarte.
29385 *Iron pyrites. Collett.
29386 *Sulphates manufacture. Collett.
29387 *Enamel. Kruse.
29388 *Numbering machines. Hollingsworth.
29389 *Ink. Rüter.
29390 Internal-combustion engines. Rieseler.
29391 Inter-action apparatus. Hart.
29392 *Tyres. Hamm.
29393 *Tyres. Hamm.
29394 *Tyres. Evans.
29395 Tools. Newland.
29396 Furnaces. Price.
29397 Safety razors. Poindexter.
29398 Electrical approach device. Reid.
29399 Wheels. Cook.
29400 Gas lighting device. Hair.
29401 Hammer. Ramage.

DECEMBER 19th, 1910.

29402 Feeding bottles. Craven.
29403 Ruber substitutes. Ingle.
29404 Passenger lift safety devices. Bates.
29405 Rope measurer. Torke.
29406 Detonator shields. Price.
29407 Velocipede mechanism. Hall.
29408 Match striking device. Wright.
29409 Planing machine. Himmelstrand.
29410 Electrical railways. Fehr.
29411 Chemical apparatus. Wilkinson.
29412 Teeth cleaning device. Lorinan.
29413 *Gasoline branding apparatus. Vanderkam.
29414 Compasses. Clark.
29415 Instrument case. Jones.
29416 Apparatus for recording densities. Jones.

29417 Hoisting apparatus. Fielding.
29418 *Cast metal flanges. Alley.
29419 *Seat rings. Alley.
29420 Fabric. Drey.
29421 Cards. Taylor.
29422 Spraying device. Wheal.
29423 Motor cycles. Lechmere.
29424 Tyres. McKinney.
29425 Electric lamps. Cheadle.
29426 Self-locking device. Douglas.
29427 Carburetters. Wingfield.
29428 Ventilator. Edgington.
29429 *Automobile starters. Klveen.
29430 Pulley mounting device. Lane.
29431 Suction gas producers. Hartness.
29432 Toys. Hartness.
29433 Railway signalling device. Field.
29434 Hair nets. Shaw.
29435 Tyres. Robins.
29436 Firegrate. Ward.
29437 Bending machine. Hill.
29438 Painting device. Rânay.
29439 Railway chapel car. Aldom.
29440 *Paper machines. Banning.
29441 Automatic switch. Jackson.
29442 Non-inflammable celluloid. Peters.
29443 *Safety pockets. Fernans.
29444 *Funnels. Michel.
29445 Speed gear. Barnes.
29446 *Cabinets. Pooler.
29447 *Locking device. Clerk.
29448 *Safety cranking device. Embleton.
29449 *Stamp affixing machines. Allen.
29450 Motor cycles. Reilly.
29451 *Fitting machines. Greenburg.
29452 Signs. Arnold.
29453 *Gas burners. Kelley.
29454 Games. Etti.
29455 Fire lighter. Neff.
29456 Electric switch. Johnscher.
29457 Elevators. Slotta.
29458 *Rammers. Heberling.
29459 Typewriting machines. Cusack.
29460 *Wheels.
29461 *Wheels. Fawcus.
29462 Ship guns. Bloxam.
29463 *Electric heat control. Geissinger.
29464 *Gate fastenings..
29465 *Resistance measuring arrangement. Schultze.
29466 *Boilers. Barlach.
29467 *Box seal. Whitehall.
29468 *Steam engines. Smal.
29469 Alloys. Duke.
29470 *Boots. Longstaff.
29471 *Stair structures. Nesdall.
29472 *Locking device. Lake.
29473 *Electro-plating apparatus. Pucklitzsch.
29474 Sighting instrument. Eardley.
29475 Tyres. Baker.
29476 Azimuth mirrors. Smith.
29477 *Elastic fluid cleaning device. Spencer.
29478 Files and books. Cluse.
29479 *Safety razors. Baker.
29480 Carburetters. Rankin.
29481 *Tyre. Polack.
29482 *Type setting-up device. Harrison.
29483 Tyres. Forster.
29484 Tyres. Forster.
29485 *White oxide. Withers.
29486 *Match boxes. Moys.
29487 *Liquid dispensing devices. Moys.
29488 *Breaking machines. Chapitel.
29489 *Sparking plugs. Anderson.
29490 Ovens. Sunt.
29491 Baking device. Sunt.
29492 *Steam pressure gauges. Shaw.
29493 Dynamo electric machines. Vandervell.
29494 *Wheels. Lloyd.
29495 *Dies. Pocock.
29496 *Spinning machines. Gminder.
29497 *Syllable-writing machines. Winterling.
29498 *Stropping machines. Postans.
29499 *Mixing machine. Humboldt.
29500 *Projectiles. Ljungstrom.
29501 Gaseous fuel production. Southey.
29502 Cycle driving pulleys. Pugh.
29503 Vehicles. Carbery.
29504 Iron non-rust treatment. Heathcote.
29505 *Lamps. Arendt.
29506 *Arc lamps. Schmidt.
29507 *Buoyancy of ships. Arnone.
29508 *Dust removal device. Rollin.
29509 *Gelatine-plastic device.

DECEMBER 20th, 1910.

29510 Life-saving device. Twin.
29511 Alternating current systems. Taylor.
29512 Luggage carriers. Deakin.
29513 Easel and desk. Gray.
29514 Roller guards. Fothergill.
29515 *Gear drives. Wiesengrund.
29516 Lockets. Jennens.
29517 Oil drums. Fieldhouse.
29518 Chemical fire extinguishers. Hepton.
29519 Metal sheet racks. Waller.
29520 Friction clutch. Broadbent.
29521 *Kilns. Tidy.
29522 *Oil gas production. Burdon.
29523 Internal-combustion engines. Snarry.
29524 Ball castors. Court.
29525 Slicing apparatus. Eastwood.
29526 Bolts. Morrall.
29527 Connecting rods. Howard.
29528 Spinning mules. Howarth.
29529 Tools. Srawley.
29530 Dishes. Coles.
29531 Flying machines. Storey.
27532 Bagpipes. MacLennan.
29533 Ash tray. Davis.
29534 Door-opening mechanism. Torks.
29535 *Tyres. Patton.
29536 *Heat exchange device. Pillock.
29537 *Roller crushing mills. Van Saun.
29538 Cycle device. Brown.
29539 Speed gears. Armstrong.
29540 Vehicle driving device. Ostler.
29541 Tobacco pipes. Cowper.
29542 Vehicle bodies. Hewer.
29543 Cough mixtures. Sinclair.
29544 *Refrigerators. Hessner.
29545 Firelighters. Groves.
29546 Rubber thread manufacture. Schlimme.
29547 *Baking powders. Oecker.
29548 Ranges. Wimshurst.
29549 *Generators.
29550 *Signal. Scourfield.
29551 Eye flap. Wecke.
29552 Coal box. Neumann.
29553 *Paper. Barat.
29554 Fluid apparatus. Shaw.
29555 *Liquid injection. Deitrich.
29556 *Card scoring board. Ulrich.
29557 Public amusements. Barsby.
29558 Tyre. Blanch.
29559 *Therapeutic preparations.
29560 Targets. Kent.
29561 *Vacuum cleaner. Harvey.
29562 *Smoothing irons. Delin.
29563 *Separators. Christenson.
29564 *Cooling device.
29565 *Mouth wash. Coulson.
29566 Talking machines. Gaydon.
29567 *Acids. Ullmann.
29568 Dress fasteners. Schroeder.
29569 *Torpedoes.
29570 *Stamping machines. Lake.
29571 Springs. Hurdley.
29572 Rock drills. Rayner.
29573 Spectacles. Butterworth.
29574 Cowls. Walker.
29575 *Fastening device. Hampson.
29576 *Optical instruments. Hampson.
29577 *Umbrellas. Goidwod.
29578 *Fare indicators. Stuttrich.
29579 Lasting machines. Boult.
29580 *Printing device. Bacegaluni.
27581 *Precipitating apparatus. Tiemann.
29582 *Cellulose. Boult.
29583 Ledgers. Brooks.
29584 Tents. Allen.
29585 Roller skates. Land.
29586 *Kinematographic pictures. Gorsky.
29587 *Records. Bishop.
29588 Ticket punches. Lewis.
29589 *Advertising device. Hermann.
29590 Dentifrice. Cunningham.
29591 Fruit gathering devices. Seidenschwann.
29592 Tyres. Cox.
29593 *Electric motors. Macdonald.
29594 Pigments. Thompson.
29595 *Illuminating devices. Martin.
29596 *Saucepans. Hanlon.
29597 *Scraping machines. Hecht.
29598 Soaps. Brown.
29599 Aeroplanes. Meyerkort.
29600 Railway brakes. O'Donnell.
29601 Coat and skirt hanger. Crisp.
29602 Internal-combustion engines. MacKechnie.
29603 *Speed gears. Stern.
29604 *Indicator. Jolivet.
29605 Camera device. Ponge.
29606 Potato-planting machine. McAllister.
29607 Document files. Burton.
29608 Marbling device. Lea.
29609 *Utilising vibration device. Raub.
29610 Wheels. Pugh.
29611 *Steering device. Milsen.
29612 Acids. Bedford.
29613 Euphoniums. Hawkes
29614 Packing devices. Walker.
29615 Tar boiling apparatus. Johnston.
29616 *Telephone systems. Murray.

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29617 Crank levers. Chappell.
29618 Ratchet brace. Lewis.
29619 Pulley. Osborn.
29620 Stoves. Waller.
29621 Plough. Whitaker.
29622 Cotton gin rollers. Armitage.
29623 Razor guards. Morgan.
29624 Gas regulator. Judd.
29625 Medicator. Verity.
29626 Lamp. Partington.
29627 Card clothing apparatus. Buch.
29628 Friction drive. Heaton.
29629 Footballs. Tucker.
29630 Perambulators. James.
29631 Fuse boxes. Hope.
29632 Wheels. Johnson.
29633 Cycle inflator. Harrison.
29634 White boot cleaning preparation. Willett.
29635 Flower holders. Emanuel.
29636 Pipe fillers. Kehrer.
29637 Hackling machines. Eves.
29638 Furnace doors. Leask.
29639 Electrical bell pushes. Kempton.
29640 *Jet suction apparatus. Frame.
29641 *Stropping device. Baker.
29642 Snow ploughs. Lindop.
29643 Towels. Croasdale.
29644 Coal conveyers. Barker.
29645 Trunks. Hill.
29646 Gas stoves. Lee.
29647 Rubber drying device. Nicholson.
29648 Neck band. Masding.
29649 Ladders. Dainesi.
29650 Airship propeller. Balestrié.
29651 *Embossing machines. Wright.
29652 Aeroplanes. Cadel.
29653 Flying machines. Cadel.
29654 *Telephone calling device. Dicker.
29655 Locks. Lovell.
29656 Gas mantles. Matthews.
29657 Neckties. Ross.
29658 Smallarms. Dawson.
29659 *Pianos. Lake.
29660 Scutching machines. Haworth.
29661 *Internal-combustion engines. Kilburn.
29662 Bottle filling device. Humphrey.
29663 Small arms. Dawson.
29664 Bath cabinets. Greenhalgh.
29665 Brushes. Banot.
29666 Firearms. Dawson.
29667 Firearms. Dawson.
29668 Firearms. Dawson.
29669 Cycle saddles. Brooks.
29670 Firearms. Dawson.
29671 *Gas burners. Aubert.
29672 *Telephone exchange circuits.
29673 Coal gas purification. Evans.
29674 *Loom fastenings. Schettler.
29675 Tool. Wall.
29676 *Vacuum cleaners. Harvey.
29677 Instruments. Barker.
29678 Postal packets. McGuffie.
29679 Couplings. Nickson.
29680 Valves. Barron.
29681 Puzzle. Assorti.
29682 *Holding attachments. Jenkins.
29683 *Counting coin device. Schlich.
29684 Duplex telegraphy apparatus. Judd.
29685 *Telephones. Climent.
29686 Adding and subtracting machines. Baille.
29687 Artificial lines. Judd.
29688 *Water tube boilers. Bayssellance.
29689 *Tyres. Grapin.
29690 Firearms. Dawson.
29691 *Sealing package device. Puleston.
29692 *Revolution indicator. Lowne.
29693 Locks. Blackmore.
29694 *Buffer devices. Columbier.
29695 *Pumping apparatus. Aaron.
29696 Sounding recording apparatus. Docen.
29697 *Carbon sheet holders. Archbald.
29698 Sparring cleats. Walker.
26999 *Ball bearing castor. Russell.
29700 *Lamp regulator. Smith.
20701 Railroad ties. Green.
29702 Roller bearings. Cooper.
29703 Boot lasting machine. Ward.
29704 Motor wind screens. Kennedy.
29705 Oil distillation apparatus. Groeling.
29706 Electric conductor fittings. Munro.
29707 Targets. Evans.
29708 Mufflers. Evans.
29709 *Water gas apparatus. Stelfox.
29710 Iron manufacture. Davidson.
29711 Collar support. Lambert.
29712 *Safety attachments for books. Bungli.
29713 *Horseshoes. Kolesza.
29714 *Gun. Tépins.
29715 *Electrical furnaces. Serpek.
29716 Pumps. Boult.
29717 *Rock pulverising machines. Campbell.
29718 Artificial rubber manufacture. Herzenstein.
29719 *Explosive mixture ignition. Hughes.
29720 Acids. Johnson.
29721 Acids. Johnson.
29722 Acids. Johnson.
29723 *Platinum alloys. Johnson.
29724 Tobacco pipes. Stunthal.
29725 *Automatic recording apparatus. Johanson.
29726 *Electric driving systems. Burge.
29727 *Electric driving systems. Burge.
29728 *Electric driving systems. Burge.
29729 *Sterilising apparatus. Thorpe.
29730 Engine cylinders. Bartlett.
29731 *Internal-combustion motors. Samain.
29732 Labels. Ellis.
29733 *Electric water-heaters. Roche.

RECENTLY COMPLETED PATENT SPECIFICATIONS.

Compiled by the Publishers of the "Practical Engineer," London.

The following Accepted Applications for Patents are open to Opposition up to January 30th, 1911, and any person properly interested can oppose the sealing and grant of the Patent by giving formal notice thereof at the Patent Office.

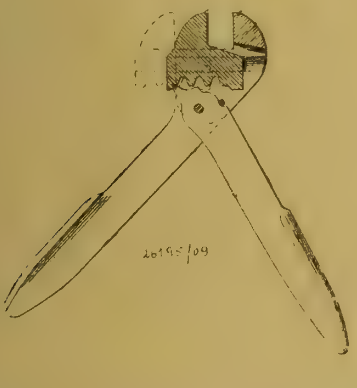
Copies of any Specification herein referred to, or of any other published Patent Specification, will be forwarded post free for 1s. on application to the Publishers of the "Practical Engineer," 19, Southampton Buildings, London, W.C.

1909.

18683 Chipperfield: Apparatus for the intermittent supply of gas to burners, particularly applicable to advertising purposes. [Post-dated February 14th, 1910.] 19117 Youlten: Means for separating materials, applicable also for use as a disintegrator. 19205 Preston and Baylay: Method of and apparatus for discharging ashes, clinkers, ballast water, bilge water, and other materials from ships and other places. 19283 Gare: Manf., moulding, and re-moulding of indiarubber goods. 21810 Victoria Spinning Co., and Black: Tempering of bobbins in certain kinds of spinning frames. [Post-dated March 23rd, 1910.] 23817 Comings: Cardboard boxes. 23860 Van Berendonck: Pneumatic elevator and conveyer having a variable output for granulated or pulverised material. 23942 McLaren and Weir: Steam generators. 24006 Zimmer: Process for waterproofing linen or other textile articles and giving them a permanent glazed washable surface. 24395 De Recondo: Apparatus for controlling and recording the speed of vehicles. [Date applied for under International Convention, October 26th, 1908. Request under Section 19 of the Act not granted.] 26170 Hunter: Chemical composition and apparatus for preventing and taking up dampness in pianos, cupboards, showcases, and the like. [Post-dated May 11th, 1910.]

26195 Lake: Spanners or plyers. [Post-dated May 12th, 1910.]

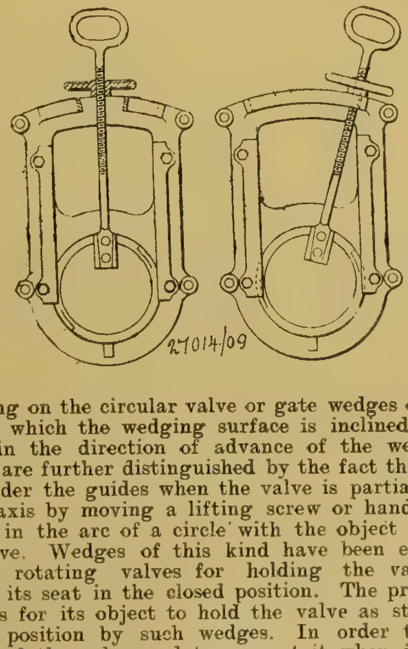
This invention relates to the type of spanner having one jaw fixed with the head of the tool and a sliding or movable jaw formed with a rack slide working within a way in the head, the rack being engaged by the end of a pivoted handle, and the invention has for its objects to limit the free sliding movement of the movable jaw and to prevent the disengagement thereof from the head of the tool. The improved spanner comprises a head having a jaw and a handle formed or fixed therewith, a movable jaw opposite the fixed jaw and carried by a slide mounted in or upon the head with a capability of rectilineal movement, a rack upon the slide, a secondary handle pivotally mounted in or on the head, and having above its axis a cam-like tooth or projection adapted to engage the rack, forming the rack at one end with a nose or stop adapted to limit the outward free movement of the rack and movable jaw by engaging a shoulder or projection on the secondary handle.



26674 Seddon: Aerial machines. [Cognate Application. 14656, 1910.] 26686 Dunsmore: Means for effecting a large reduction in steam consumption by its high-pressure generation combined with its seriate adaptation to various purposes. 26702 Hanzer and Hanzer: Automatic apparatus for lighting and extinguishing gas burners at predetermined times. 26755 Dunkley: Manf. of wheels for perambulators, cycles, and the like. 26821 Cox: Petrol cans. 26841 Ashton: Automatic rifles and other firearms. 26844 Helfenstein: Electric furnaces. 26846 Schnabl: Automatic weighing scales. 26894 Montgomery: Side carriages for use with cycles or motor-cycles. 26895 Montgomery: Attachment of side carriages and the like to motor and other cycles. 26918 Lake (Goss Printing Press Co.): Printing presses. 26923 Lake (Goss Printing Press Co.): Apparatus for treating stereotype plates. 26934 Bullock: Packing devices for pistons, piston rods, pump plungers, and the like. 26936 Wassmer: Process for the preparation of certain hydrocarbon bodies. 26938 Soc. Anon. Metallurgique Procedes de Laval: Method of obtaining a homogeneous mixture of a pulverised material and a gas and apparatus therefor. [Date applied for under International Convention, November 21st, 1908.] 26939 Sharp: Means for stopping the delivery of roving and the like in spinning and like machines. 26940 Hardingham (Elling): Manf. of section or profile paper. 26965 Boiler Scalers Ltd., Gilman and Clements: Percussive tools for scaling tubes. [Cognate Application. 14569, 1910.] 27000 Boultbee: Steam generators. 27001 Boultbee: Steam generators.

27014 J. Stone and Co., Wells and Jakeman: Disc and sluice valves and penstocks.

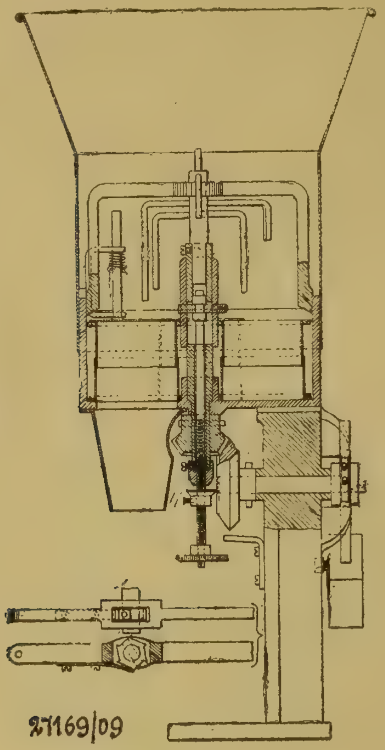
This invention relates to improvements in disc or sluice valves and penstocks of the type in which the valve is adapted to slide in guides, and is held against its seat or in the open or partly open position by wedges operated by a partial rotation of the valves. This invention consists in providing on the circular valve or gate wedges of the usual kind in which the wedging surface is inclined only in or about in the direction of advance of the wedge. The wedges are further distinguished by the fact that they only take under the guides when the valve is partially revolved on its axis by moving a lifting screw or handle attached thereto in the arc of a circle with the object of jamming the valve. Wedges of this kind have been employed on circular rotating valves for holding the valve tightly against its seat in the closed position. The present invention has for its object to hold the valve as stated in any desired position by such wedges. In order to limit the motion of the valve and to support it when in its closed position a stop may be provided on the frame or body of the valve against which the latter can rest.



27068 Grinter: Locks for railway carriage and other doors. 27076 Lachner: Process for the manf. of relief photographs. 27083 Mahood: Apparatus for raising and lowering the propeller in that class of agitating apparatus in which a propeller is used as the agitating medium. 27099 Behl: Oil pumps. 27102 Pauthonier: Manf. of new acetyl derivatives of cellulose. 27107 Adams and Gaudet: Lids or covers for wash tubs, washing-up trays, or sinks. 27109 Schellig: Partitions or screens which are capable of being rolled up. [Date applied for under International Convention, November 25th, 1908.] 27110 Mackenzie (United States Sealing Co.): Seal for newspapers, envelopes, packages, and the like. 27139 Bellini: Drawing pens. 27158 Whittaker: Apparatus for the cooling and washing of coal or other gases.

27169 Kirtley: Apparatus for measuring granular goods, powders, or other material, and delivering the same to paper bags or other receptacles.

This invention relates to apparatus for delivering measured quantities of granular pulverous or other material into receptacles of the kind in which the material to be measured is contained in a cylindrical chamber in which a rotary measuring frame containing a series of compartments or pockets, the capacity of which may be varied, is by means of pawl and ratchet or other suitable mechanism intermittently rotated betweeen the bottom of the chamber and a diaphragm or plate which is of such extent that the pocket next to be emptied will have passed completely under one end of the plate before the discharge end of the pocket begins to overlap the discharge aperture in the base plate. According to the present invention the material to be measured is contained in a cylindrical chamber at the bottom of which are telescopic tubes fitted into discs; the discs revolve and stop at an outlet in the base of the chamber to discharge. The telescopic tubes are operated from the outside by means of a central screw which extends or reduces the tubes to give the required quantity of material.

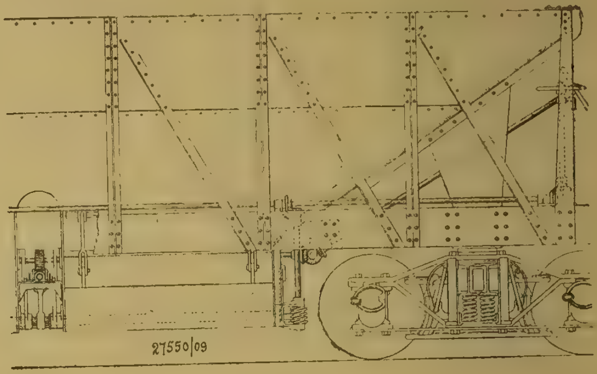


27169/09

27193 Norton: Swinging conveyers or screens. [Cognate Application. 28307, 1909.] 27233 Gibson: Acetylene gas lamp. 27238 Pollitt and Pollitt Ltd.: Oil lamps or heaters. 27272 Hilton: Method of manufacturing close wire coils, particularly for wire mattresses, and of applying the same. 27282 Chinnery, and Lindsey Bros. (London) Ltd.: Advertising signs. 27284 Richard: Optical combination for use with stereoscopic apparatus. 27287 Mackenzie (Internationale Eisenbahn Fahrkarten und Billet Ausgabe-Ges. Jefubag): Apparatus for delivering tickets from strips or rolls. 27291 Gibbons Bros. Ltd., Masters, and Van Marle: Settings of vertical retorts for the distillation of coal and other substances. 27296 Farrington and Evans: Water-pressure reducing apparatus for house and other services. 27300 Davies: Oil filters. 27332 Glass: Explosive projectiles. 27338 Parker: Windows. 27381 Levy: Inverted incandescent burner for acetylene gas. [Date applied for under International Convention, November 26th, 1908.] 27384 Rose, and Rose Bros. (Gainsborough) Ltd.: Machines for making up packets of tobacco, tea, or other granular, divided, or powdered material. 27417 Boyd, and J and T. Boyd Ltd.: Thread guides for spinning, twisting, winding, and like frames. 27437 Jackson: Acetylene generators. 27438 Margetts and Margetts: Spring wheels for vehicles. 27477 Paffard: Braking mechanism for road and other vehicles. 27480 Rudd and Scammell: Wheels for road vehicles. 27484 Dick: Wireless transmission and reception of electrical energy 27490 Michau: Flying machines. 27517 Burton: Manf. of illuminating and heating gas. 27520 Messter: Cinematograph films. 27539 Matthews, Bonas, Bonas, Bonas, and Bonas: Braking means for machines for winding predetermined lengths of cord, braid, tape, wool, cotton, and like material.

27550 Metropolitan Amalgamted Railway Carriage and Wagon Co., and Wigley: Discharging wagons.

This invention relates to discharging wagons, and consists essentially in the provision at each end of the space to be occupied by the doors of transverve plates in which are cut quadrant slots, two for each door. The doors are arranged on each side of the longitudinal axis in the central portion of the wagon and their bottom edges meet on this axis. When closed the doors fit tight into place and form a part of the V-shaped bottom of the wagon. The doors are provided with suitable trunnion connections to the slots, and as the slots are directed from the top side and the bottom side of each door, each door may be opened by lowering the top trunnions in their slot so as to hinge at the bottom side or lowering the bottom trunnions to open the door so that it hinges from the top. In this way, by operating both doors so that they hinge on the top side, the central space of the wagon is opened and discharged in the centre takes place. On the other hand, if the top sides are lowered so that the doors hinge on the bottom (which is the centre of the wagon), the open doors form a central ridge, preventing discharge between the rails and directing the materials to the sides thereof. The doors are operated in each case by toggles, one supporting the top side, whilst another supports the bottom, and by operating one toggle whilst the other remains at rest one side of the door may be lowered in its quadrant slot, whilst the other side is held by the toggle and forms a pivot. The toggles may be connected up with mechanism to give controls from both ends of a wagon and to give simultaneous operation of certain of them and separate operation of the others according as is desired for particular wagons.



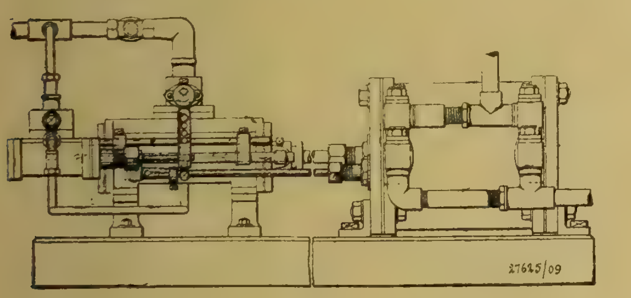
27550/09

27555 Lake (Merritt): Metal lockers. 27559 Gittins: Automatic piano players. [Application for Patent of Addition to 4532, 1909.] 27562 Hopper: Valves for hydraulic presses. 27569 Phillips and Hutchins: Apparatus for enamelling wires and the like. 27575 Richmond: Die-stamping presses. 27583 Lapisse: Process for waterproofing leather. 27604 Crawford: System for the production and supply of electricity at given tensions by means of variable-speed dynamos for railway carriages.

27625 Barnett: Apparatus for compressing gas, air, or vapour for gas lighting purposes and the like.

This invention refers to gas or vapour compressors chiefly for use with pressure gas or vapour lighting plants of the type comprising a compression cylinder and hydraulic and supplementary cylinders, and consists in applying certain improvements whereby an apparatus is produced which is entirely automatic, in which there are no dead centres and which can be started and stopped by unskilled persons. The invention comprises a compression cylinder and hydraulic and supplementary cylinders, two piston rods fitted to the piston of the compression cylinder, one of which connects with the hydraulic cylinder piston, whilst the other is provided with a tappet for operating the valve of the supplementary cylinder, and a rod or bar arranged alongside the hydraulic cylinder and provided with further tappets.

27639 Hollingsworth. Moore, and Stokes: Life guard for motor cars and the like mechanically-driven road vehicles. 27642 Messter: Cinematograph films. [Application for Patent of Addition to 21891, 1909.] 27727 Merrylees: Puncture-proof devices for pneumatic tyres. [Cognate Application. 6562, 1910.] 27758 Mappin and Webb (1908) Ltd., and Moore: Tea and buffet baskets or cases. 27787 Spencer, Spencer, Smallman, and Horton: Valves. 27791 Dewdney: Medicinal pocket inhaler for the mouth, throat, and nose. 27795 Skatschkoff: Apparatus for raising sunken vessels. 27798 Henri, Helbronner, and Von Recklinghausen: Sterilisation of water and other liquids and the cultivation of ferments. 27812 Adamson. Apparatus for scraping and cleaning water mains, pipes, and the like. [Cognate Application. 12340, 1910.] 27822 Billows: Taps for jars and other liquid containers. 27828 Pringle and Richards: Carbonisation of coal and other carbonaceous material. 27829 Pringle and Richards: Production of smokeless briquettes from coal. 27908 Woltereck: Production of isoprene. 27912 Emons and Quincey: Loose-leaf books. 27917 Buckney: Carburetters for internal-combustion engines. 27922 Clarke, Chapman, and Co., and Harris: Electric resistances. 27934 Eades, Davies, and Spicer: Non-refillable bottle. 27942 Elliott: Seals. 27968 Walker: Dynamo electric machines. 27975 Cox: Stencil sheets. 27994 England and England: Leather or the like cutting machines. [Post-dated May 9th, 1910.] 28148 Broadhurst: Apparatus for automatically filling and weighing liquids or semi-liquids into cans or other vessels. 28210 Leonard: Advertising device. 28293 Tangyes Ltd., and Robson: Governing mechanism for internal-combustion engines. 28307. *See* 27193, 1909. 28358 Jobson: Reflectors for artificial lights for photographic purposes. 28366 Anderson: Inverted incandescent gas lamps. [Cognate Application. 1029, 1910.] 28378 Maggiora: Electric ignition devices for internal-combustion engines. 28382 Duncan and Vasseur: Parachute attachment for aerial machines. [Date applied for under International Convention, January 5th, 1909.] 28387 Birmingham Railway Carriage and Wagon Co., and Foster: Manf. of bogie pillars for railway rolling stock. 28673 Wolseley Tool and Motor Car Co., and Remington: Internal-combustion engines. [Cognate Application. 6311, 1910.] 28736 Berry, Naylor, and Meters Ltd.: Prepayment gas meters and other coin-freed apparatus. 28958 Noldner: Smokeless furnace. 28973 Boswell and Thorn: Device to raise motor cars and the like by the hubs of the wheels. 29058 Lavery: Shuttle catcher for use in connection with looms. 29231 Fairweather (Mergenthaler Linotype Co.): Matrix-setting and line-casting machines. 29263 Schulte: Valve-controlling devices. 29300 Joseph and Edward Bates and Sons Ltd., and Tidmarsh: Locks. 29377 Vickery: Means for governing the position of the most advanced sheet of a pile or bank of paper in sheet-feeding apparatus [Cognate Application. 14386, 1910.] 29476 Barker: Appliances for withdrawing mine props for haulage and the like purposes. 29477 Adams: Fastenings for sliding doors. [Cognate Application. 6491, 1910.] 29570 Cosgrove and Smith: Vacuum cleaning apparatus. 29613 Haddan (Akt.-Ges. fur Autogene Aluminium Schweissung): Manf. of aluminium rims for the wheels of cycles and other vehicles. 29751 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new pharmaceutical compounds. [Application for Patent of Addition to 27030, 1909.] 29758 Richards and Richards: Washer and like turning machine. 29810 Hollingworth (Crompton and Knowles Loom Works): Shuttle-box motions for looms for weaving. 29911 Gaunt: Shanked buttons. 29945 Temmerman: Timing apparatus for use in races, games, and the like. 29995 Cleiren: Electro-mechanical power transmission. [Date applied for under International Convention, December 24th, 1908. Application for Patent of Addition to 4620, 1908.] 30129 Bloomfield and Cracknell: Air tube for pneumatic tyres. 30132 Meyer: Fastenings for buttons and the like. 30184 Schultz: Electric motor starters and the like. 30428 Totten: Alloys suitable for obtaining chilled castings. 30553 Ratcliff and Ratcliff: Flat-bed printing machines.

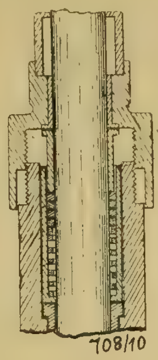


1910.

37 Hutton: Flying toys and apparatus for projecting the same. [Cognate Application. 3035, 1910.] 208 Schwarzlose: Breech closures for automatic firearms. [Date applied for under International Convention, January 4th, 1909.] 272 Schofield: Holder-up for pneumatic riveters. 281 Scheulen: Hedge-cutting devices. 493 Yates: Gas fires and like heating appliances. 546 Pellegrino and Pellegrino: Furnace grates. 620 Orton: Alternating-current electromagnets.

708 Hughes: Metallic packing for stuffing boxes.

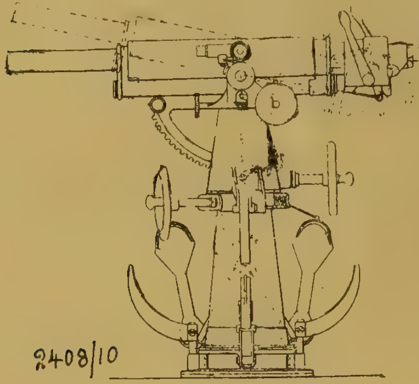
This invention relates to metallic packing of the kind having an inner tapered casing having packing rings therein, and adapted to bear against the spindle or rod of the gland and in such a manner as to allow of the packing rings being forced against the spindle or rod of the gland by forcing the rings against the incline of the casing. This invention comprises an incline casing having one or more rings therein supported resiliently by a spring or springs and bearing against the spindle or rod of the gland, and so arranged that by the tightening of the cap of the gland the packing is caused to be forced down the tapered casing whereb yit is caused to exert the necessary pressure on the gland spindle.



715 Deutsche Gasgluhlicht Akt.-Ges. (Auerges); Lamp for incandescent gas light worked by compressed gas or compressed air. [Date applied for under International Convention, October 13th, 1909.] 868 Muller: Firing mechanism for firearms. 895 Brooks and Holt: Back rests of motor cycle, cycle, and analogous saddles and seats. 1024 Bauduin: Valves and valve gear for internal-combustion engines. [Date applied for under International Convention, January 14th, 1909. Request under Section 19 of the Act not granted.] 1029. *See* 28366, 1909. 1069 Berry, and Meters Ltd.: Means for controlling combined high and low-pressure gas supplies for illuminating and other purposes. 1141 Mattioni: Pocket umbrellas. [Date applied for under International Convention, January 25th, 1909.] 1257 Huntley and Newell: Hoppers and wagon-tipping apparatus for use therewith. 1351 Papp: Bottles for preventing fraudulent refilling. 1352 Kemp and Randall: Treatment of compressed air used for breathing purposes by divers and in submarine vessels. [Request under Section 19 of the Act not granted.] 1378 Buston and German: Display trays, show tablets, photograph frames, and the like. 1412 Peak, Frean, and Co., and Rondolin: Manf. of biscuits and biscuit-cutting machines. 1478 Amphlett: Invalid or bed tables, also suitable for similar articles of furniture. 1530 Delerue: Machine for simultaneously washing and drawing and for drying wool and the like filamentous materials. 1539 Ismay: Filing devices applicable for the vertical system of filing completed order sheets and similar loose papers of various sizes. 1619 Callaway: Multiple-expansion rotary compound engines. 1727 Jones: Lubrication of vehicle wheel bearings. 1912 Haase: Apparatus for rubbing or filing tramway or railway metals and the like. 2007 Hager: Backings for bookbinding. 2107 Siddeley: Radiators for use on motor road vehicles driven by internal-combustion motors. 2276 Powley and Brown: Construction of wheels. 2310 Hough: Means for projecting the ends of boiler stays and nuts and like projections from the effects of heat. 2319 Hastwell: Brick-making machinery.

2408 Dawson and Buckham: Mountings for breech-loading guns.

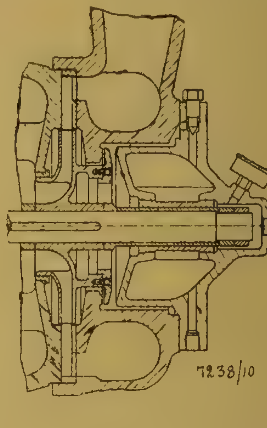
This invention relates to pedestal mountings for breech-loading guns of the kind that are provided with a fork pivot which moves with the gun during training, and carries the elevating and training gears and the gunner who operates the same. According to the present invention the forked pivot is connected with a platform or framework situated near the base of the pedestal around which it travels when the forked pivot is angularly displaced by the training gear. The rotary platform or framework has a seat for the gunner and suitable adjustable supports for his body and legs, so that he can occupy a position at one side of and facing the side of the gun, the sighting apparatus and gearing for working and firing the gun being appropriately arranged to permit of this position. The rotary platform or framework is also provided with suitable foot rests, one of which is pivotally mounted and suitably connected with the firing gear of the gun in such a manner that the actuation of the foot rest fires the gun. The gunner thus has both his hands free to operate the training and elevating gear, and to set the sighting apparatus.



2410 James (Compagnie Generale de Phonographes, Cinematographes, et Appareils de Precision): Electromagnetically-operated instruments for cutting out stencil bands for colouring cinematographic films. 2545 Dixon: Loose-leaf books. 2578 Dawson and Berry: Sleeve ironing boards. 2622 Philip: Games. 2661 Barker: Moulding machines. 2711 Specialfabrik fur Aluminium-Spulen und Leitungen Ges.: Process for the production of electric insulating layers of oxide on metal wires or bands. [Date applied for under International Convention, February 5th, 1909.] 2757 Douglas: Boots and protectors therefor. 2797 Hollingworth (Crompton and Knowles Loom Works): Magazines for automatic weft-replenishing looms. 2798 Hollingworth (Crompton and Knowles Loom Works): Let-off mechanism for looms for weaving. 2956 Passler: Bottle stoppers. 3013 Winsborough: Safety apparatus for use with electrical installations. 3030 Mowat: Tobacco pipe. 3031 Fischer: Process for roasting coffee extract. [Date aplied for under International Convention February 9th, 1909.] 3035. *See* 37, 1910. 3085 Lake (Sanitary Heating Co.): Domestic stoves. 3265 Dixon: Slam locks such as used on the doors of carriages, motor cars, and the like. 3271 Hollingworth (Crompton and Knowles Loom Works): Filling detector or feeler mechanism for weft-replenishing looms. 3284 Filmer: Folding boxes made of cardboard and the like. 3301 Maschinenfabrik Moenus Akt.-Ges.: Apparatus for pulling over of boots, shoes, and the like. [Date applied for under International Convention, February 15th, 1909.] 3350 Sherwood: Burners of certain kinds of oil lamps. 3378 Buckingham: Locking devices for hinges. [Cognate Application. 14553, 1910.] 3468 Hollingworth (Crompton and Knowles Loom Works): Application of weft-replenishing mechanism to over-pick looms. 3476 Jelley: Jointed air tubes for pneumatic tyres. 3732 Slavin: Airships. 3747 Hindman: Means for spacing railway sleepers. 3881 Dargue and Dargue: Drawing apparatus. 3947 Pistonless Hydraulic Press Co., and Beckwith: Pistonless presses. 4055 Mower and Spencer: Feed-water regulators for steam boilers. 4201 Landrin: Agricultural machines for tilling. 4418 Bradbury: Devices for greasing cooking utensils. 4477 Matthew Swain Ltd., and Swain: Lined saucepans, kettles, and like utensils. 4539 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of new santalol compounds. 4580 Ballu: Talking machines. 4595 Riley, Ashworth, Foden, Steele, and Steele: Ring spinning, doubling, and twisting machines. 4631 Stiff: Calipers for measuring the interior of engine cylinders and the like. 4744 Holmes: Starting switches for electric motors. 4868 Bowdler: Hot-air baking ovens. 4871 Beresford: Hinges for doors. 4925 Eccles and Eccles: Adjustable pipe wrench. 4934 Brennan: Driving mechanism of cycles. 4959 Eichengrun: Method of manufacturing brilliant frosted or patterned layers or coatings from acetyl cellulose. [Date applied for under International Convention, April 15th, 1909.] 5374 Creed and Coulson: Telegraphic transmitters. 5412 Hockner and Woodroffe: Burners of oil lamps and stoves. 5558 Martin: Sighting attachments for rifles. 5562 Walker and Burrell: Roller grinding machines. 5585 Deutsche Waffen und Munitionsfabriken: Machine guns. [Date applied for under International Convention, March 26th, 1909.] 5618 Watts: Trousers presses and stretchers. 5630 Barnes: Force pumps for oil and other liquids. 5662 Lanagan: Reversible windows. 5739 Patrick: Golf clubs. 5750 Wort: Packing for railway axle boxes and the like. 5816 Gandil: Machines for manufacturing horseshoes. [Date applied for under International Convention, March 11th, 1909.] 6052 Rosenberger and Coates: Neckties. 6156 Hydes and Wigful Ltd., Handford and Studley: Targets and marking boards. 6236 Izbicki: Means for securing feather boas and the like. 6259 Bradbury: Frames of umbrellas and the like. 6311. *See* 28673, 1909. 6402 Akt.-Ges. Brown, Boveri, et Cie.: Connection of single-phase motors to polyphase circuits. [Date applied for under International Convention, November 18th, 1909.] 6491. *See* 29477, 1909. 6497 Deutsche Waffen-und Munitionsfabriken: Automatic guns. [Date applied for under International Convention, April 8th, 1909.] 6562. *See* 27727, 1909. 6574 Samuelson and Backhouse: Aspirators or air separators for granular substances. 6752 Aveling: Winding gear of ploughing and like engines. 6847 Drew: Heat-retaining devices for food vessels. 7054 Heath: Charge-mixing devices for internal-combustion engines. [Date applied for under International Convention, September 20th, 1909.] 7057 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of octendione and its homologues. 7077 Lake (Firm Ernst Gideon Bek): Machines for manufacturing metal ring fabrics. 7179 Rowley: Game.

7238 Millington: Automatic equilibrating devices for relieving the end thrust in centrifugal pumps.

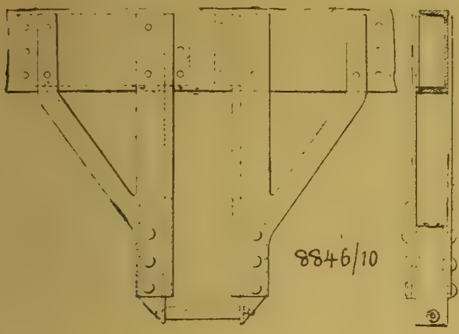
This invention relates to improvements in automatic equilibrating devices for relieving the end thrust in centrifugal pumps. The invention comprises a variable pressure chamber of which the back of, say, the last impeller forms the wall by means of which the equilibrating pressure is applied; liquid under pressure is admitted from the delivery of the pump or from the periphery of the last impeller to the variable pressure chamber through a valvular passage formed by the contiguous faces of a stationary part and a rotating part moving axially on or with the shaft, and the liquid from the pressure chamber escapes through an adjustable valve or through an orifice of definite size.



7252 Baker: Bakers' and confectioners' ovens. 7332 Houskeeper: Electric contact devices for use with moving conductors. [Date applied for under International Convention, March 31st, 1909. Request under Section 19 of the Act not granted.] 7375 Jourdain: Internal-combustion turbines. [Post-dated July 14th, 1910.] 7450 Pal es Fial: Manf. of wire netting. [Date applied for under International Convention, March 24th, 1909.] 7503 Whiteley: Machines for steaming and cooling textile fabrics. 7639 Firm Robert Bosch: Method of and apparatus for igniting the combustible mixture in reversible internal-combustion engines. [Date applied for under International Convention, March 29th, 1909.] 7769 Hancock: Apparatus or machines for use in shaping articles of pottery. 7826 Farbwerke vorm. Meister, Lucius, and Bruning: Product for use in alizarin printing and the application thereof. [Date applied for under International Convention, April 3rd, 1909.] 7858 Rottger: Process and apparatus for splitting up atmospheric air into oxygen and nitrogen. [Date applied for under International Convention, April 7th, 1909.] 7932 Firm Franz Ritter and Sohn: Brushes for machines for cleaning knives, forks. and the like. [Date applied for under International Convention, April 5th, 1909.] 8070 Krause and Ladd: Vacuum cleaning apparatus. 8185 Lechner: Knee protector. [Date applied for under International Convention, April 9th, 1909.] 8348 Smith: Printing presses. [Date applied for under International Convention, April 13th, 1909.] 8372 Blackburn: Trolleys for moving furniture and the like. 8393 McIntyre: Collapsible coops for pheasants or other birds. 8417 Hellberg: Method of and means for producing paper strips for spinning into threads and the like. 8589 Latham: Device for facilitating the exchange of coins when making payments or receiving change. 8636 Thompson (Union Special Maschinenfabrik Ges.): Registering and change-giving machines. 8638 Ott: Means for cooling and moistening air. [Date applied for under International Convention, April 10th, 1909.] 8819 Schwab: Device for stretching curtains.

8846 Sheffield and Twinberrow: Axle box guards for vehicles.

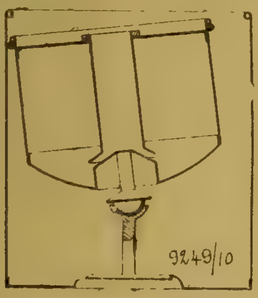
This invention relates to axle box guards for vehicles of the kind in which the load is transmitted through the springs directly to the axle boxes, and more particularly to the type in which a double guard is provided, the two plates being arranged on either side of the centre line of the journal. The invention consists in connecting the parts laterally and longitudinally by means of stiffening pieces, consisting in a piece of channel section both to be the lateral stiffening piece on each side of the axle box, and to bear in a wide groove on each side of the axle box, and in spreading or cranking the guard plates.


8846/10

8946 Lucas and Edwards: Horns for motor and other cycles and the like. 9001 Panichelli: Non-heating and non-inflammable fire escape extending ladder or staircase fixture. 9027 Waterhouse: Apparatus for airing and drying boots and shoes.

9249 Byrne and Lawrence: Acetylene generators.

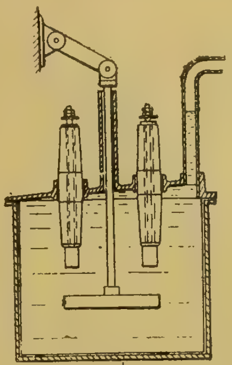
This invention relates to acetylene generators as employed more especially for the lamps of motor road vehicles, and has for its object to provide an improved generator of the type in which the carbide holder is freely mounted within the generator and adapted to oscillate or otherwise move under the action of the vibrations of the vehicle for facilitating the falling away from the holder of the spent carbide. The invention comprises the mounting or suspension of the carbide holder freely within the gas chamber upon a central support which permits a univerasl rolling motion of the holder about a vertical axis.


9249/10

9258 Coates: Production of fertilisers. [Date applied for under International Convention, April 26th, 1909.] 9333 Kuchenmeister: Gymnastic apparatus. 9358 Newton (Farbenfabriken vorm. F. Bayer and Co.): Manf. and production of octadionol and its homologues. 9401 Rider: Incandescent kerosene lamps. 9458 Hudnall: Binders for loose leaves. [Date applied for under International Convention, April 30th, 1909.] 9469 Keymer, Parsons, and Clymo: Boiler attached in the roof of gas ovens. [Date applied for under International Convention, June 25th, 1909.] 9490 Benford: Dish cover. 9689 Williams and Thomas: Pit safety cage. 9736 Adams Manufacturing Co. (Cutler Hammer Manufacturing Co.): Controllers for electric motors. 9772 Juston: Magneto-electric current generators. [Date applied for under International Convention, May 6th, 1909.] 10018 Spence: Machines for heckling, combing, carding, or cleaning jute and other fibres. 10116 Wasdell: Cycle and like mud guards. 10280 Austin: Lifting jacks.

10315 Siemens Bros. Dynamo Works (Siemens Schuckertwerke Ges.): Electric switches.

This invention has reference to electric switches, and relates more particularly to switches of the kind or class in which an ordinary oil vessel is used wherein are placed one or more fixed contacts adapted to be engaged with one or more movable contacts. According to the present invention an oil chamber in which the main body of oil is stationary and the circuit breaking movement takes place entirely within the chamber is so arranged that the oil space is completely filled, and that in addition to this the oil lever extends upward either into a vent tube or into a narrow space enclosed by the rim of the oil vessel, so that the body of the oil is kept under a definite head or pressure, as it were, whilst, however, any gas can rise through the upwardly extending portion of the oil and so make its escape.

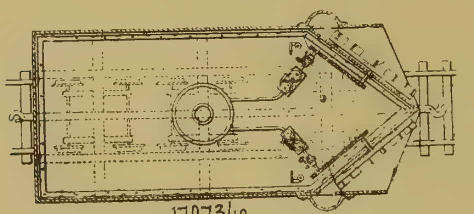

10315/10

10339 Rebollo: Cylinders of internal-combustion engines. 10927 Lake (Brown Perfection Tube Co.): Inner tubes for pneumatic tyres. 10948 Stringer: Tools and appliances for power hammers for the production of light forgings. 11070 Specht: Production of sounds in alarm clocks. 11122 Bengert: Tobacco pipes. 11144 Gotze: Devices for automatically operating the stop cocks of water pipes. 11718 Fitzgerald: Electric furnaces. [Date applied for under International Convention, May 13th, 1909.] 11725 Asmus: Apparatus for stopping and starting trains independently of driver. 11730 Bredin-Crawford: Apparatus for distilling, concentrating, evaporating, and condensing liquids. 11822 Seaborne: Method of and means for cleaning kinematograph and like films. 12052 Hugo: Machines for making paper envelopes. [Date applied for under International Convention, May 28th, 1909.] 12127 Hansen: Braces and suspenders for personal wear. [Date applied for under International Convention, May 17th, 1909.] 12180 Shemwell: Means for operating tramway and like switches from the vehicles. [Date applied for under International Convention, May 29th, 1910.] 12214 Hiorth: Electric induction smelting furnaces. [Date applied for under International Convention, May 22nd, 1909.] 12340. *See* 27812, 1909. 12542 Buhring and Wagner: Apparatus for the separation of liquids from gases or vapours. 12619 Johansen: Boiler-cleaning mechanism. 12628 Rees, Rees, and Nettlefold and Sons Ltd.: Door check and spring closing apparatus. [Application for Patent of Addition to 26255, 1908.] 12658 Rudiger and Wolff: Felt for paper making, cardboard, wood pulp, and cellulose machines. 12937 Schneider: Breech mechanism of firearms. 13104 Tschorner: Method of and apparatus for telegraphically transmitting and reproducing pictures and the like. [Date applied for under International Convention, June 30th, 1909.] 13303 Nielsen: Circular saw machines for cutting steel girders or the like. [Application for Patent of Addition to 438, 1908.] 13498 Ringer: Device for locating and fastening adjustable shelves and drawboards in bookstands, cabinets, and similar places. [Date applied for under International Convention, June 4th, 1909.] 13605 Gottwald: Cellulose wadding. 13703 Norton and

Mannix: Device for obtaining a mould of the natural foot arch. 13709 Routin: Means for regulating dynamos. 13789 Meier: Structural slabs. 14028 Menck and Hambrock Ges.: Supporting tracks for scoop navvys. [Date applied for under International Convention, June 15th, 1909.] 14278 Soc. Anon. des Anciens Etablissements Panhard and Levassor: Valves and valve gear for internal-combustion engines. [Date applied for under International Convention, June 17th, 1909.] 14386. *See* 29377, 1909. 14404 Mitchell: Slag steam generators. 14553. *See* 3378, 1910. 14569. *See* 26965, 1909. 14603 Lake (Firm Ernst Gideon Bek): Manf. of metallic fabrics. 14651 O'Brien, Punshon, Oliver, and Preiser: Valves for hammer drills. 14656. *See* 26674, 1909. 14688 Roenne: Airship. 14740 Dudley: Water waste-preventing devices for standposts and the like. 14742 Marmion: Electric contacts under carpets and the like for alarm signals and other purposes. [Date applied for under International Convention, June 24th, 1909.] 15022 Harrison (Osborn Manufacturing Co.): Foundry moulding machines. 15109 Placzek: Releasing devices for photographic shutters. 15152 Curtis and McClenny: Photo printing frames. 15161 Cummins: Baling presses. 15163 Rubber Patents Ltd., and Turner: Manf. of cases for footballs and the like. 15319 W. Mann and Cie.: Method for applying the ink in embossing presses. [Date applied for under International Convention, July 16th, 1909.] 15353 Stumpf: Uni-directional flow steam engines. 15508 Boistel: Apparatus for cleansing filter beds. [Date applied for under International Convention, August 11th, 1909.] 15660 Kursten: Convertible perambulators and bags. 15906 Rotzov: Device for shutting off or closing the fuel or heat supply to cooking apparatus. [Date applied for under International Convention, July 3rd, 1909.] 16037 Soc. Anon. Comptoir Financier Francais: Elastic wheel for automobiles and other vehicles. [Date applied for under International Convention, March 10th, 1910.] 16169 Sefton-Jones (Quade): Production of water soluble crystalline aluminium formate. 16268 Knapen: Bricks, tiles, and the like for facing purposes. [Date applied for under International Convention, July 7th, 1909.] 16274 Bloxam (Akt.-Ges. Kuhnle, Kopp, and Kausch): Steam engines. 16567 Peters: Appliance for turning the rings of gas cookers or the like. 16714 Harrison (Maschinenfabrik Sack Ges.): Means for delivering bars from rolling mills. 16853 Rawlins: Mangling and wringing machines. 16943 Vernaz: Files. [Date applied for under International Convention, May 10th, 1910.] 17063 Alexander (Lackawanna Steel Co.): Interlocking steel sheet piling.

17073 Ferguson: Rotary snow plough. [Date applied for under International Convention, July 21st, 1909.]

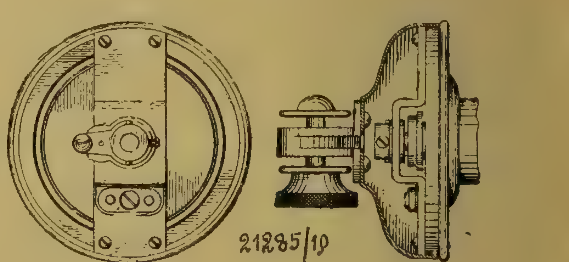
This invention relates to snow ploughs, and has more particular relation to ploughs of the class having converging front walls and rotary cutters projecting through such walls for dislodging the snow against which the plough is directed. The object of the present invention is to provide an improved snow plough of the above character wherein the plough faces are provided with disintegrating wheels which cut up the snow and carry it away from the snow band and force it through blower chutes, and, further, to provide means whereby at the same time that the wall of snow at the front of the car is being cleared away the snow on each side of the track rails may be most effectually thrown off to the side. A railroad snow plough characterised by having a wedge-shaped end on the side faces of which cutting wheels are mounted, the wheels having projecting knives and fan blades, chutes being provided rearward of the wheels and extending tangentially therefrom through which the snow is directed by the wheels and is further characterised by having the side walls extending beyond the rear edges of the inclined faces of the plough to form pockets, the chutes extending upward from the pockets tangentially to the cutting wheels.


17073/10

17074 Heinz: Screw and like propellers. 17198 Mitchell: Water-cooled valves. [Date applied for under International Convention, January 3rd, 1910.] 17453 Barbezat: Automatic device to balance axial thrust in steam turbines. [Rights under Section 91 of the Act not granted.] 17463 Essinger (Hartmann): Receptacle for medical threads for sewing. 17487 John Marston Ltd., and Morgan: Cycle head locks. 17547 Otto-Hilgenstock Coke-Oven Co. (C. Otto and Co. Ges.): Regenerative coke oven installations. 17644 Fleuss and Davis: breathing appliances. 17703 Tonks: Jointed catches of casement fasteners and other like fasteners. 17884 Lake (Æolian Co.): Automatic piano player actions. 17962 Schuh: Driving of submarine boats. [Date applied for under International Convention, September 17th, 1909.] 18174 Gare: Manf., moulding, and re-moulding of indiarubber goods. [Date applied for under Rule 13, August 21st, 1909.] 18177 McMillan and Osman: Timing machines for pigeon races and the like. 18374 Weinland: Motors for driving boiler tube cleaners. 18518 Cross: Shoe attachment for ladders or the like. 18591 Lundberg, Lundberg & Lundberg: Electric switches. 18602 Walter: Pince-nez. 18871 Ruggles: Apparatus for preventing and removing incrustation in boilers and pipes. 19243 Rheinische Metallwaaren-und Maschinenfabrik: Guns which can be taken to pieces for transport. [Date applied for under International Convention, February 21st, 1910.] 19360 Gain: Means for ventilating railway and other carriages. 19568 Dixon: Clutches or brakes. [Application for Patent of Addition to 7085, 1906.] 19672 Bauer (Litchfield): Detachable spindle for loom shuttles. 19682 Zange: Tool case. 19686 Hoffman: Code cards for identifying the amounts and other data of cheques and the like. [Date applied for under International Convention, September 2nd, 1909.] 19741 Crossley and Reeves: Attachments for the steering wheels of auto-motor road vehicles. 19750 Akt.-Ges. Brown, Boveri, et Cie.: Method of working steam or gas turbine installations. [Date applied for under International Convention, March 17th, 1910.] 19942 Stock: Gear casing for the wheels of self-propelled vehicles, ploughs, or the like. [Date applied for under International Convention, September 30th, 1909.] 19949 Blum: Device for closing trawl nets. [Date applied for under International Convention, August 27th, 1909.] 20640 Heinrichs: Driving belts and the like. 20664 Luckenbach: Pulverisers. 20969 Firm Robert Bosch: Washing table for washing with inflammable liquids. [Date applied for under International Convention, July 30th, 1910.]

21285 Western Electric Co. (Western Electric Co.): Telephone transmitters.

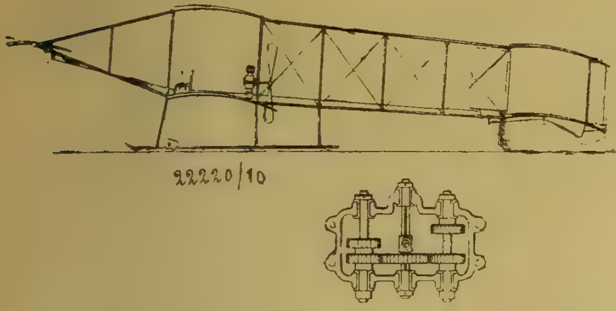
This invention relates to improvements in telephone transmitters, its object being to provide a construction and arrangement which is simple and inexpensive and which permits assembly of the parts in their proper positions without requiring great accuracy in machining, or shaping the parts, or special means for adjustment. The invention comprises a diaphragm loosely seated against a flat surface of the transmitter frame, the diameter of the diaphragm being less than that of the flat surface, and provided with a central depression or indentation being engaged by a spring-pressed stud projecting from the front electrode of the transmitter so that the diaphragm is retained in its seat.


21285/10

21816 Zohrab and Dunham-Massey: Treatment of peat. [Date applied for under Rule 13, August 23rd, 1909.] 21331 Luce: Method of and an articulator for making artificial dentures. 21869 Adamson: Cleaning tools for pipes and tubes. [Date applied for under Rule 13, November 29th, 1909.] 21870 Adamson: Joints or couplings for rods and shafts. [Date applied for under Rule 13, November 29th, 1909.] 21878 Pickering and Unsworth: Driving belts.

22220 Farman: Aeroplanes. [Date applied for under International Convention, January 8th, 1910.]

This invention relates to improvements in aeroplanes, and consists in an arrangement on the tail of monoplane, biplane, or other aeroplanes of one or more movable rear ailerons or planes which may be controlled either independently of the front plane or elevation rudder or simultaneously with the latter for the purpose of re-establishing longitudinal stability. The invention comprises in the ordinary manner two superposed supporting surfaces in the front plane cannot be operated accidentally because they arranged. The tail constituted by two superposed surfaces is arranged at the rear. At the rear portion of each of these surfaces or at the end of one of them only an aileron is hinged, its length being equal to greater than or less than its width. The two ailerons are operated by the aviator in such a manner as to turn in the opposite direction to the small front plane and either independently of this plane or simultaneously therewith, in order to re-establish the longitudinal equilibrium of the aeroplane. These ailerons, which are likewise adapted to be fitted to the rear of the monoplane type of apparatus or any other existing apparatus, thus serve as a safety or emergency device for the aviator when the operating parts for the front plane cannot be operated accdentally because they fulfil the same purpose as the plane. The operating lever has keyed to its pivot a pinion meshing with two gear wheels, each mounted upon its own shaft. Upon one shaft there is keyed an arm connected by means of cables and bent levers with the front plane, and by means of a similar arm and suitable connections the shaft controls the rotation of the rear ailerons.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22302 Carrez: Rotation mechanism for turning bridges. 22320 Pauling: Process of treating aqueous nitric acid and the like with sulphuric acid and other hygroscopic substances. 22419 Michelin et Cie. (Soc. en Commandite par actions): Bottles and like containers for compressed gas. [Date applied for under International Convention, September 29th, 1909.] 22656 Drey: Machines for cutting weft pile fabrics. 23252 Pietzsch and Adolph: Manf. of persulphuric acid and its salts. [Date applied for under International Convention, October 11th, 1909.] 23464 Lowe: Spinning mules. [Date applied for under International Convention, October 12th, 1909.] 23924 Akt.-Ges. fur Anilin Fabrikation: Manf. of acetic anhydride. [Date applied for under International Convention, October 19th, 1909.] 25272 Weinfeld: Process of and apparatus for the threshing of cereals and the like. [Date applied for under International Convention, November 2nd, 1909.] 25580 Baker and Boulnois: Machines for making bags of paper or other suitable material. [Date applied for under Rule 13, November 22nd, 1909.]

COMPLETE SPECIFICATIONS OPEN TO PUBLIC INSPECTION BEFORE ACCEPTANCE, UNDER THE PATENTS ACT, 1907.

1910.

6381 Warchalowski: Coupling device for use with vehicles fitted with limbers. 8530 Johnson: Manf. of steel. 13324 Rheinisch Westfalische Sprengstoff Akt.-Ges.: Propellers for aerial and marine navigation. 14635 De Temple: Device for varying the working speed of a centrifugal governor. 21244 Duguette: Shoe lacings. 21467 Rhea: Boiler. 22136 Rhea: Boiler. 22766 F. Krupp Akt.-Ges.: Percussion fuses. 24017 Worthington: Rat trap for use on ships' hawsers. 24136 Flachaire: Advertising and publicity apparatus. 24168

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